22. Biodiversity

This chapter provides a summary of the results of the biodiversity assessment of the proposal undertaken in accordance with the *Framework for Biodiversity Assessment* (Office of Environment and Heritage, 2014a). A full copy of the assessment report is provided as Technical paper 9 – Biodiversity assessment report. The Secretary's environmental assessment requirements relevant to biodiversity, together with a reference to where the results of the assessment are summarised in this chapter, is provided in Table 22.1.

Table 22.1 Secretary's environmental assessment requirements – biodiversity

Ref	Secretary's environmental assessment requirements - biodiversity	Where addressed
5. Biodiversity		
5.1	The Proponent must assess biodiversity impacts in accordance with the current guidelines including the Framework for Biodiversity Assessment (FBA).	A summary of the results of the biodiversity assessment is provided in this chapter. The full results are provided as Technical paper 9.
5.2	The Proponent must assess any impacts on biodiversity values not covered by the FBA as specified in s2.3.	Section 22.3.7
5.3	The Proponent must assess impacts on the Long-nosed Bandicoot Inner Western Sydney Population (including an assessment of vehicle strike (from more frequent trains) and a loss of threatened species and their habitat which is not associated with vegetation (e.g. building demolition, bridge reconstruction, etc.) and provide the information specified in s9.2 of the FBA.	Sections 22.3.2, 22.3.3 and 22.3.5
5.4	The Proponent must identify whether the project as a whole, or any component of the project, would be classified as a Key Threatening Process in accordance with the listings in the *Threatened Species Conservation Act 1997*, *Fisheries Management Act 1994* and *Environmental Protection and Biodiversity Conservation Act 2000*.	Section 22.3.4

22.1 Assessment approach

22.1.1 Legislation and policy context to the assessment

In addition to the EP&A Act, the following legislation is relevant to the biodiversity assessment:

- TSC Act – provides the statutory framework for the conservation and management of biota of conservation significance in NSW. It lists terrestrial flora, fauna, populations, and communities that must be assessed to determine if an activity would have a significant impact and further assessment or approval is required.
- FM Act – aims to conserve, develop and share the fishery resources of the State for the benefit of present and future generations. It lists aquatic flora, fauna, populations, and communities that must be assessed to determine if an activity would have a significant impact and further assessment or approval is required.
- *Noxious Weeds Act 1993* – provides for the declaration of noxious weeds. It identifies certain classes of noxious weed and required controls. All private landowners, occupiers, public authorities, and councils are required to control noxious weeds on their land.
- EPBC Act – lists matters of national environmental significance, which relevantly include listed threatened species and communities, listed migratory species, Ramsar wetlands of

international significance, and the Commonwealth marine environment, and outlines the approval process where there is the potential for significant impacts to these matters.

The *NSW Biodiversity Offsets Policy for Major Projects* (Office of Environment and Heritage, 2014b) ('the Biodiversity Offsets Policy') provides guidance in relation to biodiversity offsetting for major project approvals. A key principle underpinning the policy is that offset requirements should be based on a reliable and transparent assessment of biodiversity losses and gains. The policy:

- establishes a set of offsetting principles for major projects
- defines key thresholds for when offsetting is required
- adopts an assessment methodology to quantify and describe the offset required
- defines the mechanisms required to establish offset sites
- provides a range of flexible options that can be used in lieu of providing offsets, including rehabilitation actions and supplementary measures.

The Biodiversity Offsets Policy is underpinned by the *Framework for Biodiversity Assessment*. The framework sets out:

- requirements for a reliable and transparent assessment of biodiversity values on land to:
  - identify the biodiversity values subject to a proposed major development
  - determine the impacts of the development on biodiversity
  - quantify and describe the biodiversity offsets required for the unavoidable impacts of the development on biodiversity values
- types of conservation measures that are available to offset the unavoidable impacts of major projects, and how they may be used by a proponent to prepare a biodiversity offset strategy.

Under the *Framework for Biodiversity Assessment*, should biodiversity credits be required to offset impacts, a Biodiversity Offset Strategy must be prepared to outline how the proponent intends to offset the impacts of a major project.

Where a proponent is proposing to establish an offset site as part of a biodiversity offset strategy for a major project, the *Framework for Biodiversity Assessment* requires that the Biobanking Assessment Methodology be used to:

- assess the biodiversity values of the offset site
- identify the number and type of biodiversity credits that may be created on the offset site.

22.1.2 Methodology

The main components of the methodology for the biodiversity assessment were:

- A desktop assessment was undertaken to describe relevant features of the existing environment and to identify the suite of threatened biota potentially affected by the project.
- Field surveys were undertaken to describe the biodiversity values of the project area and wider study area, to determine the likelihood of threatened biota and their habitats occurring in the project area and/or being potentially impacted by the project.
- Calculations were undertaken in accordance with the *Framework for Biodiversity Assessment,* using the credit calculator (version 4.1), to quantify the biodiversity impacts of the project, and determine the biodiversity credits required to offset these impacts.

Study area

The study area for the biodiversity assessment included the project area with buffers in some locations to include areas of adjoining vegetation or biodiversity value. The study area is shown in Figure 22.1.

Literature review and database searches

Existing information on the biodiversity of the study area was obtained from a range of sources, including databases, aerial photographs and maps, and previous studies carried out in the study area. Previous documents and reports relevant to the study area were reviewed, including previous biodiversity studies, environmental attribute mapping, and previous impact assessments. Digital aerial photography was reviewed to identify spatial patterns in vegetation, land use, and landscape features.

Searches were undertaken of species databases to identify:

- threatened flora and fauna species, populations and ecological communities, listed under the TSC Act and FM Act
- nationally threatened native species, ecological communities, and native migratory species listed under the EPBC Act.

The search area adopted was a radius of ten kilometres around the study area.

Likelihood of occurrence

The database searches identified threatened flora and fauna species either recorded or considered likely to occur in the search area. The probability of each threatened species occurring within the study area was rated as low, moderate, high, or known, based on the criteria provided in Technical paper 9.

Survey effort

Staged surveys of the study area were conducted with reference to Section 6 of the *Framework for Biodiversity Assessment* and relevant targeted survey guidelines. This included taking into consideration the threatened biota that may occur given the urban context of the study area and the modified nature of habitats present.

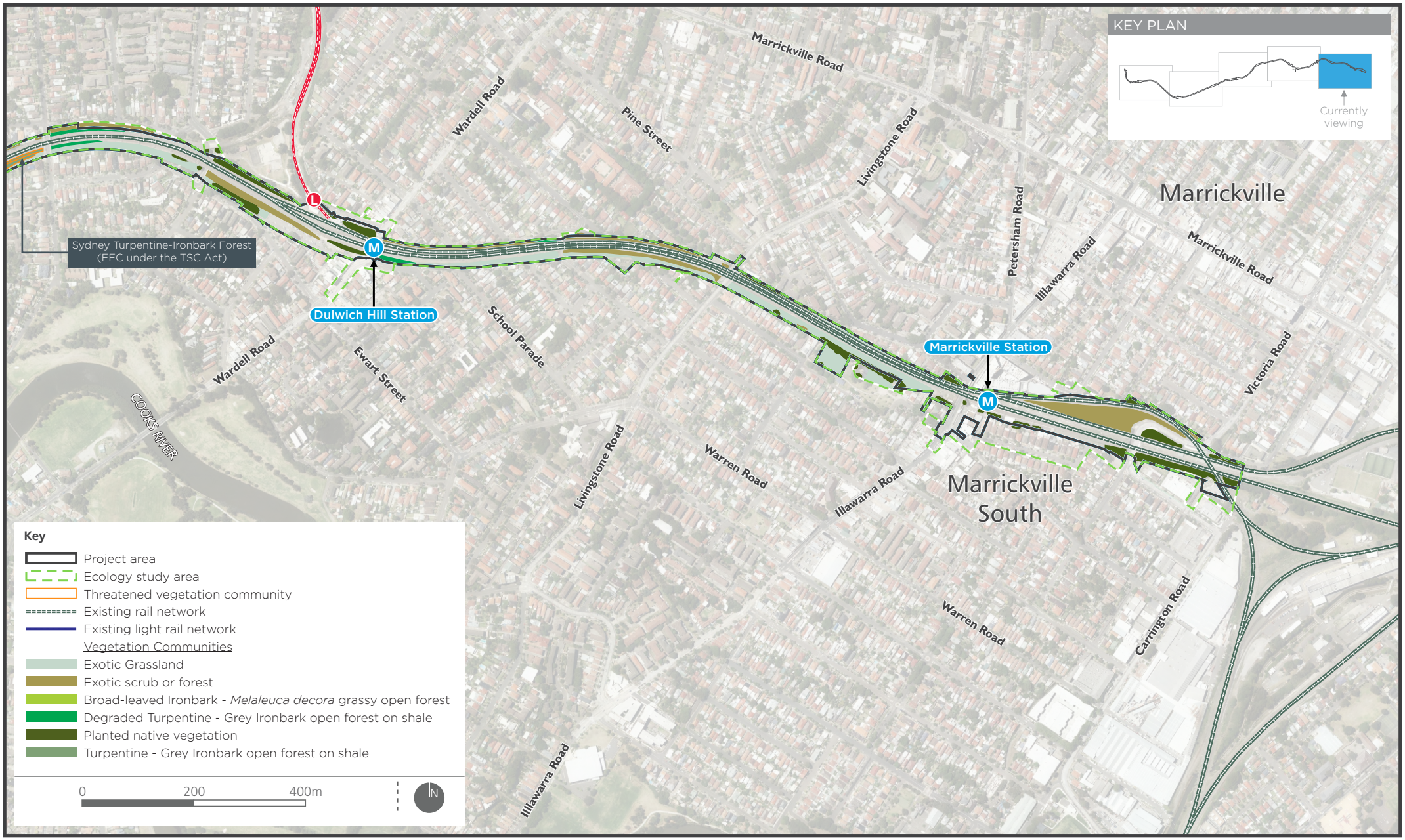
Surveys were undertaken on 16 June 2016, 22-23 June 2016 and 5 October 2016.

Biodiversity credits

The Biobanking Assessment Methodology sets out how biodiversity values are to be assessed, establishes rules for calculating the number and class of biodiversity credits, and determines the trading rules that will apply. The methodology includes a software package known as the BioBanking Credit Calculator, which processes site survey and assessment data by:

- assessing the biodiversity on a project site
- calculating the number and type of credits required to offset impacts on biodiversity and to be created on a biobank site
- estimating the approximate area of land required for an offset.

The credit calculator was used to determine the number and type of biodiversity credits required to offset the impacts of the project.



sydney METRO | city & southwest

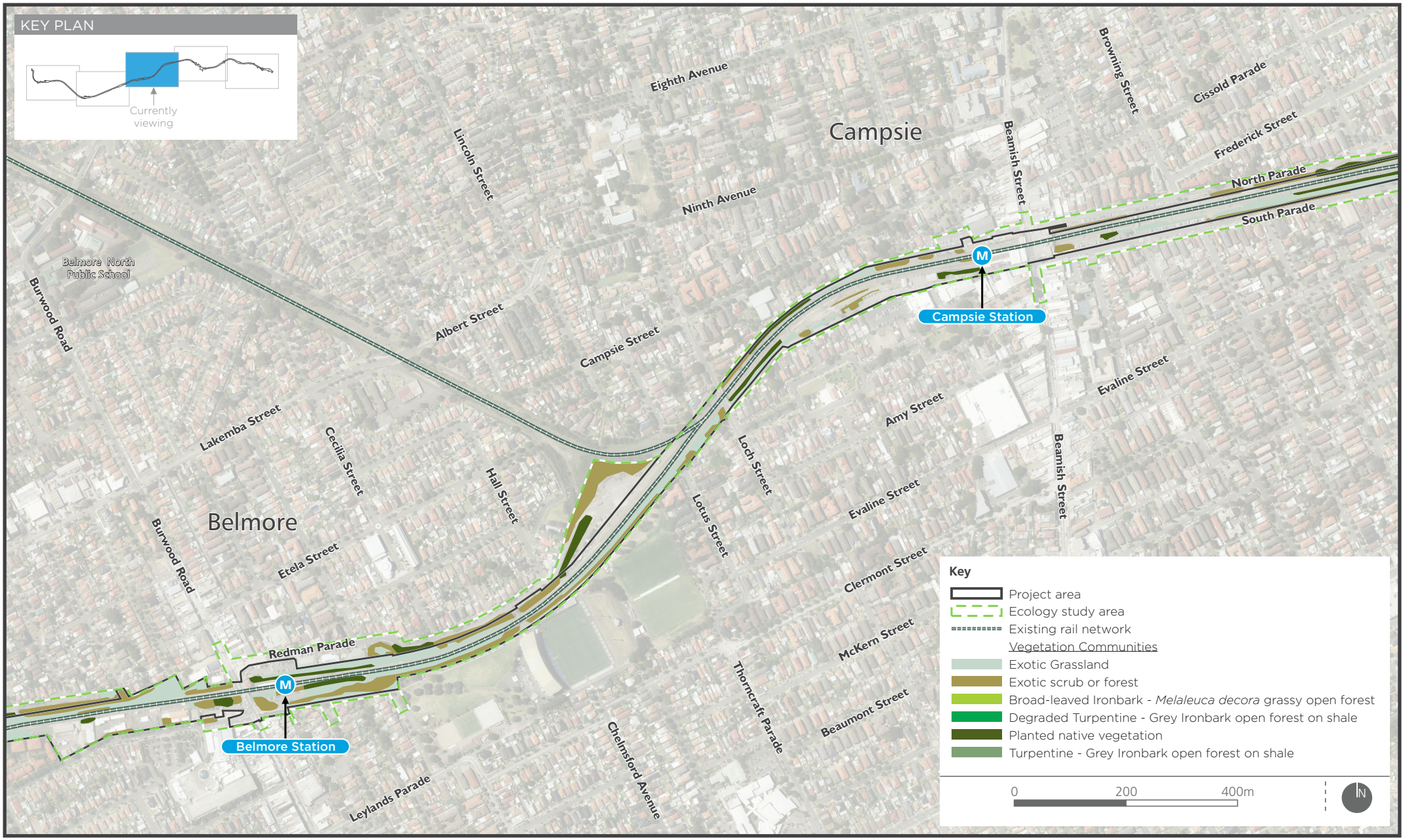
Biodiversity study area, vegetation and threatened species - map 1

FIGURE 22.1

sydney METRO | city & southwest

Biodiversity study area, vegetation and threatened species - map 2

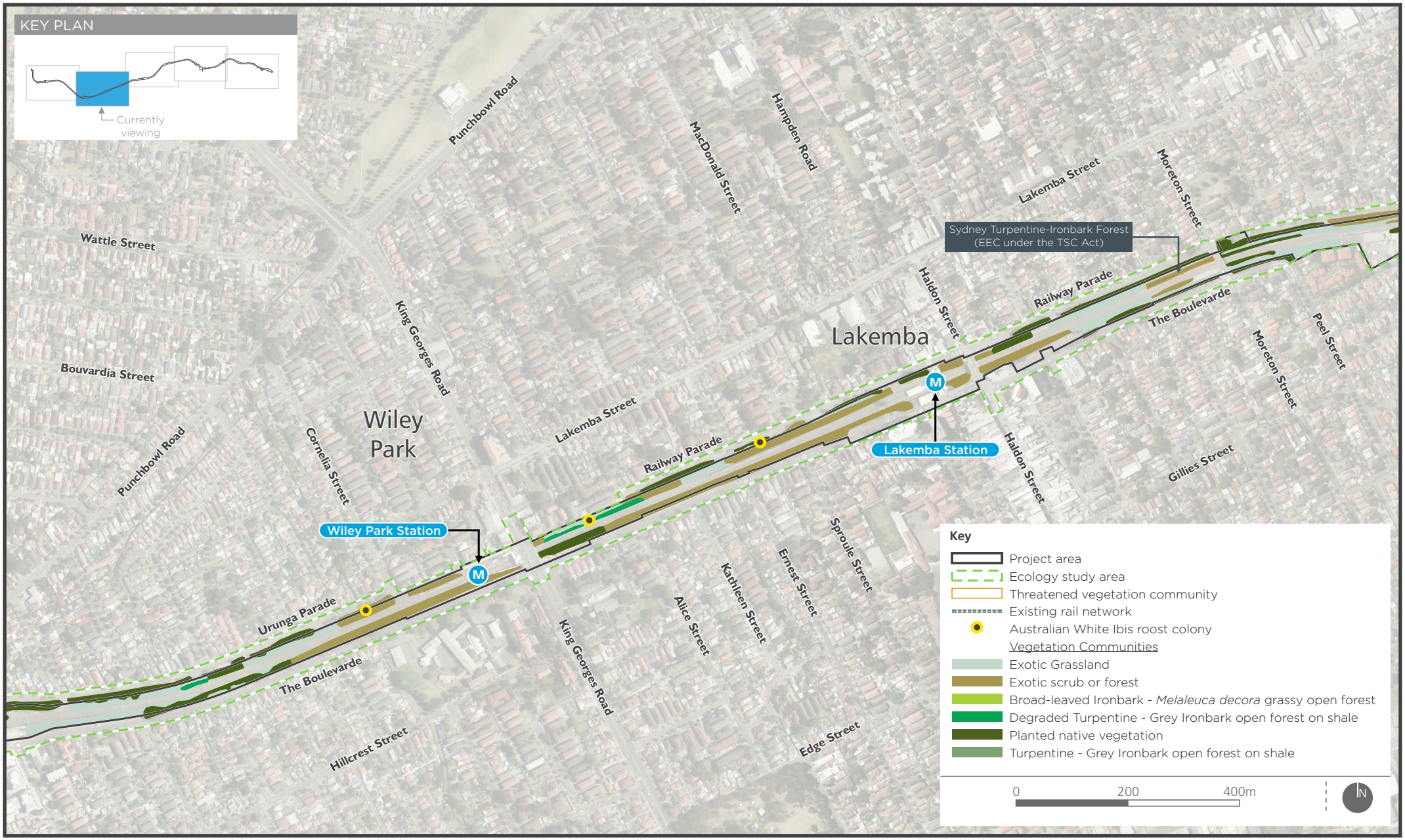
FIGURE 22.1



sydney METRO | city & southwest

Biodiversity study area, vegetation and threatened species - map 3

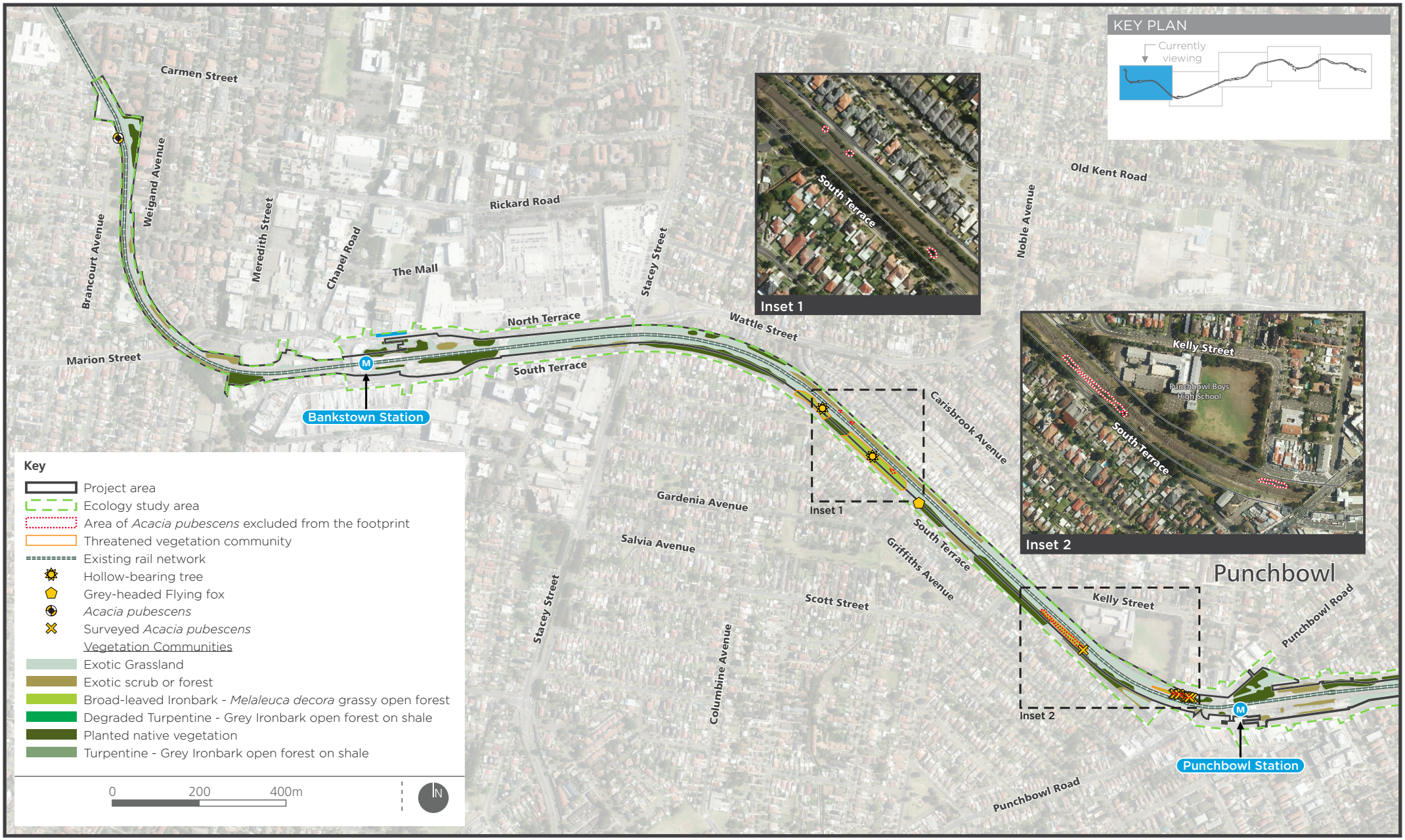
FIGURE 22.1



sydney METRO | city & southwest

Biodiversity study area, vegetation and threatened species - map 4

FIGURE 22.1



Biodiversity study area, vegetation and threatened species - map 5

FIGURE 22.1

Flora surveys

Vegetation was mapped in the field via systematic walked transects across the entire study area, which was divided into relatively homogenous or discrete units. The remainder of the study area (containing non-native vegetation) was divided into separate map units based on observed structure and species composition.

Threatened plant surveys were conducted throughout the study area during field surveys. Threatened plants potentially present were identified based on the desktop assessment results and the species credit-type threatened species identified by the preliminary *Framework for Biodiversity Assessment* credit calculations. Habitat for these species was identified based on threatened species profiles. A supplementary threatened flora survey was conducted over one day, including targeted threatened flora searches in areas of previously identified habitat, and precise mapping of the locations of threatened plants.

Fauna surveys

The survey methodology included relatively limited targeted fauna survey techniques. This was because of the limited extent and quality of fauna habitat in the study area, and because the *Framework for Biodiversity Assessment* assesses the majority of threatened fauna species that could occur based on habitat.

An assessment was made of the type and quality of habitats present in the study area for native fauna. Habitat quality was based on the level of breeding, nesting, feeding, and roosting resources available. The study area was searched for habitat features, such as hollow-bearing trees, feed trees for the Grey-headed Flying-fox, and shelter habitat for the Long-nosed Bandicoot. Culverts and bridges were inspected for signs of roosting bats (such as bat droppings) or bird nests.

Spotlighting for nocturnal fauna was also carried out, targeting the Long-nosed Bandicoot, Grey-headed Flying-fox, and other nocturnal fauna. Spotlighting was conducted within the rail corridor near Dulwich Hill and Marrickville stations, and between Bankstown and Punchbowl stations. Call playback for the Barking Owl and Powerful Owl was also conducted.

Three motion activated infra-red cameras were set in the rail corridor between Hurlstone Park and Marrickville stations, particularly targeting potential habitat for the Long-nosed Bandicoot. Searches for bandicoot diggings were also conducted in grassland areas between Hurlstone Park and Marrickville.

22.2 Existing environment

22.2.1 Flora

The majority of the study area has been heavily modified by past and ongoing disturbances associated with urban development and the active rail corridor. Urban development, clearance, and ongoing maintenance of the rail corridor has resulted in fragmentation, a high level of disturbance, and degradation of vegetation communities.

The majority of vegetation in the project area and surrounding study area comprises exotic or planted native species on highly modified landforms. There are small isolated patches of remnant or regrowth native vegetation in small portions of the study area associated with rail cuttings with less disturbed soil profiles.

Native vegetation and habitat within the project area is in medium to poor condition, and features impacts from existing maintenance activities, edge effects, weed infestation, and exotic pests.

Database search results

A search of relevant databases indicated that 38 threatened flora species or populations listed under the TSC Act, 25 threatened flora species listed under the EPBC Act, and six threatened ecological communities listed under the TSC Act and/or the EPBC Act have been recorded or are predicted to occur in the search area.

Threatened species with the potential to occur, given nearby records and potential presence of suitable habitat, include:

- a small shrub (*Pultenaea parviflora*), listed as an endangered species under the TSC Act and a vulnerable species under the EPBC Act
- Matted Pea Bush, listed as an endangered species under the TSC Act
- Narrow-leafed Wilsonia, listed as a vulnerable species under the TSC Act
- Downy Wattle, listed as a vulnerable species under the TSC Act and the EPBC Act
- Austral Toadflax, listed as a vulnerable species under the TSC Act and the EPBC Act.

Vegetation mapping

According to *Native vegetation of the Sydney Metropolitan Area,* the most extensive vegetation map unit in the study area is 'Urban/exotic/native'. No native vegetation is mapped within the study area. A linear strip of 'Estuarine Mangrove Forest' is mapped immediately adjacent to the study area where it crosses the Cooks River.

Flora survey results

There is relatively low native species richness within the study area, which confirms that the native vegetation has been extensively modified and is in moderate to poor condition.

A total of 129 flora species from 40 families were recorded within the study area, comprising 63 native and 66 exotic species. Poaceae (grasses, 22 species, 11 native), Myrtaceae (flowering shrubs and trees, 20 species, 13 native), Fabaceae (23 species, 17 native), and Asteraceae (flowering herbs, 11 species, 2 native) were the most diverse families recorded. One threatened flora species (Downy Wattle) was recorded in the study area, outside the project area.

Plant communities

Plant communities in the study area are summarised in Table 22.2 and shown in Figure 22.1.

The majority of vegetation in the study area (97 per cent) comprises exotic or planted native species. About 0.6 hectares of the native vegetation matches two plant community types according to the *Framework for Biodiversity Assessment*:

- Turpentine - Grey Ironbark open forest on shale (PCT ID 1281, Biometric vegetation type HN604)
- Broad-leaved Ironbark - Grey Box - *Melaleuca decora* grassy open forest (PCT ID 724, Biometric vegetation type HN512).

Table 22.2 Vegetation in the study area

Plant community type	Condition	Conservation significance	Extent in study area (hectares)
Turpentine - Grey Ironbark open forest on shale	Moderate/good - medium	Conforms to the TSC Act listed endangered ecological community *Sydney Turpentine Ironbark Forest in the Sydney Basin Bioregion*	0.2
Degraded Turpentine - Grey Ironbark open forest on shale	Moderate/good - poor	Not an endangered ecological community because it does not contain characteristic canopy species.	0.4
Broad-leaved Ironbark - Grey Box - *Melaleuca decora* grassy open forest	Moderate/good	Conforms to the TSC Act endangered ecological community *Shale Gravel Transition Forest in the Sydney Basin Bioregion*	0.4
Subtotal – native vegetation			***1.0***
Exotic grassland	Cleared/non-native vegetation	Very low (exotic vegetation)	12.5
Exotic scrub or forest	Cleared/non-native vegetation	Very low (exotic vegetation)	9
Planted native species	Cleared/non-native vegetation	Low (non-indigenous native vegetation)	7.3
Subtotal – exotic or planted native vegetation			***28.8***
Total vegetation in study area			**29.8**

Noxious weeds

Fifteen species of noxious and environmental weeds are broadly distributed throughout the study area. Many of these are also listed as 'weeds of national significance', which are recognised as Australia's worst invasive plants.

Threatened flora species

No listed threatened flora species were recorded in the project area. One threatened plant species Downy Wattle (*Acacia pubescens)* listed as vulnerable under the EPBC Act and TSC Act, was recorded in the study area. Around 650 stems are located near the project area as shown in Figure 22.1.

The patches of stems recorded are located mainly in the vicinity of Punchbowl Station, with around two stems recorded in the rail corridor, and one stem in a Council reserve around 100 metres east of the Yagoona substation. The project has been designed to avoid impacting on the recorded locations of this species.

Threatened ecological communities

As noted in Table 22.2, two of the native plant communities identified conform to the following threatened ecological communities listed under the TSC Act:

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

No threatened ecological communities listed under the EPBC Act are located in the study area.

Groundwater dependent ecosystems

The National Atlas of Groundwater Dependent Ecosystems, maintained by the Bureau of Meteorology, maps known groundwater dependent ecosystems and ecosystems that potentially use groundwater. No groundwater dependent ecosystems are located in the study area.

Some patches of vegetation along Wolli Creek downstream of the study area are mapped as potential groundwater dependent ecosystems. Wolli Creek is subject to pollution from urban environments, and its interaction with the Cooks River, which is heavily polluted.

22.2.2 Terrestrial fauna

Database search results

A total of 60 threatened fauna species listed under the TSC Act and 25 threatened fauna species listed under the EPBC Act have been recorded or are predicted to occur in the search area. Most of these threatened species are considered unlikely to occur, as they rely on specific habitat that is not present in the project area.

Species considered most likely to occur include:

- the Grey-headed flying-fox, listed as a vulnerable species under the TSC Act and the EPBC Act
- microchiropteran bats, such as the Eastern Bentwing Bat and Large-footed Myotis, listed as vulnerable species under the TSC Act
- a range of threatened bird species listed, under the TSC Act and/or the EPBC Act, which may forage in planted trees or along the Cooks River on occasion.

Terrestrial fauna habitats

Several general fauna habitat types were identified during field surveys. Each of these habitat types has a range of characteristics that influence habitat value, and the range of fauna species with the potential to be present. These are summarised below.

Exotic and native grassland

The majority of the rail corridor is cleared and vegetated with introduced grasses and herbs, interspersed with bare ground, ballast, and other artificial substrates. Some areas with native groundcover species are present. These areas are devoid of shrubs and trees. Exotic and native grassland contains few habitat resources of relevance to most native species.

Exotic forest and scrub and planted native species

Patches of weeds and planted native or exotic trees and shrubs within the study area provide potential foraging habitat for a range of common bird species (the Noisy Miner was the most abundant species observed) and mammal species (including the Common Brushtail Possum and Common Ringtail Possom).

Three roosting colonies of the Australian White Ibis were observed in planted trees in the rail corridor near Wiley Park Station.

Native woodland and forest

Occasional hollow-bearing trees, which could provide potential nesting habitat for arboreal mammals or birds, were recorded in the Punchbowl to Bankstown section of the study area. A range of flowering shrubs and trees are present, including Tallowood, Sydney Blue Gum, Turpentine, and Red Ironbark, which provide foraging resources for a range of birds, including cockatoos, parrots, honeyeaters, and arboreal mammals.

Two hollow-bearing trees were identified within the rail corridor at Punchbowl. These would potentially be used by common and introduced species. They could also be used by microbat species as roosting habitat.

No large hollows suitable for threatened owls were identified. Species such as the Powerful Owl may forage for arboreal mammals (including possums) within the rail corridor.

Culverts and bridges

Culverts provide potential temporary roosting habitat for microbat species, such as the threatened Eastern Bentwing Bat and Large-footed Myotis. The Eastern Bentwing Bat breeds in specific maternity roosts and would not breed in these structures. However, there is potential for the Large-footed Myotis to breed in these structures. No bats were observed in the culverts inspected during surveys, and no bat droppings were detected.

No bird nests were observed in any culverts inspected during the surveys, although it is possible that species such as Welcome Swallows and Fairy Martins could use these built features for nesting.

Many rail bridges are present in the project area. These provide breeding habitat for the introduced Rock Dove. No evidence of roosting bats or bat droppings were detected at any of the bridges inspected.

A number of structures (e.g. station buildings, warehouses, and residential buildings) within the project area may provide roosting habitat for the introduced Rock Dove and native species, such as Welcome Swallows and Fairy Martins. Microbats, including the Gould's Wattled Bat, were recorded by Arcadis (2016) in the Marrickville area during surveys for the Chatswood to Sydenham project.

Urban gardens

Urban gardens are known to provide shelter and foraging habitat for the Long-nosed Bandicoot. However, no evidence of bandicoots was recorded during targeted surveys, and no evidence of bandicoots was recorded in 2016 during four months of infra-red camera surveys along the light rail line or from the associated community survey.

Fauna survey results

A low diversity of fauna species was recorded during the field surveys, as would be expected in a highly modified urban environment. A total of 23 native species were recorded during surveys, which included 17 bird species, two mammal species, three reptile species, and one frog species. No microbat species were recorded. Five introduced bird species and three introduced mammal species were also recorded. One threatened fauna species, the Grey-headed Flying-fox, was recorded.

Literature review

The Long-nosed Bandicoot population in inner western Sydney is known or predicted to occur in the study area. The rail corridor is located along the southern boundary of the mapped core area of records of the population. The exact area occupied by the population is not clearly defined, but it includes parts of the former local government areas of Marrickville and Canada Bay, with the likelihood that it also includes parts of the former Canterbury, Ashfield, and Leichhardt local government areas. Potential habitat for the bandicoot is present in parts of the study area.

Threatened fauna species and populations

The Grey-headed Flying-fox, which is listed as vulnerable under the TSC Act and EPBC Act, was recorded in the study area. The location of this record is shown in Figure 22.1. No microbats were recorded during anabat surveys. This may suggest there is only limited habitat for these species,

and that none rely on the habitats present for their foraging requirements. Nevertheless, the following species listed as vulnerable under the TSC Act are considered likely to occur:

- Eastern Bentwing Bat
- Large-footed Myotis
- Eastern Freetail Bat
- Yellow-bellied Sheath-tail Bat.

Although the Long-nosed Bandicoot population in inner western Sydney is known or predicted to occur in the study area, no evidence of the population was found, either from searches for diggings or camera surveys, and there have been no records of the population or any recent sightings since 2014. Spotlighting undertaken during the assessment did not identify any records of this species.

The biodiversity assessment concluded that the Long-nosed Bandicoot is unlikely to occur in the project area, as a result of:

- the lack of evidence of the species in the project area and surrounding area, despite recent targeted surveys
- limited presence of shelter habitat
- high abundance of introduced predators
- difficulty of access to the rail corridor.

22.2.3 Aquatic ecology

Cooks River

The project area crosses the Cooks River to the west of Canterbury Station. The Cooks River is also located downstream of the study area between Marrickville and Campsie stations. The Cooks River is mapped as key fish habitat.

Two threatened fauna species listed under the FM Act have been recorded or are predicted to occur in the study area. However, based on previous records and habitat requirements, these species are considered unlikely to occur.

Sampling carried out in 2007 in Wolli Creek, which flows into the Cooks River at Tempe, identified six native fish species in the freshwater section above the Henderson Street weir at Turella:

- Empire Gudgeon
- Flathead Gudgeon
- Striped Gudgeon
- Firetail Gudgeon
- Common Galaxia
- Long-Finned Eel.

The following species were collected immediately below the weir and are likely to occur along the Cooks River:

- Sea Mullet
- Yellow-fin Bream
- Port Jackson Perchlet
- Toadfish.

Table drains

Aquatic habitats within the project area are mostly limited to a number of shallow table drains alongside the rail line. Most ditches are shallow, with no emergent vegetation, however some display emergent rushes (*Typha*). Table drains are generally fed by seepages from embankments. Some drains run into concrete gutters before exiting from the railway corridor. The Common Eastern Froglet was heard calling from table drains.

No threatened species listed under the FM Act have potential habitat in these table drains. Table drains do not classify as key fish habitat.

Cup and Saucer Creek

The route for the proposed high voltage electricity feeder cable between the proposed Campsie traction substation and the existing Ausgrid Canterbury electrical substation would cross Cup and Saucer Creek. At the crossing location, the creek consists of a concrete canal. The canal is concrete-lined to its confluence with the Cooks River, about 250 metres to the north, and for a number of kilometres upstream. A stormwater treatment wetland (Cup and Saucer Wetland) was constructed by Sydney Water in 2010 near the confluence of the creek and the river to filter some of the stormwater in Cup and Saucer Creek.

22.2.4 Other matters of national environmental significance

The protected matters search tool identified six World Heritage Properties, six National Heritage Places, and one wetland of international importance within the search area. The project would not impact on the World Heritage Properties and National Heritage Places as they are outside the study area. The wetland of international importance, Towra Point Nature Reserve, is located on the southern side of Botany Bay, over four kilometres from the mouth of the Cooks River. This location is well beyond the maximum extent of potential impacts arising from the project.

A large number of migratory species were reported in the search area by the protected matters search tool based on species behaviour and habitat presence. However, only three of these species were considered to have the potential to occur within the study area on an occasional or transient basis – Satin Flycatcher, Rufous Fantail, and Rainbow Bee-eater. No potential habitat for these wetland species is present in the project area.

22.3 Impact assessment

22.3.1 Risk assessment

Potential risks

The environmental risk assessment for the project, undertaken for the State Significant Infrastructure Assessment Report, identified the following as the main potential biodiversity risks:

- impacts to the Long-nosed Bandicoot listed under the TSC Act, and areas of known habitat
- loss of foraging habitat for the threatened Grey-headed Flying Fox (vegetation adjoining the corridor) and foraging and roosting habitat (e.g. culverts and bridges) for threatened microchiropteran bats
- impacts to patches of remnant or regenerating vegetation, comprising potential habitat for threatened ecological communities and/or threatened plants
- impacts to riparian and aquatic habitats associated with the Cooks River crossing
- removal of street trees, particularly at stations.

Other potential risks include:

- clearing of native vegetation resulting in direct impacts on threatened species and endangered populations and communities, loss of fauna habitat, habitat fragmentation, and loss of connectivity
- potential for pest plants and animals
- indirect impacts due to increased dust, sedimentation and erosion, noise, and light
- disturbance to aquatic habitats
- alterations to surface water flow regimes and interruptions to fish passage
- fauna mortality from vehicle strikes.

How potential impacts have been avoided or minimised

In general, potential impacts on biodiversity have been avoided or minimised by:

- designing the project to minimise the potential for impacts outside the rail corridor
- placement of construction compounds within already cleared areas where practicable (e.g. carparks)
- the location of project infrastructure at Punchbowl Station was refined to avoid impacts on Downy Wattle
- areas of Downy Wattle between Punchbowl and Bankstown stations were excluded from the project area and would be protected during construction.

22.3.2 Construction impacts

Potential impacts on biodiversity during construction include:

- direct impacts as a result of clearing of vegetation in the project area
- indirect impacts on flora and fauna located outside the project area as a result of activities within the project area.

A summary of the results of the impact assessment is provided below.

Vegetation clearing

As described in Chapter 9 (Project description - construction), it is assumed that construction of the project would require removal of all vegetation located along the rail corridor in the project area. This would involve removal of 29.8 hectares of vegetation. The majority of this vegetation comprises exotic plants or planted (often non-indigenous) native species on fill material, with native vegetation making up around three per cent of the direct disturbance footprint. Removing all vegetation in the rail corridor would impact a total of one hectare of native vegetation.

The project has been designed to avoid impacts on the local population of the endangered plant species Downy Wattle. There are no Downy Wattle stems in the project area, and none would be impacted during construction.

As described in Section 9.3, a number of trees of varying sizes would also need to be removed to facilitate works at each station. This impact, which has the potential to affect the amenity and character of station areas, is considered in Section 19.3.2. Impacts to trees would be managed in accordance with the proposed tree management and replacement strategy (described in Section 9.3). This would include preparation of comprehensive tree reports by a qualified arborist for each tree requiring protection, pruning, or removal, to guide the approach to managing each tree during construction.

Terrestrial habitat removal

Only a small area of fauna habitat would be removed, as most of the project area is already cleared land. The vegetation that would be removed or modified provides limited habitat resources for native fauna species, due to its existing highly modified nature and the surrounding urban environment. Fauna habitat resources that would be removed include foraging and shelter resources for mainly common native fauna typical of urban environments. It is highly unlikely that any threatened species or any fauna populations would rely on the habitat resources within the project area for their survival.

Loss of fauna habitat would involve the following:

- removal of one hectare of native vegetation, and 7.3 hectares of planted native species, which would provide nesting and foraging habitat for common species of birds and possums
- removal of 7.9 hectares of foraging habitat for the threatened Grey-headed Flying-fox, Eastern Bentwing Bat and other threatened fauna species with known or potential habitat in the study area
- removal of 21.5 hectares of exotic vegetation with a forest, scrub, or grassland structure, which provides nesting and potential foraging habitat for species such as the Long-nosed Bandicoot and common small birds, as well as shelter and foraging habitat for reptiles and frogs
- removal of aquatic habitat associated with drainage channels
- possible removal of potential roost sites for common microbats associated with two hollow-bearing trees at Punchbowl, and impacts to bridges and culverts
- removal or disturbance of vegetation providing habitat for the Australian White Ibis near Wiley Park Station, resulting in dispersal of individuals to other locations.

Fragmentation or isolation of habitat

The vegetation within the study area is currently fragmented by the existing rail corridor, roads, and urban development. It is unlikely that the project would create an additional barrier to movement. Therefore, the project is unlikely to affect the life cycle of either common or threatened flora species.

The only remnant vegetation adjacent to the study area is a narrow, linear strip along the banks of the Cooks River. The removal of a small area of vegetation at the edge of this patch would not sever this connecting link, and is unlikely to significantly increase the degree of fragmentation of native vegetation and habitat in the local area. Connectivity of terrestrial, riparian, and aquatic habitat would be maintained.

Works to overbridges and culverts have been designed to minimise the impact on hydrology and flooding. Once construction is complete, connectivity of aquatic habitats would be relatively unaffected.

Fauna injury or mortality

Construction has the potential to result in injury or mortality of some individuals of less mobile fauna species, and other small terrestrial fauna that may be sheltering in vegetation within the project area. The potential injury or mortality of individuals is highly unlikely to affect an ecologically significant proportion of any local populations. More mobile native fauna, such as native birds, bats, terrestrial, and arboreal mammals are likely to be able to evade injury during construction activities.

Impacts on the Long-nosed Bandicoot Inner Western Sydney population

As noted in Section 22.2.2, the biodiversity assessment concluded that the Long-nosed Bandicoot is unlikely to occur in the project area. As a result, no direct impacts of the project on this species are predicted.

Construction traffic has the potential to introduce a vehicle strike risk to any individuals that may be present in the surrounding area. However, given the lack of evidence of a resident population in the project area and its position at the edge of the mapped habitat area, it is unlikely that this would occur.

The project would not increase the predation risk of the bandicoot in the region, as it would not result in an increase in foxes or cats.

Noise and vibration from construction and operation has the potential to disturb fauna adjacent to the project area. However, individuals are likely to be accustomed to existing noise from trains, road traffic, and the urban environment, as well as lights from trains, cars, streetlights, and buildings. While there would be localised increases in noise and light that could temporarily create disturbance, increases in noise and light above existing background levels are unlikely to result in a significant impact.

Aquatic habitat

The project would remove small areas of low quality aquatic habitat associated with drainage structures and small depressions. There would be no direct impacts (such as blockage of fish passage or removal of key fish habitat) on the Cooks River.

Impacts on groundwater dependent ecosystems

Any runoff (including water, sediments and contaminants) during construction would be managed to minimise the potential for indirect impacts on downstream areas, including the groundwater dependent ecosystems present along Wolli Creek.

Indirect impacts

Indirect impacts could include the following:

- Edge effects – these can occur in adjoining areas of vegetation and habitat as a result of weed growth, increased noise and light, erosion and sedimentation, and can result from vegetation clearance, where a new edge is created between vegetation and cleared areas, or from widening or extending cleared easements through existing vegetation.
- Light and noise – these could impact breeding, foraging, and roosting activities where fauna are located close to construction activities.
- Erosion, sedimentation, and dust generation – uncontrolled erosion can cause weed problems, reduce habitat values, and stifle plant growth.
- Weeds – dispersal of weed propagules (seeds, stems and pollen) into areas of native vegetation could occur as a result of erosion (wind and water) and the movement of workers and vehicles.
- Plant pathogens – potential spread of soil-borne pathogens of native plants (such as Phytophthora) spread on machinery.
- Disease – potential spread of Chytrid fungus into local native frog populations, through soil and water carried on machinery and by the movement of workers between different areas.
- Aquatic habitat disturbance – as a result of works near the Cooks River and potential water quality impacts.

These impacts can be managed through the implementation of standard construction soil and water management measures (listed in Chapters 20 (Soils and contamination) and 21 (Hydrology, flooding and water quality)), and the mitigation measures listed in Section 22.4. With the implementation of these measures, no significant indirect impacts on biodiversity are predicted.

22.3.3 Operation impacts

The project area is dominated by existing rail and road infrastructure, and is located in a highly modified environment. Vegetation adjoining the project area is already subject to weed infestation and other edge effects. Fauna that occupies habitats within the project area and adjacent areas are likely to be accustomed to noise from trains, road traffic, and the urban environment. Given the highly modified habitats present, additional train movements are unlikely to significantly increase the risk of collisions.

In this context, the project is likely to comprise only a minor increase in any of these potential impacts. The project is unlikely to increase the extent, duration, or magnitude of these impacts, to the extent that a significant negative effect on biodiversity values would result during operation.

As noted in Section 22.3.2, the Long-nosed Bandicoot is not considered likely to occur within the project area. However, for any individual present, operation of the project has the potential to increase the risk of vehicle strike due to an increased frequency of metro services along the corridor compared to existing services. Given the lack of evidence of a resident population in the project area, and the project area's position at the edge of the mapped habitat area, any increase in the number of train services is unlikely to impact the bandicoot.

Similar to the potential for construction impacts, any additional noise or light during operation is unlikely to impact any local population of the Long-nosed Bandicoot. Bandicoots (if present) are likely to be accustomed to existing noise and light from trains, road traffic, and the urban environment. Increases in noise and light above existing background levels are unlikely to result in a significant change in impacts.

22.3.4 Key threatening processes

A key threatening process is as an action, activity, project or potential threat, listed under the TSC Act, FM Act, and EPBC Act, which:

- adversely affects two or more threatened species, populations, or ecological communities
- could cause species, populations or ecological communities that are not currently threatened to become threatened.

The key threatening processes relevant to the project are considered in Table 22.3. The project itself does not constitute a key threatening process, and is unlikely to exacerbate those processes. Implementation of the mitigation measures described in Section 22.4 would minimise the potential impacts identified.

Table 22.3 Key threatening processes relevant to the project

Key threatening process	Listing	Assessment
Clearing of native vegetation	TSC Act EPBC Act	The project would involve clearing of one hectare of remnant and regrowth native vegetation, and would not affect the viability of remnant vegetation in the study area, or reduce the extent of habitat below the minimum size required for any fauna species. The majority of vegetation to be removed is in relatively poor condition, and on the edge of remnant patches adjacent to the rail corridor.
Clearing of hollow-bearing trees	TSC Act	Surveys undertaken for the biodiversity assessment indicated that the project would remove two hollow bearing trees as part of the clearing of native vegetation within the rail corridor.
Removal of dead wood and dead trees	TSC Act	The project area contains very little fallen timber. Construction may result in the removal or disturbance of the minimal amounts of timber that occur.
The degradation of native riparian vegetation along NSW water courses	FM Act	Planted riparian vegetation is located along the banks of the Cooks River (near Canterbury Station). The project would not impact this vegetation.
Human-caused climate change	TSC Act EPBC Act	Combustion of fuels associated with construction and operation would contribute to emissions of greenhouse gases. The project does not pass through any areas mapped as coastal corridors for climate change.

22.3.5 Impacts on biodiversity related matters of national environmental significance

Threatened ecological communities

There are no threatened ecological communities listed under the EPBC Act in the study area. There is native vegetation in the study area that is floristically similar to Cumberland Plain Woodland and Shale-gravel Transition Forest or Sydney Turpentine Ironbark Forest, both of which are listed as Critically Endangered Ecological Communities under the EPBC Act. The vegetation in the study area does not meet the patch size or condition criteria required to comprise occurrences of these Critically Endangered Ecological Communities as defined under the EPBC Act.

Threatened species

The study area contains around 650 stems of Downy Wattle, which is listed as a vulnerable species under the EPBC Act. The project has been purposefully designed to avoid impacts on the population of this threatened plant. There are no Downy Wattle stems in the project area. An assessment of the likely significance of impacts on Downy Wattle was prepared as part of the biodiversity assessment in accordance with the EPBC Act significant impact guidelines. The assessment concluded that the project would remove around 0.6 hectares of potential habitat for this species. This would result in indirect effects on occupied habitat through increased fragmentation of habitat, reduction in native vegetation cover, and disturbance of surface soil in the vicinity of occupied habitat. The local population has persisted in a highly modified environment adjacent to heavy rail infrastructure. The post-construction environment would be very similar to the existing environment.

The project would not directly harm any individuals of this species, and construction and environmental management measures are likely to mitigate the risk of indirect impacts. Based on these considerations, the project is not likely to have a significant impact on Downy Wattle.

The Grey-headed Flying-fox was recorded foraging within the project area during surveys. The project would remove foraging habitat for this species. An assessment of the likely significance of impacts on the Grey-headed Flying-fox was prepared in accordance with the EPBC Act significant impact guidelines. The Grey-headed Flying-fox may forage on occasion in the project area, especially when figs are fruiting or eucalypts are in flower. The project would not directly or indirectly affect roost camps. Construction would remove 7.9 hectares of foraging habitat, including remnant, regrowth and planted native tree species in the project area. The habitat to be removed comprises a minor proportion of the available habitat resources in the wider region, which includes many thousands of individual blossom or fruit bearing trees in streetscapes, parks and gardens. Based on these considerations, the project is not likely to have a significant impact on the Grey-headed Flying-fox.

No other threatened fauna species listed under the EPBC Act are likely to be impacted by the project. Given the minor magnitude of impacts on threatened fauna and their habitats further assessment or approval under the EPBC Act is highly unlikely to be required and a referral is not required.

Migratory species

No migratory bird species listed under the EPBC Act were recorded during field surveys. However, there is potential habitat for species such as the Rufous Fantail and Rainbow Bee-eater in the project area and study area. As discussed previously, vegetation in the study area is highly modified, fragmented, and would have limited value for these migratory species. Individuals that may occur would occur on a transient basis only.

The study area is not considered important habitat for migratory species according to the significant impact criteria for migratory species (Department of the Environment, 2013). No assessments of significance have been prepared for migratory species. Based on the above considerations, the project is unlikely to significantly impact any of the listed migratory fauna species that were predicted to occur.

22.3.6 Assessment against the Framework for Biodiversity Assessment

The *Framework for Biodiversity Assessment* requires assessment of the project against a number of factors. The results of the assessment are presented in the Biodiversity Assessment Report (Technical paper 9) and summarised below.

Impacts on biodiversity that require further consideration

Under the *Framework for Biodiversity Assessment,* impacts that require further consideration include:

- significant impacts on landscape features
- impacts on endangered ecological communities that are likely to significantly affect the persistence or viability of that community
- impacts on critical habitat or on threatened species that are likely to significantly affect the persistence or viability of a population of a threatened species.

The project has been designed to avoid impacts on biodiversity values as far as is practicable. The project has been designed to avoid impacts on Downy Wattle.

The project would result in minor impacts on Sydney Turpentine Ironbark Forest and Shale Gravel Transition Forest, but would not significantly affect the persistence or viability of these communities.

Although the project would result in the loss of very small areas of foraging habitat, it would not affect any critical habitat for the Grey-headed Flying-fox, threatened microbats, or other mobile

threatened fauna that may potentially occur. The project would remove low quality, potential habitat for the endangered population of the Long-nosed Bandicoot in Inner Western Sydney located outside of its known area of occupancy. However, this is highly unlikely to threaten the viability of these species or population.

The project would not threaten the persistence or viability of any threatened species.

The project would not impact on matters that require further consideration.

Impacts requiring biodiversity offsets

The project would result in the removal of one hectare of native vegetation requiring biodiversity offsets. The biodiversity credits that would be required to offset impacts are summarised in Table 22.4. A biodiversity offset strategy has been prepared to offset the required credits and is discussed in Section 22.4.2.

Table 22.4 Ecosystem credits required to offset impacts of the project

Plant community type	Area (ha)	Loss in landscape value	Loss in site value score	Threatened species with highest credit requirement	Threatened species offset multiplier	Credits required
Turpentine - Grey Ironbark open forest on shale (ME041)	0.2	6.00	39.58	Greater Broad-nosed Bat	2.2	6
Turpentine - Grey Ironbark open forest on shale (ME041)	0.4	6.00	24.48	Greater Broad-nosed Bat	2.2	8
Broad-leaved Ironbark - Grey Box - Melaleuca decora grassy open forest on clay/gravel soils (ME004)	0.4	6.00	38.54	Greater Broad-nosed Bat	2.2	13
Total credits required						**27**

Areas not requiring offset determination

The majority of native flora in the project area is contained within patches of planted native species. These areas were identified as planted, rather than regrowth or remnant native vegetation, because they contained sub-mature, even aged plants arranged in straight lines and are located on cuttings or fill material associated with unnatural landforms such as embankments. Further, many of these native plant species are not native to the Sydney region or are garden cultivars.

These planted native species would provide some habitat for threatened species, including the Grey-headed Flying-fox. However, the vegetation lacks the structural and species diversity of native vegetation communities. In addition, it does not contain species credit type threatened species or their habitats. Therefore, this vegetation does not require offset calculation, and is not included in the above calculations.

Areas not requiring assessment

The assessment did not address non-native or exotic vegetation, gravel tracks, hardstand areas, and other infrastructure with occasional plants associated with cracks or shallow soil deposits that clearly do not comprise native vegetation within the meaning of the *Framework for Biodiversity Assessment*.

22.3.7 Impacts on biodiversity values not covered by the Framework for Biodiversity Assessment

The Secretary's environmental assessment requirements specify that the biodiversity assessment must assess impacts on biodiversity values not covered by the *Framework for Biodiversity Assessment*, and that these should include values specified for consideration by the Office of Environment and Heritage. The framework nominates a number of biodiversity values that are not considered under the framework as requiring further consideration. No additional values where specified by the Office of Environment and Heritage for consideration (refer to the summary of responses provided by government agencies during consultation for the Secretary's environmental assessment requirements, provided in Appendix A).

The following values are not assessable under the framework, but are considered to be relevant to the project and were assessed by the biodiversity assessment:

- vehicle strike
- aquatic biodiversity
- downstream impacts on terrestrial and aquatic vegetation, including groundwater dependent ecosystems.

Vehicle strike was considered as a potential operational impact in general, and for the Long-nosed Bandicoot Inner Western Sydney population in particular (refer to Section 22.3.3). Potential construction impacts on aquatic biodiversity and downstream areas are considered in Section 22.3.2.

22.3.8 Cumulative impacts

The study area is located within a developed urban area, with an extensive rail and road network, and urban development.

The project would involve the removal of small patches of already highly fragmented, predominantly planted vegetation. Future infrastructure and road projects, as well as residential development along the Sydenham to Bankstown corridor, would result in the removal of mainly planted vegetation and associated fauna habitats. These losses in biodiversity are likely to be restricted in area, given their location in a highly modified environment. Together, these projects and other developments would result in the further loss of habitat from an already modified environment with limited natural biodiversity values.

22.4 Mitigation measures

22.4.1 Approach to mitigation and management

The overall approach to managing impacts to biodiversity is, in order of importance, to:

- avoid impacts on habitat, through the planning and design process
- mitigate impacts on habitat, through the use of a range of mitigation measures
- offset any residual impact that could not be avoided or mitigated.

The project is largely contained within an existing rail corridor. The project area falls within land which has been previously modified by land clearing and development. Impacts on native flora and fauna are substantially less than would be associated with an undisturbed 'greenfield' site. There is no practical alternative to the location of the project. As such, there is little opportunity to further avoid impacts, other than through the micro-siting of infrastructure.

Mapping of biodiversity values early in the design process has allowed some impacts to be avodied. Notably, the project has been purposefully designed to avoid direct impacts to Downy

Wattle. Siting construction compounds in cleared areas has also been able to avoid or minimise impacts on native flora and fauna.

The Construction Environmental Management Framework (Appendix D) provides for the development and implementation of a Flora and Fauna Management Plan during construction. Additional mitigation measures are identified in Table 22.5.

22.4.2 List of mitigation measures

The mitigation measures that would be implemented to address potential biodiversity impacts are listed in Table 22.5.

Table 22.5 Mitigation measures – biodiversity

ID	Impact/issue	Mitigation measures	Relevant location(s)
Design/pre-construction			
B1	Direct impacts to biodiversity	Detailed design and construction planning would minimise direct impacts to vegetation mapped as threatened ecological communities as far as practicable, and have regard to the habitat management measures provided in the biodiversity assessment report.	All
B2		Pre-clearing surveys and inspections for endangered and threatened flora and fauna species would be undertaken by qualified ecologists prior to any clearing occurring. The surveys and inspections, and any subsequent relocation of species, would be undertaken in accordance with the measures provided in the biodiversity assessment report.	All
B3	Biodiversity offsets	The biodiversity offset strategy prepared for the Environmental Impact Statement would be updated to confirm the approach to retiring the required biodiversity credits (including appropriate biobank sites). It would also include a timeframe to retire the required credits based on the confirmed construction schedule and biobank site owner agreements/ requirements.	All
Construction			
B4	Direct impacts to biodiversity	Areas of biodiversity value outside the project area would be marked on plans, and fenced or signposted where practicable, to prevent unnecessary disturbance.	All
B5		Impacts to Downy Wattle would be avoided. The locations of Downy Wattle stems would be marked on plans, fenced on site, and avoided.	Punchbowl and Bankstown stations
B6		Equipment storage and stockpiling would be restricted to identified compound sites and already cleared land.	All
B7		A trained ecologist would be present during the clearing of native vegetation or removal of potential fauna habitat (including underbridges) to avoid impacts on resident fauna, and to salvage habitat resources as far as is practicable.	All
B8	Management of weeds	Noxious weeds would be managed in accordance with the *Noxious Weeds Act 1993*. Weeds of national environmental significance would be managed in accordance with the *Weeds of National Significance Weed Management Guide*.	All
Operation			
B9	Management of weeds	Annual inspections would be undertaken for weed infestations and to assess the need for control measures.	All

ID	Impact/issue	Mitigation measures	Relevant location(s)
B10		Any outbreak of noxious and/or weeds of national environmental significance would be managed in accordance with the relevant guidelines.	All

22.4.3 Consideration of the interactions between mitigation measures

Measures to minimise potential impacts associated with noise, air quality, soils, hydrology, and water quality and would also assist in minimising potential impacts to biodiversity. These mitigation measures are provided in Chapters 12, 13, 20, 21, and 23.

22.4.4 Managing residual impacts

Despite measures taken to avoid and mitigate impacts, the project would result in some unavoidable residual adverse impacts, including removal of native vegetation and habitat resources, and edge effects on adjoining areas of native vegetation.

Residual impacts following implementation of the mitigation measures in Section 22.4.2 are predicted to include:

- removal or modification of one hectare of native vegetation and associated habitat resources
- removal or modification of 7.3 hectares of planted native species that provide potential habitat for threatened species
- noise, light, traffic and altered environmental conditions associated with construction and operation.

The above residual impacts are small in extent and magnitude, and would comprise a minor reduction in biodiversity values in the study area. The biodiversity offset strategy (described below) would assist in mitigating residual impacts.

Biodiversity offset strategy

A biodiversity offset strategy has been developed to compensate for the unavoidable loss of ecological values as a result of the project. Transport for NSW commits to the retirement of the required credits in accordance with the *Framework for Biodiversity Assessment* and the NSW offsets policy. The Biodiversity Offset Strategy requires the purchase and retirement of biodiversity credits calculated in accordance with the *Framework for Biodiversity Assessment*. Transport for NSW would consult with the vendor/s of the biodiversity credits detailed in Technical Paper 9, and arrange to purchase and retire a total of 27 biodiversity credits appropriate to offset the impacts of the project.

23. Air quality

This chapter provides an assessment of the potential impacts of the project on air quality. Although there are no Secretary's environmental assessment requirements directly relevant to air quality, the assessment has been undertaken as air quality was identified as a potential risk by the State Significant Infrastructure Application Report, particularly in terms of the potential for amenity impacts.

23.1 Assessment approach

23.1.1 Legislative and policy context relevant to the assessment

The main legislation and guidelines relevant to the assessment and management of air quality are summarised below.

Protection of the Environment Operations Act 1997

As described in Section 20.1, the POEO Act provides the statutory framework for managing pollution in NSW. It includes procedures to regulate the potential for pollution, including the issue of environment protection licences, in relation to aspects such as air pollution. Air quality requirements (including criteria) are specified by environment protection licences. Environment protection licences would be obtained for both the construction and operation of the project, and the project would comply with requirements related to the minimisation of air quality impacts.

Clean Air Regulation

The *Protection of the Environment Operations (Clean Air) Regulation 2010* (the Clean Air Regulation) provides regulatory requirements to control emissions from motor vehicles, fuels, and industry. The project would be constructed and operated to ensure it complies with the Clean Air Regulation.

Approved Methods

Air quality impact assessment is guided by the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (DEC, 2005) (known as 'the Approved Methods'). The Approved Methods generally apply to stationary sources of air pollution. However, the qualitative assessment described in this chapter gave consideration to the Approved Methods, including relevant criteria and the assessment methodology.

Air NEPM

The *National Environment Protection (Ambient Air Quality) Measure* ('the Air NEPM') sets non-binding standards and ten-year goals. The Air NEPM has a goal for particulate matter with an aerodynamic diameter of less than 10 microns (PM_{10}) of 50 micrograms per cubic metre ($\mu g/m^3$) as a 24-hour average (no exceedances per year), and a $PM_{2.5}$ goal of 25 $\mu g/m^3$ as a 24-hour average. Consideration was given to these goals as part of the assessment.

23.1.2 Methodology

The main risk of the project with respect to air quality is emissions (mainly dust) during construction. These potential impacts would be temporary, confined to the construction period, and readily managed through the implementation of standard construction management measures.

As such, potential air quality impacts of the project have been assessed qualitatively, involving:

- a desktop review of the background air quality environment, including:
  - air quality data sourced from the NSW Office of Environment and Heritage's air quality monitoring stations, located at Earlwood, Chullora, and Liverpool (the closest stations to the project area)
  - the National Pollutant Inventory maintained by the Australian Government Department of the Environment and Energy, to identify any facilities that may be contributing to local/regional air quality conditions
- identifying sensitive receivers with the potential to be adversely affected by air quality impacts
- reviewing the construction and operational aspects of the project with the potential to generate air emissions
- a qualitative assessment of potential air quality impacts
- identifying appropriate mitigation and management measures, as necessary.

23.2 Existing environment

23.2.1 Ambient air quality

Ambient air quality in Sydney is influenced by a number of factors, including topography, prevailing meteorological conditions (such as wind and temperature, which vary seasonally), and local and regional air pollution sources (such as motor vehicles, industrial facilities and bushfires). Consequently, regional air quality can be highly variable and impacted by events occurring a significant distance away.

Air quality surrounding the project area is typical of a highly developed urban area that consists of a mix of land uses. Local air quality is mainly affected by vehicles on the road network, in particular on major roads such as Canterbury Road, King Georges Road, and Stacey Street/Fairford Road. Air quality is also affected by the operation of diesel freight trains along the rail corridor between east of Marrickville Station and west of Campsie Station.

The NSW Office of Environment and Heritage uses a standardised measure known as the air quality index to characterise air quality at a location and compare it in relative terms with other locations throughout NSW. The average daily air quality index values for the monitoring stations at Earlwood, Chullora, and Liverpool (refer to Table 23.1) varied between 46 and 51 in the available monitoring years. These values correspond with an air quality index outcome of 'good', indicating that air quality is generally of an acceptable quality.

23.2.2 Local emission sources

The desktop review identified the following potential air pollution sources in the study area:

- industrial facilities that reported air emissions during the 2014-2015 reporting period, including:
  - petroleum and coal product manufacturing facility (in Alexandria)
  - Sydney Trains Sydenham Maintenance Centre (in Sydenham)
  - airport operations and other air transport support services (in Mascot)
  - ceramic product manufacturing facility (in Punchbowl)
  - basic chemical manufacturing facility (in Bankstown)
- vehicle exhaust emissions from road and rail networks

- commercial businesses, such as service stations and smash repairs
- domestic activities, such as wood-fired home heaters and lawn mowing.

Only one air pollution source, the XPT Maintenance Centre located on Way Street in Sydenham, is located in the immediate vicinity of the project area (about 200 metres south-east). All other sources are located more than one kilometre from the project area.

23.2.3 Background air quality data

Air quality monitoring data sourced from the monitoring stations is summarised in Table 23.1. The data shows that the concentrations of air pollutants were generally below the applicable air quality criteria, with the exception of occasional days when PM_{10} exceeded 50 µg/m^3. These occurrences are generally the result of natural events such as dust storms and bushfires.

Table 23.1 Background air quality data

Pollutant	Averaging period	Criteria	Earlwood			Chullora			Liverpool		
			2013	2014	2015	2013	2014	2015	2013	2014	2015
PM_{10} (µg/m^3)	Maximum 24-hour	50	63	45	67	69	40	65	99	41	69
	95th percentile 24-hour	50	35	30	28	32	30	29	37	33	31
	Annual	30	20	18	17	18	18	18	21	19	19
Carbon monoxide (CO) (mg/m^3)	Maximum 1-hour	30	-	-	-	3	2	2	3	3	2
Nitrogen dioxide (NO_2) (µg/m^3)	Maximum 1-hour	246	97	81	107	111	130	109	113	89	122
	Annual	62	20	16	16	26	26	26	22	20	20
Sulphur dioxide (SO_2) (µg/m^3)	Maximum 1-hour	570	-	-	-	34	54	40	-	-	-
	Annual	60	-	-	-	3	3	3	-	-	-

23.2.4 Sensitive receivers

The project area is surrounded by a wide range of sensitive receivers, including residential properties, community facilities (such as schools, childcare centres, places of worship, and medical facilities), and recreational areas. A number of these receivers are located immediately adjacent to the project area.

Land uses surrounding the project area are described in Chapter 16 (Land use and property). Figure 12.1 shows sensitive receivers located generally within about 250 metres of the project area.

23.3 Impact assessment

23.3.1 Risk assessment

Potential risks

The environmental risk assessment for the project, undertaken for the State Significant Infrastructure Application Report, identified the following as the main air quality risks:

- impacts to local air quality due to the operation of construction plant and equipment.
- impacts to local air quality due to increased vehicle movements from replacement bus services and transport of construction materials
- impacts to local air quality due to dust generation from exposed surfaces.

As the project would be powered by electricity, there is expected to be minimal risk of air quality impacts during operation.

Chapter 24 (Sustainability and climate change) provides estimates of electricity use, and the initiatives and targets proposed to be considered further during detailed design. A preliminary estimate of construction emissions from plant and equipment use was prepared as part of greenhouse gas assessment (refer to Chapter 24).

How potential risks and impacts would be avoided

In general, potential air quality impacts would be avoided by:

- managing air quality in accordance with relevant legislative and policy requirements, as described in Section 23.1.1
- managing air quality in accordance with the environment protection licences for construction and operation
- implementing the air quality management measures described in Section 23.4.

23.3.2 Construction

Construction activities, including earthworks, storage and transport of spoil and waste materials, demolition of buildings, and exhaust emissions from construction equipment and vehicles, have the potential to impact on local air quality. The main potential impacts on air quality during construction are described below.

Dust generation

The processes that have the potential to generate particulate matter during construction are:

- mechanical disturbance − dust emissions as a result of earthworks/excavation and the operation/movement of construction vehicles and equipment
- wind erosion − dust emissions from disturbed soil surfaces and stockpiles in windy conditions.

Construction activities with the greatest potential to generate dust would include:

- demolition of buildings and infrastructure
- excavations and trenching for the installation of footings and new infrastructure
- transport, handling, stockpiling, loading, and unloading of spoil and imported materials

- creation of exposed surfaces through the clearing of vegetation, stripping of topsoil and other overlying structures (such as road and footpath pavements)
- other general construction activities that would occur along the length of the corridor.

The volume of dust generated would depend on the:

- type of equipment used
- construction technique employed
- type, particle size, and moisture content of material
- size of the exposed area
- meteorological conditions (in particular wind conditions).

Without the implementation of effective mitigation measures, dust emissions from construction could reduce local air quality and impact on nearby sensitive receivers.

The project would involve surface works in the project area, including track realignment, and other civil works to adjust drainage, install noise barriers, maintain embankments, upgrade and replace bridges, and to demolish and upgrade station buildings and structures. However, no major earthworks are required.

As a result of the limited scale of earthworks and nature of the works proposed, dust emissions are expected to be manageable through the implementation of standard erosion control and dust management measures applied successfully to other similar rail infrastructure projects, as required by the Construction Environmental Management Framework (refer to Section 23.4).

Exhaust emissions

The main source of emissions would be from the combustion of diesel fuel and petrol from heavy vehicles, mobile excavation machinery, and stationary combustion equipment as well as from the handling and/or on-site storage of fuel and other chemicals.

The volume of emissions from construction vehicles and machinery would depend on the type of fuel used, the power output and condition of the engine, and duration of operation.

Exhaust emissions would involve periodically localised emissions of carbon monoxide, particulate matter (PM_{10} and $PM_{2.5}$), nitrous oxides, sulphur dioxide, volatile organic compounds, and polycyclic aromatic hydrocarbons associated with the combustion of diesel fuel and petrol.

The highest potential for air quality impacts from plant emissions would be associated with works where multiple items of equipment operate simultaneously.

Exhaust emissions generated during construction would not significantly contribute to emissions in the project area, given the existing levels of vehicle use. These emissions would be managed by the implementation of standard construction mitigation measures, described in Section 23.4. As such, no long-term adverse impacts to air quality are anticipated.

23.3.3 Operation

Local impacts

There is the potential for minor air quality impacts. Any greenhouse gas emissions associated with the consumption of electricity during operation would be fully offset. Further information is provided in Chapter 24.

As the project would be powered by electricity, local emissions during operation are expected to be minimal and highly dispersed. Minor quantities of particulate matter (PM_{10}) emissions would be generated along the corridor, mainly due to the wear of the train brake pads, vaporisation of metals

due to sparking, and wear of steel due to friction between wheels and rail. These emissions would be in very low concentrations, and are not expected to be different from the current operational rail corridor.

Regional impacts

The project would not to result in any substantial regional air quality impacts as any emissions would be highly dispersed in the local area and would not impact on any areas away from the project.

23.3.4 Cumulative impacts

Cumulative air quality impacts may result from increased dust generation and emissions from other projects occurring concurrently to the project. The Chatswood to Sydenham project is the only identified project that would coincide spatially with the project area, at the eastern extent of the project near Fraser Park. The surface sections of WestConnex Stage 2 are located about two kilometres south of the project area at Lakemba, and about one kilometre south of Sydenham Station. Therefore, it is unlikely that these projects would combine with the project to generate cumulative air quality impacts.

The linear extent of the project and the scope and nature of the emission sources means that any cumulative impacts, are likely to be limited. The adoption of standard control measures, are expected to result in the successful management of dust and other emissions from the project, including any cumulative impacts.

As described in Section 23.3.3, operational air quality impacts are expected to be minor. Cumulative impacts associated with operation of the project and other local emissions sources are not expected.

23.4 Mitigation measures

23.4.1 Approach to mitigation and management

Potential impacts to air quality would be managed in accordance with the Construction Environmental Management Framework (as described in Chapter 28 (Synthesis of the Environmental Impact Statement)), which provides for development and implementation of an air quality management plan, to include (as a minimum):

- air quality mitigation measures, including those provided in the framework
- requirements of the environmental protection licence
- site plans or maps indicating locations of sensitive receivers and key air quality/dust controls
- responsibilities of key project personnel with respect to the implementation of the plan
- air quality and dust monitoring requirements
- compliance record generation and management.

During operation, air quality would be managed in accordance with the operational environment protection licence, in accordance with the operational environmental management plan.

23.4.2 List of mitigation measures

Table 23.2 provides the relevant mitigation measure for air quality impacts.

Table 23.2 Mitigation measures – air quality impacts

ID	Impact/issue	Mitigation measures	Applicable location(s)
Design/pre-construction and construction			
AQ1	Air quality impacts	An air quality management plan would be prepared and implemented during construction, to define the measures to minimise air quality impacts during construction.	All

23.4.3 Consideration of the interactions between mitigation measures

Measures to minimise the potential for air quality impacts would overlap with the measures proposed for the control of erosion and sedimentation (described in Chapter 20 (Soils and contamination)), as the major pollutant of concern is dust. As described in Section 20.4, soil and erosion control measures would be implemented during construction in accordance with *Soils and Construction - Managing Urban Stormwater Volume 1* (Landcom, 2004) and *Volume 2A* (DECC, 2008). Implementation of these measures would be guided by a soil and water management plan prepared in accordance with the Construction Environmental Management Framework.

Other interactions include measures relating to the emission of contaminated substances (also described in Chapter 20), sustainability and climate change measures to be implemented to manage impacts of electricity use during construction and operation (described in Chapter 24), and measures to manage impacts as a result of hazardous materials (described in Chapter 25). Implementation of these measures, together with the requirements of the Construction Environmental Management Framework, would minimise the potential for air quality impacts.

23.4.4 Managing residual impacts

The mitigation and management measures proposed are expected to minimise the potential for impacts to air quality. With the implementation of these measures, residual impacts are expected to be minimal.

24. Sustainability and climate change

This chapter assesses the project in terms of sustainability, and how it does, and would continue to, meet relevant sustainability requirements. It addresses the Secretary's environmental assessment requirements listed in Table 24.1. The chapter also provides a climate change risk assessment, and a greenhouse gas assessment for the project.

Table 24.1 Secretary's environmental assessment requirements – sustainability

Ref	Secretary's environmental assessment requirements - sustainability	Where addressed
12. Sustainability		
12.1	The Proponent must assess the sustainability of the project in accordance with the Infrastructure Sustainability Council of Australia (ISCA) *Infrastructure Sustainability Rating Tool* or equivalent and relevant rating tool.	Section 24.3.1
12.2	The Proponent must review the project against the current guidelines including targets and strategies to improve Government efficiency in use of water, energy and transport.	Sections 24.2 and 24.3

24.1 Assessment approach

24.1.1 Sustainability

What is sustainability?

Sustainability, or sustainable development, has many different definitions, depending on the application and context. In 1987, the Brundtland Commission defined sustainable development 'as development that meets the needs of the present, without compromising the ability of future generations to meet their own needs' (World Commission on Environment and Development, 1987).

In 1992, ecologically sustainable development (ESD) was defined by the Ecologically Sustainable Development Steering Committee as 'using, conserving and enhancing the community's resources so that ecological processes, on which life depends are maintained, and the total quality of life, now and in the future can be increased' (Ecologically Sustainable Development Steering Committee, 1992).

In NSW, the concept of ESD was introduced into planning and development legislation by the EP&A Act. One of the objectives of the EP&A Act is '(vii) to encourage ecologically sustainability development'. In accordance with part 3 of schedule 2 of the Regulation, an Environmental Impact Statement is required to include '(f) the reasons justifying the carrying out of the development, activity or infrastructure in the manner proposed, having regard to … the principles of ecologically sustainable development set out in subclause (4).'

Section 6(2) of the *Protection of the Environment Administration Act 1991* states that ESD can be achieved through the implementation of:

- the precautionary principle
- intergenerational equity
- conservation of biological diversity and ecological integrity
- improved valuation, pricing and incentive mechanisms.

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

Methodology for this assessment

The assessment summarised in this chapter considers the application of sustainability principles to the project, and the opportunities to achieve sustainability targets and outcomes aligned with best practice infrastructure projects. It considers Transport for NSW's sustainability strategy for Sydney Metro City & Southwest (provided in Appendix F), and other relevant policies and legislation.

The sustainability targets and initiatives outlined have been developed in response to various guidance documents and will be integrated into the design, construction, and operation of the project.

24.1.2 Climate change

What is climate change?

Climate change has the potential to alter the frequency, intensity, and distribution of extreme weather related natural hazards, including more intense and frequent heat waves, droughts, floods, and storm surges. The risk of climate change impacts on infrastructure (including the project) needs to be considered as part of the design process, as structures need to be designed to last for many years, and therefore need to be resilient to climate change.

Climate change adaptation planning and risk management is an evolving field. Responses to reduce the risks of climate change broadly fall into two categories: mitigation and adaptation. Using the definitions of the Inter-governmental Panel on Climate Change, mitigation aims to reduce human effects on the climate system by strategies to reduce greenhouse gas sources and emissions, and to enhance greenhouse gas sinks. Adaptation refers to adjustments in response to actual or anticipated climate changes or their effects, to moderate harm or to exploit beneficial opportunities. Infrastructure design and planning needs to incorporate adaptation measures, based on the assessed risk of climate change to a proposal.

Methodology for this assessment

The purpose of the climate change risk assessment is to:

- identify and assess the risks that climate change poses to the project
- prioritise risks that require further action as a basis for decision-making and planning.

A climate change risk assessment was undertaken by Transport for NSW in accordance with the *TfNSW Climate Risk Assessment Guidelines* (Transport for NSW, 2016b) and based on *AS 5334-2013 Climate change adaptation for settlements and infrastructure – A risk based approach.*

The following steps were undertaken to complete the risk assessment:

- determine the climate change context
- identify the climate risks and assess the likelihood and consequence of each risk
- identify adaptation responses.

During design development, two risk workshops were held with multidisciplinary members of the project team. The preliminary risks identified at the workshops were formalised in a risk register, and thorough risk descriptions were provided, including cause, impact/consequence, and current treatment.

Climate projections

Climate change risks associated with the operational phase of the project are much greater than during the construction phase, as there is much more time for those effects to be realised. Due to the expected design life of assets such as bridges and drainage infrastructure (60 to 100 years), the time periods selected for the assessment were 2030, 2060, and 2090. The climate models used to project future climate conditions are not an effective tool to determine near term changes, such as within the next 10 years. Construction phase climate change risks were therefore not assessed.

The climatic variables identified as potentially generating risks for the project were annual average rainfall, extreme rainfall, extreme temperature, extreme wind, storms (cyclones, hail, dust and lightning), sea level rise, and fire danger.

Climate change has the potential for direct and indirect impacts on the project. The types of potential impacts are relatively well understood, but their severity and extent is uncertain. As such, there is a need to identify these risks and develop strategies to treat them. Risks were identified and rated as either low, medium, high, or very high.

24.1.3 Greenhouse gas and energy

What are greenhouse gases?

Greenhouse gas is a collective term for a range of gases that absorb outgoing infrared radiation reflected from the earth, which in turn generate heat. This heat warms the atmosphere. This is known as the greenhouse effect, which is linked to climate change.

Human activities, including the combustion of carbon-based fuels, increase the concentration of greenhouse gases in the atmosphere. This leads to greater absorption of infrared radiation and an increase in atmospheric temperature. This is known as the enhanced greenhouse effect. The following six greenhouse gases are covered under international climate change agreements:

- carbon dioxide (CO_2)
- methane (CH_4)
- nitrous oxide (N_2O)
- hydrofluorocarbons (HFCs)
- perfluorocarbons (PFCs)
- sulphur hexafluoride (SF_6).

Identifying the likely greenhouse gas emissions associated with a project enables the scale of potential emissions to be determined, providing a baseline from which to develop and deliver greenhouse gas reduction measures.

Each greenhouse gas behaves differently in the atmosphere with respect to its ability to trap outgoing radiation and its residence time in the atmosphere. To achieve a common unit of measurement, each greenhouse gas was compared to the warming potential of carbon dioxide over a 100 year period. This provides a global warming potential for each greenhouse gas, which can be applied to the estimated emissions of the project. The resulting aggregated emissions are referred to in terms of carbon dioxide-equivalent emissions (or CO_2-e).

Methodology for this assessment

A greenhouse gas assessment was undertaken by Transport for NSW in accordance with *The Greenhouse Gas Protocol* (WRI and WBCSD, 2004), the Intergovernmental Panel on Climate Change, and Australian Government greenhouse gas accounting/classification systems.

Emissions were categorised into three different categories (known as 'scopes') to help differentiate between direct emissions from sources that are owned or controlled by a project, and upstream indirect emissions that are a consequence of project activities, but which occur at sources owned or controlled by another entity. The three greenhouse gas scopes are:

- Scope 1 emissions, also referred to direct emissions
- Scope 2 emissions, also referred to as indirect emissions
- Scope 3 emissions, includes all indirect emissions (not included in scope 2) due to upstream or downstream activities.

The objectives of the greenhouse gas assessment were to:

- identify the likely sources of greenhouse gas emissions associated with construction and operation
- quantify the greenhouse gas emissions associated with each greenhouse gas source
- identify opportunities (mitigation measures) to reduce greenhouse gas emissions.

The greenhouse gas assessment is a preliminary estimate based on current design information and construction staging. The assessment would be revised and updated as the design evolves and more accurate information becomes available.

Operational greenhouse gas emissions related to maintenance equipment use, maintenance transport, waste generation, and materials used for maintenance, are considered to be low compared with electrical consumption, and were not included in the greenhouse gas assessment.

24.2 Context for the assessment

24.2.1 Sustainability

Legislative and policy context for the assessment

Sustainability considerations have been embedded in a number of legislative and policy mechanisms, particularly in relation to resource use, waste, and energy efficiency. These include:

- *Waste Avoidance and Resource Recovery Act 2001*
- *National Greenhouse and Energy Reporting Act 2007*
- *National Strategy for Ecologically Sustainable Development* (Ecologically Sustainable Development Steering Committee, 1992)
- *National Waste Policy: Less Waste, More Resources* (Environment Protection and Heritage Council, 2009)
- *Sustainable Procurement Guide* (Australian Government, 2013)
- *NSW Government Resource Efficiency Policy* (Office of Environment and Heritage, 2014d).

The *NSW Long Term Transport Master Plan* (Transport for NSW, 2012b) acknowledges that meeting community expectations in environmental sustainability is a statewide challenge. Initiatives to manage and minimise the environmental impacts of NSW's transport system include:

- a co-ordinated approach to addressing environmental issues at all levels of transport planning
- sustainable design guidelines for transport projects
- better ways to assess the environmental benefits of projects.

The *Transport Environment and Sustainability Policy Framework* is a collective and co-ordinated approach to deliver the NSW Government's environmental and sustainability agenda across the transport 'cluster' (Transport for NSW, Sydney Trains, NSW Trains, Roads and Maritime Services, and the State Transit Authority of NSW. The framework was developed to implement the *Transport Environment and Sustainability Policy Statement* (Transport for NSW, 2013c).

Regulatory and policy drivers for the inclusion of workforce development initiatives as part of the sustainability program for the project include:

- The NSW State Priorities include creating jobs and apprenticeships for the construction sector through infrastructure investment, and increasing the proportion of people completing apprenticeships and traineeships to 65 per cent.
- The *Australian Jobs Act 2013* requires proponents of major projects, with a capital expenditure of $500 million or more, to prepare and implement an Australian Industry Participation plan, to support the development of a more diverse workforce, and future growth opportunities for Australian enterprises.
- The NSW Aboriginal Participation in Construction Policy aims to deliver more employment and business opportunities for Aboriginal people on selected NSW Government construction projects. The category of a project defines the percentage of the project spend to be directed to Aboriginal-related employment and education activities, and/or the procurement of goods or services from recognised Aboriginal businesses or other programs.

Sydney Metro City & Southwest Sustainability Strategy

Figure 24.1 shows how sustainability is governed for Sydney Metro, and Figure 24.2 shows how it is integrated into the environmental management system.

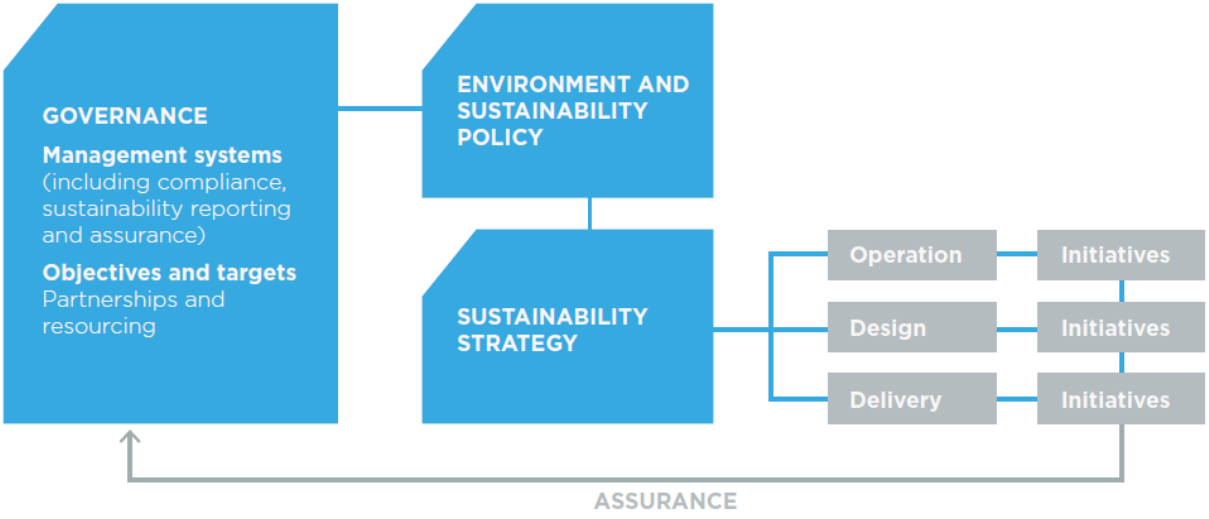


Figure 24.1 Sydney Metro sustainability governance structure

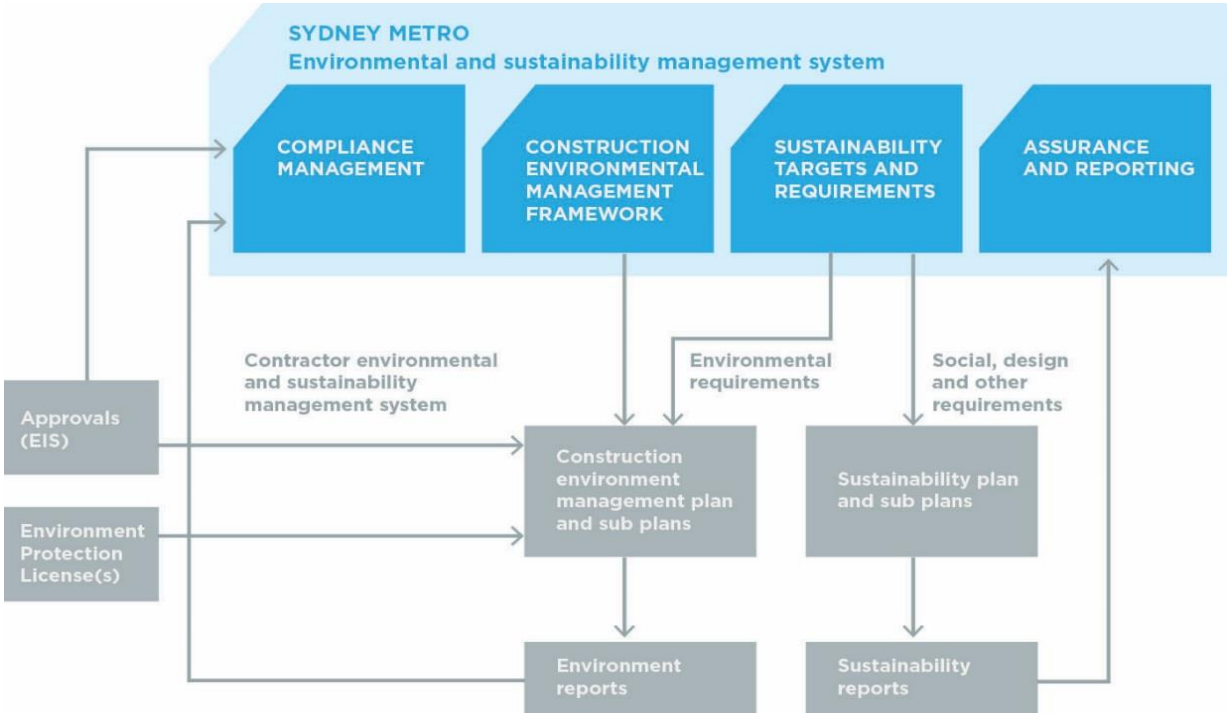


Figure 24.2 Sydney Metro environmental and sustainability management system

A sustainability strategy has been developed for Sydney Metro City & Southwest taking into account Transport for NSW sustainability commitments, and a copy is provided in Appendix F. The strategy provides an overarching framework for integrating sustainability into project planning, design, procurement, and operation. The strategy outlines objectives, targets, initiatives, and requirements for embedding sustainability across each of the following themes:

- governance
- carbon and energy management
- pollution control
- climate change resilience
- resources water efficiency
- resource waste and materials
- biodiversity conservation
- heritage conservation
- liveability
- community benefit
- supply chain
- workforce development
- economic.

24.2.2 Climate change

Legislative and policy context for the assessment

Relevant climate change policies, guidelines, and standards include:

- *Climate Change Impacts and Risk Management – A Guide for Business and Government* (Australian Greenhouse Office, 2006)
- *AS 5334:2013 Climate change adaptation for settlements and infrastructure – a risk based approach*
- *National Climate Resilience and Adaptation Strategy* (Australian Government, 2015)
- *Climate Change in Australia - East Coast Cluster Report* (CSIRO and Bureau of Meteorology, 2015)
- Office of Environment and Heritage's NSW climate change adaptation guidelines.

As noted in Section 24.2.1, the *NSW Long Term Transport Master Plan* acknowledges that meeting community expectations in environmental sustainability is a statewide challenge. Relevant actions include 'boosting our resilience to climate change and natural disasters' and 'assessing transport climate resilience'.

The Transport for NSW *Environment and Sustainability Policy Framework's* climate change resilience theme acknowledges that some level of climate change is inevitable. It focuses on Transport for NSW's efforts to adapt and build resilience into its planning, projects and operations, to minimise the impacts and costs of climate change on customers, and contribute to greater climate change resilience for NSW.

The Sydney Metro City & Southwest sustainability strategy includes an objective that infrastructure and operations are resilient to the impacts of climate change.

24.2.3 Greenhouses gases

Transport for NSW's online Carbon Estimate and Reporting Tool was used for the greenhouse gas emissions assessment. The tool was developed to provide consistency in greenhouse gas emissions assessment and reporting for the construction stage of Transport for NSW projects.

24.3 Assessment results

24.3.1 Sustainability

The ISCA's Infrastructure Sustainability framework ('the IS framework'), or equivalent, would be applied to the project. The IS framework applies a point score across 15 sustainability themes, including water and energy use, innovation, materials, management, climate change, heritage, stakeholders, and biodiversity. The IS framework's themes and aims are consistent with those in the Sydney Metro City & Southwest Sustainability Strategy. Under the IS framework, points are achieved by providing verified evidence of performance, and totalled to achieve an overall project rating. The IS rating is determined by a score out of 100 and has four rating levels – Commended (25 to 29 points); Excellent (50 to 74 points); and Leading (75 to 100 points). A rating of Commended indicates that a project is achieving better than business as usual. A rating of Excellent indicates that a project is generally achieving Australian best practice in sustainability. A Leading rating indicates that a project is close to world's best practice.

The project would comprise a number of contract packages. For those packages where the IS framework is relevant, Transport for NSW is targeting achievement of an 'Excellent' rating, with a minimum score of 65 points. Where the IS framework is not relevant, Transport for NSW would

apply the principles of other equivalent guidance and rating schemes, and would target a high level of achievement under those schemes.

Sustainability initiatives and targets that would be integrated into the design, construction and operation of the project, following confirmation during the detailed design process, are summarised in Table 24.2.

Table 24.2 Sustainability initiatives and targets

Area	Project response/targets
Governance	• targeting a 65-point 'Excellent' rating under the ISCA IS framework for the design and 'as built' ratings • regular reporting of sustainability performance
Carbon and energy management	• 15 per cent station energy performance improvement over minimum Building Code of Australia requirements, including use of efficient glazing, building fabric, mechanical, electrical, and lighting systems • use of onsite solar photovoltaics renewable energy systems • offset 25 per cent of construction electricity • reducing greenhouse gases by 20 per cent compared to business as usual, using sustainable construction practices • reduction of traction electricity demand using regenerative braking • offset 100 per cent of operational electricity
Pollution control	• integration of water sensitive urban design measures • placing limits on volatile organic compounds for paints, finishes, adhesives, and sealants, and on formaldehyde for all composite wood products
Climate change resilience	• station and critical infrastructure levels and drainage design to allow for an increase in rainfall intensity
Water	• 10 per cent saving in potable water use during construction • using rainwater harvesting and reuse to reduce potable water consumption at stations • incorporating water efficient fixtures and fittings • using drought resistant species in landscaping
Waste and materials	• 90 per cent of construction and demolition waste to be recycled • 60 per cent of site office waste generated during construction to be recycled • 100 per cent beneficial reuse of usable spoil • 15 per cent reduction in the environmental impact of materials, compared to business as usual • 25 per cent reduction in Portland cement used in concrete
Biodiversity	• retention of existing trees where practicable • using drought resistant native plants for landscaping • additional street tree planting to complement existing plantings
Heritage conservation	• heritage interpretation which supports local heritage values, existing community values, and station identity
Liveability	• stations minimise distance for interchange, and prioritise pedestrians and cycle accessibility to integrate with existing or planned pedestrian and cycle networks. • stations provide secure cycle parking spaces
Community benefit	• station works include pedestrian pathway improvements and improved connections to existing cycle ways • creation of enhanced and additional public plazas • increased accessibility of existing stations
Supply chain	• use of sustainably sourced timber • responsible sourcing of steel and concrete

Area	Project response/targets
Workforce development	• increase opportunities for employment of local people, participation of local businesses, and participation of small to medium enterprises • enable targeted and transferable skills development that resolves local and national skills shortages, supports industry to compete in home and global markets, and embeds a health and safety culture within all induction and training activities, promoting continuous improvement • increased workforce diversity and inclusion, targeting Aboriginal workers and businesses, female representation in non-traditional trades, and long term unemployed • inspire future talent and develop capacity in the sector, engaging young people via education and work experience, collaborating with higher education institutions to provide programs responding to rapid transit and other infrastructure requirements, and supporting vocational career development through apprenticeships and traineeships

24.3.2 Climate change

In summary, the climate risk assessment process identified (residual risks):

- no very high ('unacceptable') risks
- no high ('undesirable') risks
- fifteen medium ('tolerable') risks
- no low ('acceptable') risks.

The fifteen medium risks comprised issues in the following categories:

- increased rainfall intensity and extreme events affecting stations and surrounds
- changed rainfall patterns affecting overland flows and drainage requirements
- effects of changes in groundwater levels and extreme rainfall events resulting in instability of cuttings and embankments
- damage of roofs and critical equipment associated with hailstorm events.

All proposed drainage works have been designed to comply with relevant guidelines as far as possible. Where necessary, drainage works have included carparks and as well as drainage in areas surrounding the stations. Flood modelling included a 10 per cent allowance for the effects of climate change. Further sensitivity analyses for additional increases in rainfall intensity would be completed during detailed design.

Retaining walls have been designed to allow for elevated ground water levels. As a result, changes in ground water levels do not represent a high risk.

To effectively manage these and other climate change risks, each stage of the design and delivery of the project would consider the most up to date climate change projections and design guidelines and would be subject to ongoing review and response by designers and constructors.

24.3.3 Greenhouse gas

Potential greenhouse gas emissions

Potential scope 1, 2 and 3 greenhouse gas sources for construction and operation are listed in Table 24.3.

Table 24.3 Potential greenhouse gas sources and categorisation

Scope	Description	Construction	Operation
Scope 1	Direct greenhouse gas emissions generated on site.	Construction equipment – use of fossil fuels, typically diesel, which would create greenhouse gas emissions. Removal of vegetation – vegetation absorbs carbon dioxide from the atmosphere by photosynthesis. Where vegetation is removed, the ability for the vegetation to act as a carbon sink would be lost.	Maintenance plant and equipment – use of fossil fuels, typically diesel, which would create greenhouse gas emissions.
Scope 2	Indirect greenhouse gas emissions associated with electricity used on-site for lighting construction sites, where actual emissions are generated elsewhere (generally at the source of the electricity generation).	Electricity and fuel use - used by site offices for lighting and security.	Traction power and rail systems electricity Electricity for station and maintenance facilities Upstream fuel and electricity usage.
Scope 3	Other indirect emissions, such as the extraction and production of purchased materials and fuels, transport-related activities, and waste disposal.	Construction materials embodied energy – different construction materials contain varying levels of embodied emissions. For example, high-strength concrete contains a greater proportion of cement (which has a high level of embodied emissions), compared to concrete for lower-strength applications that contain fly-ash (which has a lower level of embodied emissions). Transport of construction materials and wastes – transport would create greenhouse gas emissions from the burning of fossil fuels.	Materials used for operation and maintenance – different materials contain varying levels of embodied emissions. Operations and maintenance vehicles – consumption and burning of fossil fuels.

Greenhouse gas emissions – construction estimates

Greenhouse gas emissions were estimated for the range of construction emission sources. The estimated scope 1, 2 and 3 emissions are summarised in Table 24.4.

Table 24.4 Estimated construction phase greenhouse gas emissions

Scope	Source	Greenhouse gas emissions (tCO_2e)[1,2]
Scope 1	Construction plant and equipment energy use (on site)	7,533
	Land and vegetation clearing	Not assessed – minor contribution relative to others
Scope 2	Upstream electricity and fuel use	9,940
Scope 3	Embodied emissions of construction materials	47,793
	Transport of materials	3,309

Scope	Source	Greenhouse gas emissions (tCO_2e)[1,2]
	Construction related transport to and from site	2,652
TOTAL		**71,225**

Notes: 1. tCOe = tonnes of CO equivalent.
2. These are preliminary estimates which would be further refined during detailed design. Estimates include the Sydney Metro Trains Facility South stabling yard and do not include demolition works.

In 2013, NSW's annual greenhouse gas emissions were about 146.7 million tCO_2-e (EPA, 2015b), with the transport industry sector accounting for about 8.44 per cent of the total. Construction of the project would equate to about 0.5 per cent of the transport industry's 2013 annual greenhouse gas emissions.

Greenhouse gas emissions – operation

Operational greenhouse gas emissions would mainly be associated with the scope 2 emissions, such as electricity consumption to power:

- metro trains (traction power)
- station facilities
- signalling and communications.

The annual electricity consumption during operation was estimated to be 86,576 tonnes of CO_2 equivalent. Operation of the project would represent about 0.7 per cent of NSW's transport industry's 2013 annual greenhouse gas emissions.

Operation and maintenance of the project would result in increased emissions of greenhouse gas as a result of increased electricity use. However, the project has the potential to reduce greenhouse gas emissions by providing a comfortable and efficient alternative to private car travel.

24.4 Mitigation measures

24.4.1 Approach to mitigation and management

Figure 24.2 shows how sustainability is integrated with the construction environmental management process for Sydney Metro. The project would be constructed and operated in accordance with the Sydney Metro City & Southwest sustainability strategy (described in Section 24.2) and constructed in accordance with the Construction Environmental Management Framework.

The Construction Environmental Management Framework (included in Appendix D) provides for the development and implementation of a construction sustainability management plan. The framework provides minimum requirements for the plan, which includes a:

- construction workforce development plan
- construction carbon and energy management plan
- waste management and recycling plan.

The construction sustainability plan would also incorporate the project specific mitigation measures listed in Table 24.5, and address the requirements of the Sydney Metro City & Southwest sustainability strategy. Further information on the approach to environmental management during construction and operation is provided in Section 28.4.

24.4.2 List of mitigation measures

The mitigation measures that would be implemented to address potential sustainability and climate change impacts are listed in Table 24.5.

Table 24.5 Mitigation measures – sustainability and climate change

ID	Impact/issue	Mitigation measures	Relevant location(s)
Design/pre-construction			
SCC1	Sustainability	Sustainability initiatives and targets would be reviewed and incorporated into the detailed design to support the achievement of the project's sustainability objectives. A best practice level of performance would be targeted using relevant sustainability rating tools eg ISCA as built 'excellent' level rating.	All
SCC2		A sustainable procurement strategy would be developed and implemented to apply to Principal Contractors, their subcontractors and their suppliers.	All
SCC3		A workforce development plan would be developed covering both construction and operation.	All
SCC4	Climate change	Climate change risk treatments would be incorporated into the detailed design, including ensuring that adequate flood modelling is carried out and integrated into the design.	All
SCC5	Greenhouse gas emissions	An iterative process of greenhouse gas assessments and design refinements would be carried out during detailed design and construction to identify opportunities to minimise greenhouse gas emissions. Performance would be measured in terms of a percentage reduction in greenhouse gas emissions from a defined reference footprint.	All
Construction			
SCC6	Sustainability	Sustainability reporting (and corrective action where required) would be undertaken during construction.	All
SCC7		The construction workforce development plan would be implemented.	All
SCC8	Greenhouse gas emissions	25 per cent of the greenhouse gas emissions associated with consumption of electricity during construction would be offset.	All
Operation			
SCC9	Sustainability	Prior to operation commencing, sustainability initiatives would be reviewed and updated, and relevant initiatives would be implemented to support the achievement of the project's sustainability objectives.	All
SCC10		The operation workforce development plan would be implemented.	All
SCC11	Climate change risks	Periodic review of climate change risks would be carried out to ensure ongoing resilience to the impacts of climate change.	All
SCC12	Greenhouse gas emissions	100 per cent of the greenhouse gas emissions associated with consumption of electricity during operation would be offset.	All

24.4.3 Consideration of the interactions between mitigation measures

The relationship between key documents within the Sydney Metro environment and sustainability management system and the contractor's environment and sustainability management system is shown in Figure 24.2, notably:

- The construction environment management plan and its sub-plans would capture the construction environmental management requirements of this Environmental Impact Statement, approval conditions, and the Sydney Metro City & Southwest Sustainability Strategy.
- The sustainability plan and its sub-plans would define the governance and design requirements, as well as the sustainability initiatives under the Sydney Metro City & Southwest Sustainability Strategy.
- These plans would vary across different delivery packages.

Sub-contractors engaged by the contractor would be required to work under the contractor's environmental and sustainability management system.

25. Hazards, risks and safety

This chapter considers the potential hazard, risk, and safety impacts of the project. There are no Secretary's environmental assessment requirements specifically relevant to hazards, risks, or safety. The assessment has been undertaken as the State Significant Infrastructure Application Report identified hazards, risk and safety as a potential issue associated with the project.

25.1 Assessment approach

25.1.1 Legislative and policy context to the assessment

The assessment considered the following legislation, policies, and guidelines:

- *Australian Code for the Transport of Dangerous Goods by Road & Rail* (National Transport Commission, 2017) ('the Dangerous Goods Code')
- *Dangerous Goods (Road and Rail Transport) Regulation 2009*
- *Code of practice for the storage and handling of dangerous goods* (WorkCover NSW, 2005)
- *Hazardous and Offensive Development Application Guidelines: Applying SEPP 33* (Department of Planning, 2011) ('Applying SEPP 33').

Dangerous goods and hazardous materials

Hazardous materials (or substances) are those that, following exposure, can have an adverse effect on health. Examples include materials that cause cancer, burns, skin and eye irritations, and poisons. Hazardous materials are those that meet the classification criteria specified by the *Work Health and Safety Regulations 2011* and the Globally Harmonised System of Classification and Labelling of Chemicals (an internationally agreed system of chemical classification).

Dangerous goods are classified according to their physical or chemical effects, such as fire, explosion, corrosion and poisoning, affecting property, the environment, or people. Dangerous goods are substances that, because of their physical, chemical (physicochemical) or acute toxicity properties, present a risk to people, property, or the environment. Types of substances classified as dangerous goods include explosives, flammable liquids and gases, corrosives, and chemically reactive or acutely (highly) toxic substances. Dangerous goods are defined by the Dangerous Goods Code. Many dangerous goods are also classed as hazardous substances.

As the project is critical State significant infrastructure, the guideline, Applying SEPP 33, does not apply to the project. However, Applying SEPP 33 provides a process of identifying a potentially hazardous development by identifying storage and transport screening thresholds. The thresholds in Applying SEPP 33 represent the maximum quantities of hazardous materials or substances that can be stored or transported without causing a significant off-site risk. Applying SEPP 33 defines hazardous materials as substances falling within the classification of the Dangerous Goods Code.

25.1.2 Methodology

A qualitative desktop assessment was undertaken, which included:

- reviewing the relevant regulatory framework and applicable guidelines (described in Section 25.1.1)
- identifying construction and operational activities with the potential to cause risks to health and safety
- identifying and assessing the hazards that could be encountered during construction and operation (including hazardous materials and dangerous goods)

- identifying storage and transport screening thresholds for hazardous materials and dangerous goods that may be required during construction and operation
- qualitatively assessing potential impacts to public health and safety
- providing mitigation and management measures.

The assessment focuses on those construction and operational activities with the potential to result in health and safety impacts on surrounding communities, land uses, and the environment (also known as 'off-site receivers'). The assessment does not take into account potential health and safety risks to on-site workers associated with normal construction operations, as these are regulated by workplace health and safety legislation (including the *Work Health and Safety Act 2011*), and are not relevant to approval of the project under Part 5.1 of the EP&A Act. Site management would be the responsibility of the construction contractor/s, who would be required (under the Work Health and Safety Act and applicable regulations) to manage the site in accordance with relevant regulatory requirements.

25.2 Existing environment

The urban setting of the project means that there is the potential for the community to be impacted if construction and operation activities are not properly managed. A description of existing land use patterns and sensitive receivers surrounding the project area is provided in Chapter 16 (Land use and property). Other sensitive receivers include members of the community travelling or moving in close proximity to work areas and operational areas.

25.3 Impact assessment

25.3.1 Risk assessment

Potential risks

The environmental risk assessment for the project, undertaken for the State Significant Infrastructure Application Report, identified the following as the main risks in relation to hazards, risks and safety:

- onsite storage, use, and transport of chemicals, fuels, and materials during construction and operation
- rupture of, or interference with, underground services during construction
- construction of new traction substations which have the potential to introduce risks associated with electric and magnetic fields.

Other potential risks include:

- emissions from vehicles or plant during construction
- reduced safety for road users and pedestrians during construction
- health impacts from noise and air pollution during construction
- structural risks and exposure to hazardous materials and any contaminated soil during demolition and construction works
- potential for train strike for pedestrians and vehicles crossing the rail corridor during operation.

How potential risks and impacts would be avoided

In general, potential health and safety impacts would be avoided by:

- managing construction and operation in accordance with relevant legislative and policy requirements, including those listed in Section 25.1.1
- designing, constructing, and operating the project to minimise risks to health and safety, including the features described in Chapter 8 (Project description – operation) and summarised below
- implementing the management and mitigation measures described in Section 25.4.

Further information on the measures that would be implemented to minimise risks to the health and safety of customers and the community is provided below.

Unauthorised access to the rail corridor

Unauthorised access to the rail corridor has the potential to result in serious injury or fatality. To prevent unauthorised access, the project would incorporate the following elements (further information is provided in Chapter 8):

- security fencing installed along both sides of the rail corridor
- a trackside intruder detection system, consisting of non-mechanical protection measures to supplement the fencing, including closed circuit television.

Customer safety and security

A key metro characteristic is to provide a system that is inherently safe for customers on trains, at stations, and at the interface with the public domain. As described in Chapters 7 (Design development and place making) and 8, the safety of passengers and the general public has been, and will continue to be, a key consideration during the design process. The following metro features would contribute to the safety and security of customers:

- customer service assistants at every station and moving through the network during the day and night
- station and train design that allow for good line of sight to enable passive and active surveillance
- stations and surrounding areas that are designed to be highly visible, active spaces with good lighting and amenity
- ensuring customers can see all the way along the train and move easily between carriages, including wide, open walkways between carriages
- providing platform screen doors at stations which keep people and objects away from the edge, improving customer safety and allowing trains to get in and out of stations much faster.

Other station safety features include:

- CCTV cameras linked to the operations control centre
- emergency help points
- passenger information signage.

Further information on safety and security is provided in Chapter 8.

25.3.2 Construction impacts

Storage, handling, and transport of dangerous goods and hazardous materials

The storage and handling of dangerous goods and hazardous materials have the potential to impact the surrounding community and environment if leaks and spills occur, resulting in the potential contamination of air, soils, surface water, and/or groundwater.

Dangerous goods that may be used during construction are listed in Table 25.1. These are compared to the storage and transport thresholds in Applying SEPP 33. These thresholds represent the maximum amounts of dangerous goods that can be stored or transported to and from a construction site without causing a significant risk to off-site receptors.

In general, low volumes of dangerous goods would be stored at construction sites. The quantity of goods stored would be commensurate with the demand for those goods so that excess goods are not sitting idle.

Table 25.1 Dangerous goods volumes and thresholds

Material	Dangerous Good Code Class	Storage method	SEPP 33 thresholds		
			Storage volume	Minimum storage distance from sensitive receivers	Transport
Diesel	C11; 3 PG III2	20 litre drums/ carry cans	Greater than 5 tonnes, if stored with other Class 3 flammable liquids	5 metres	Not applicable if not transported with Class 3 dangerous goods
Petrol	C11; 3 PG III2	20 litre drums	Greater than 5 tonnes, if stored with other Class 3 flammable liquids	5 metres	Not applicable if not transported with Class 3 dangerous goods
Lubricating and hydraulic oils and greases	C2	20 litre drums	n/a	n/a	Not applicable, if not transported with Class 3 dangerous goods
Acetylene	2.1	Cylinders (up to 55 kgs) in rack	Greater than 0.1 tonnes (100 kg)	15 metres	2 tonnes; 30 times per week
Cement	n/a	Bags/pallets (in container)	n/a	n/a	Not subject to Applying SEPP 33 transport thresholds
Premix concrete	n/a	Bags/pallets (in container)	n/a	n/a	Not subject to Applying SEPP 33 transport thresholds
Concrete curing compounds	n/a	20 litre drums	n/a	n/a	Not subject to Applying SEPP 33 transport thresholds
Concrete retardant	3 PG III	205 litre drums	Greater than 5 tonnes	5 metres	10 tonnes; 60 times per week
Epoxy glue	3 PG III	Small containers	Greater than 5 tonnes	5 metres	10 tonnes; 60 times per week

Material	Dangerous Good Code Class	Storage method	SEPP 33 thresholds		
			Storage volume	Minimum storage distance from sensitive receivers	Transport
Coagulants	n/a	1,000 litre intermediate bulk containers	n/a	n/a	Not subject to Applying SEPP 33 transport thresholds
Acids	8 PG II	1,000 litre intermediate bulk containers	Greater than 25 tonnes	n/a	2 tonnes; 30 times per week
Bases	8 PG II	1,000 litre intermediate bulk containers	Greater than 25 tonnes	n/a	2 tonnes; 30 times per week
Disinfectant	8 PG III	500 litre intermediate bulk containers	Greater than 50 tonnes	n/a	2 tonnes; 30 times per week
Anti-scalent	n/a	100 litre drums	n/a	n/a	Not subject to Applying SEPP 33 transport thresholds
Membrane preser-vative	8 PG III	10 litre drums	Greater than 50 tonnes	n/a	2 tonnes; 30 times per week
De-bonding agents	n/a	Drums/ containers	n/a	n/a	Not applicable
Contamin-ated waste	Dependent on nature of material	Bunded areas or removed directly from site	Dependent on nature of material	Dependent on nature of material	Dependent on nature of material
Paint	n/a	20 litre drums	n/a	n/a	Not subject to Applying SEPP 33 transport thresholds

Underground utilities

As described in Chapter 9 (Project description – construction), a number of utilities would need to be adjusted, relocated, and/or protected to enable construction. The potential rupture of underground utilities during excavation or collision of plant and equipment with aboveground services could pose risks to public safety. Rupture or contact with services during works could also result in releases and/or short-term outages, as could relocation of utilities and services.

Health and safety impacts associated with encountering utilities would be minimised by implementing the utilities management strategy described in Section 9.10.

Working in the vicinity of utilities

If inadequately managed, works in the vicinity of utilities which are not protected or relocated (such as high voltage electricity transmission lines or gas pipelines) could result in increased risks to the workforce and/or surrounding environment/community. These potential risks would be minimised through careful construction planning and the implementation of the utilities management strategy described in Section 9.10.

Removal of buildings and structures

The project requires the removal of structures at and around stations. Hazards and risks associated with building demolition include:

- unplanned structure collapse
- falls from one level to another
- falling objects
- the location of above and underground services
- exposure to any hazardous chemicals and materials (such as asbestos fibres, lead dust, and biological material)
- noise from plant and explosives used in demolition work
- proximity of the building or structure being demolished to other buildings or structures.

To minimise exposure to these hazards and risks, a risk assessment would be carried out prior to works commencing. The risk assessment would include:

- an assessment of the structural integrity of the structure to be demolished
- an assessment of the method of demolition, including sequencing, scheduling, plant and equipment, and the layout of work areas
- a hazardous material survey for those buildings and structures suspected of containing hazardous materials (particularly asbestos).

Demolition would be carried out by licensed demolition contractors, in accordance with relevant regulatory requirements, and the project specific construction environmental management requirements described in Chapter 28 (Synthesis of the Environmental Impact Statement).

Potential contamination

Contaminants of potential concern that could be exposed during excavation include hydrocarbons, heavy metals, herbicides, and asbestos. Exposure to these contaminants could cause health and safety impacts to the community through inhalation and/or direct contact, or impacts to the environment due to contamination of land.

Health and safety impacts associated with potential exposure to contaminated and hazardous materials would be minimised through implementation of an unexpected finds protocol and waste management plan. Further information on contamination and waste, and associated mitigation measures is provided in Chapters 20 (Soils and contamination) and 26 (Waste management).

Risk of subsidence

As described in Chapter 21 (Hydrology, flooding and water quality), the potential for changes to groundwater levels as a result of construction is low, due to the generally shallow depth and limited extent of excavation. The project would also not involve the excavation of any tunnels or other sub-surface cavities. Based on the nature of the works being undertaken and the existing environment, the risk of subsidence as a result of construction is considered negligible.

Other health and safety risks

Other construction activities could result in impacts to the health and safety of site workers, users, visitors, and the local community if improperly managed. These include:

- working within an operating rail environment
- the operation of vehicles and construction equipment on site

- the transportation of equipment, excavated spoil, and material to and from site
- construction failures or incidents resulting in flooding, inundation, or excavation collapse.

In addition to the above, there is the potential for risks to pedestrians/public safety resulting from unauthorised access to construction work areas.

NSW workplace safety laws require construction sites to have adequate site security, which includes appropriate fencing. All construction work would be isolated from the general public. The construction contractor/s would need to ensure that construction sites are secure at all times, and take all possible actions to prevent entry by unauthorised persons.

Health and safety risks during construction would be managed by the implementation of standard workplace health and safety requirements. A work health and safety management plan, and safe work method statements would be developed in accordance with regulatory requirements.

The mitigation measures provided in Section 25.4 would be implemented to minimise and avoid the potential for health and safety impacts during construction.

25.3.3 Operation

Storage, handling and transport of dangerous goods and hazardous materials

The amount of hazardous materials and dangerous goods that would be used during maintenance activities would be much smaller than the volumes required during construction. Hazardous materials and dangerous goods required during maintenance would be similar to those listed in Table 25.1, and would be transported in vehicles/trucks to areas requiring maintenance. Therefore, the potential for impacts during operation associated with the storage and handling of hazardous materials and dangerous goods is considered negligible. Potential impacts would be managed through the implementation of standard mitigation measures to be developed as part of the operational environmental management plan.

Operation of traction substations and electrical wiring

The project includes the augmentation of existing power supplies, including new traction substations, feeders and overhead wiring. The possibility of adverse health effects due to the electro-magnetic fields associated with electrical equipment, including traction substations and overhead wiring, has been the subject of considerable research, and the results are still inconclusive.

The design, construction, and operation of the project's power supply would be undertaken in accordance with standard industry guidelines and codes of practice, such that conductive and semi-conductive materials effectively shield electrical fields. With regard to magnetic fields, the separation distance would be maximised between substations and public areas to minimise the potential to alter electro-magnetic field strength within the surrounding area.

The project would be designed to comply with appropriate Australian and international standards, to minimise the risk associated with electro-magnetic field exposure.

Other health and safety risks

Potential impacts to the health and safety of the community and customers during operation include:

- safety risks (e.g. unauthorised access)
- general worker health and safety issues for drivers and maintenance staff.

As described in Section 25.3.1, these risks would be mitigated through the design process which would include an appropriate emphasis on safety according to relevant design standards and

requirements. The project has been designed to incorporate features which would ensure sufficient levels of safety specific to metro operations, for example security fencing, platform screen barriers, and a trackside intruder detection system. Further information is provided in Chapter 8.

Maintenance activities and other works within the rail corridor would be undertaken in accordance with Transport for NSW's standing operating procedures, reducing the potential for impacts to the health and safety of workers, visitors, and customers.

25.4 Mitigation measures

25.4.1 Approach to mitigation and management

Dangerous goods and hazardous materials

The construction environmental management plan for the project, and operational procedures for Sydney Metro as a whole, would include requirements for the storage, handling, and transport of dangerous goods and hazardous materials, in accordance with relevant regulatory requirements and standards. This would include procedures for the management of any accidental spills.

The risk of mobilising hazardous materials during construction and operation would be managed by:

- undertaking demolition and hazardous materials removal in accordance with relevant regulatory requirements and the construction environmental management plan
- transporting, storing, and using dangerous goods and hazardous materials in accordance with applicable standards
- the implementation of spill management and emergency and incident response procedures, defined by the environmental management plans for construction and operation
- managing any contaminated soils as described in Chapter 20
- incorporating bunding designed in accordance with the applicable standards into the design of relevant facilities to contain any chemical spills or leaks.

Emergency and incident response

The construction environmental management plan would include emergency and incident response procedures, as specified by the Construction Environmental Management Framework. The procedures would specify:

- roles and responsibilities
- notification and reporting protocols
- action and investigation requirements
- training programs to ensure that all staff are familiar with the plan
- design and management measures to address the potential environmental impacts of an emergency situation.

Response to emergencies during operation would be undertaken in accordance with Transport for NSW's existing procedures.

25.4.2 List of mitigation measures

The mitigation measures that would be implemented to minimise health and safety risks are listed in Table 25.2.

Table 25.2 Mitigation measures – hazards, risks and safety

ID	Impact/issue	Mitigation measures	Relevant location(s)
Design/pre-construction			
HRS1	Public safety	A hazard analysis would be undertaken during the detailed design stage to identify risks to public safety from the project, and how these can be mitigated through safety in design.	All
Construction and operation			
HRS2	Hazardous materials and substances	All hazardous substances that may be required for construction and operation would be stored and managed in accordance with the *Code of practice* for the *storage and handling of dangerous goods* (WorkCover NSW, 2005) and the *Hazardous and Offensive Development Application Guidelines: Applying SEPP* 33 (Department of Planning, 2011).	All

25.4.3 Consideration of the interactions between mitigation measures

There are interactions between the mitigation and management measures for hazards, risks and safety, and those for traffic, transport and access (Chapters 10 and 11), noise and vibration (Chapters 12 and 13), soils and contamination (Chapter 20), water quality (Chapter 21), and air quality (Chapter 23). Together, all these measures would serve to minimise the potential for impacts to the community.

25.4.4 Managing residual impacts

With the incorporation of design features described in Section 25.3.1, and implementation of the mitigation and management measures provided in this section, no residual health and safety risks are anticipated.

26. Waste management

This chapter assesses the predicted waste generation during construction and operation, and provides a description of how waste would be managed. There are no Secretary's environmental assessment requirements specifically relevant to waste. The assessment has been undertaken as the State Significant Infrastructure Application Report identified waste management as a potential issue associated with the project.

26.1 Assessment approach

26.1.1 Legislative and policy context to the assessment

The main legislation relevant to the management of waste are the POEO Act, the *Protection of the Environment Operations (Waste) Regulation 2014* (the Waste Regulation) made under the POEO Act, and the *Waste Avoidance and Resource Recovery Act 2007* (the WARR Act).

The POEO Act establishes the procedures for environmental control, and for issuing environmental protection licences covering issues such as waste. The Waste Regulation regulates matters such as the obligations of consignors (producers and agents), transporters, and receivers of waste, in relation to waste transport licensing and tracking requirements.

The movement of controlled waste is also regulated by the *National Environment Protection (Movement of Controlled Waste between States and Territories) Measure 1998*, made under the *National Environment Protection Council Act 1994*.

Definition of waste

Schedule 5 of the POEO Act defines waste as:

> *(a) any substance (whether solid, liquid or gaseous) that is discharged, emitted or deposited in the environment in such volume, constituency or manner as to cause an alteration in the environment*
>
> *(b) any discarded, rejected, unwanted, surplus or abandoned substance*
>
> *(c) any otherwise discarded, rejected, unwanted, surplus or abandoned substance intended for sale or for recycling, processing, recovery or purification by a separate operation from that which produced the substance*
>
> *(d) any processed, recycled, reused or recovered substance produced wholly or partly from waste that is applied to land, or used as fuel, but only in the circumstances prescribed by the regulations*
>
> *(e) any substance prescribed by the regulations to be waste.*

Waste classification

The classifications that apply to waste in NSW and the descriptions of each are provided by the POEO Act, and the Waste Regulation and supporting guidelines, including the *Waste Classification Guidelines* (EPA, 2014a). Many waste types are pre-classified under the POEO Act and do not require testing. However, if a waste is not pre-classified, it may need to be tested to determine its classification.

Waste policy and strategic framework

The WARR Act aims to ensure that waste management options are considered against the following waste management hierarchy:

1. avoidance of unnecessary resource consumption
2. resource recovery (including reuse, reprocessing, recycling and energy recovery)
3. disposal.

To support the waste hierarchy, the *NSW Waste Avoidance and Resource Recovery Strategy 2014–21* (EPA, 2014b) provides a framework and targets for waste management and recycling in NSW. Targets established under this strategy comprise:

- avoiding and reducing the amount of waste generated per person in NSW
- increasing recycling rates to 70 per cent for municipal solid waste, 70 per cent for commercial and industrial waste, and 80 per cent for construction and demolition waste
- increasing waste diverted from landfill to 75 per cent
- managing problem wastes better, and establishing 86 drop-off facilities and services across NSW.

Transport for NSW, as a NSW Government agency, has a general responsibility to support these targets by:

- implementing complementary policies and programs, including sustainable procurement
- incorporating resource recovery and waste reduction objectives into its operations
- complying with relevant regulations.

26.1.2 Methodology

A desktop assessment was carried out, which involved:

- reviewing the regulatory framework for waste management
- identifying potential waste generating activities during construction and operation
- reviewing the likely waste streams and volumes, including wastewater and demolition materials
- identifying the likely classification of waste streams in accordance with relevant legislation and guidelines
- estimating the quantities of bulk earthworks and spoil balance to be generated through the construction of the project
- developing proposed management and handling techniques for key wastes streams including contingencies for managing unexpected waste volumes
- identifying lawful disposal or recycling locations.

It is noted that the waste types and quantities estimated are indicative, and have been identified for the purpose of determining potential waste management options. Although the quantities of waste actually generated by the project may differ from the estimates made, the identified waste management options would be appropriate to the final waste quantities.

Potential impacts of transport during construction (which includes the transport of construction waste) are considered in Chapter 10 (Construction traffic, transport and access). The management of any contaminated soils and hazardous materials are considered in Chapters 20 (Soils and contamination) and 25 (Hazards, risks and safety) respectively.

26.2 Impact assessment

26.2.1 Risk assessment

Potential risks

The main potential risks in terms of waste management would occur during construction. The environmental risk assessment for the project, undertaken for the State Significant Infrastructure Assessment Report, identified the following as the main risks:

- incorrect disposal of general, demolition, and construction waste generated
- incorrect disposal of any excess spoil
- incorrect disposal of any contaminated or hazardous waste.

The assessed risk level for the potential risks was low. This is because the project is unlikely to result in significant amounts of waste, with the exception of construction related waste.

How potential impacts would be avoided

In general, with respect to waste, potential impacts would be avoided by:

- managing waste in accordance with relevant legislative and policy requirements, as outlined in Section 26.1.1
- designing, constructing and operating the project so that wastes are managed according to the waste minimisation hierarchy
- implementing the waste management and mitigation measures provided in Section 26.3.

26.2.2 Construction

Waste generation

The main construction activities anticipated to generate waste are listed in Table 26.1 together with the materials that may be produced, and likely waste classifications.

Table 26.1 Indicative types of waste generated during construction

Activity	Waste streams that may be produced	Likely classification of waste stream
Excavation and general earthworks	Spoil comprising virgin excavated natural material (uncontaminated soil and crushed rock)	General solid waste (non-putrescible)
	Contaminated materials	Hazardous waste and/or special waste
	Potential acid sulfate soils	Special waste
	Ballast	General solid waste (non-putrescible)
Demolition/removal of buildings (mainly at stations) and other infrastructure (such as road overbridges)	Concrete, asphalt, bricks, tiles, timber (treated and untreated), metals, plasterboard, carpets, electrical and plumbing fittings and furnishings (such as doors and windows)	General solid waste (non-putrescible)
	Hazardous waste (such as asbestos and insulation)	Hazardous waste and/or special waste
Dust suppression, wash down of plant and equipment, and staff amenities at construction sites (such as toilets)	Sediment-laden and/or potentially contaminated wastewater, sewage and grey water	Liquid waste

Activity	Waste streams that may be produced	Likely classification of waste stream
Station fit-out and general construction activities and resource use	Concrete waste, timber formwork, scrap metal, steel, plasterboard, cable and packaging material	General solid waste (non-putrescible)
Maintenance of construction plant, vehicles and equipment	Adhesives, lubricants, waste fuels and oils, engine coolant, batteries, hoses	Hazardous waste
	Tyres	Special waste
Activities at offices and crib rooms	Putrescibles	General solid waste (putrescible)
	Paper, cardboard, plastics, glass and printer cartridges	General solid waste (non-putrescible)
Clearing and grubbing of vegetation, landscaped and/or turfed areas	Green waste	General solid waste (non-putrescible)

The types and quantities of construction waste generated by the project would vary throughout construction. Of these, estimates for the main waste streams (spoil, ballast, concreate/brick, and asphalt) are provided in Table 26.2. The volumes of other wastes are expected to be comparable to similar infrastructure projects. The quantities and classifications of all waste streams would be confirmed following finalisation of the detailed design.

With respect to waste generation, based on the current design, it is estimated that:

- about 85,000 cubic metres of spoil would be required for fill
- about 45,000 cubic metres of surplus material would be generated.

Table 26.2 Indicative waste estimates for the main waste streams

Location	Spoil (tonnes)	Spent ballast (tonnes)	Concrete/brick (tonnes)	Asphalt (tonnes)
Marrickville	300	2,400	900	200
Dulwich Hill	11,000	2,400	800	700
Hurlstone Park	1,800	2,400	500	200
Canterbury	600	2,400	150	250
Campsie	4,000	2,400	500	300
Belmore	6,000	2,700	1,000	1,000
Lakemba	6,000	2,400	1,000	1,000
Wiley Park	400	2,400	50	0
Punchbowl	6,000	2,400	1,000	200
Bankstown	14,000	1,800	1,800	200
Drainage works	17,800	0	0	0
Earthworks in corridor (away from stations)	38,200	0	0	0
Bridge works	300	0	0	0
Substation works	1,250	0	0	0
Combined services route	400	0	0	0
Total	**108,050**	**23,700**	**7,700**	**4,050**

Waste management

Consistent with the waste hierarchy, the approach to spoil management for uncontaminated spoil would follow the hierarchy of options listed in Table 26.3.

Table 26.3 Spoil management hierarchy (uncontaminated spoil)

Priority	Reuse options	Potential options for reuse of spoil
1	Within the project area	• fill embankments and mounds within a short haulage distance of the source • site restoration • feed product in construction materials.
2	Environmental work	• for environmental restoration projects (such as coastal protection, flood mitigation).
3	Other development projects (including other Sydney Metro projects)	• fill embankments and mounds on projects within a financially feasible transport distance of the site • land reclamation or remediation projects • for manufacturing concrete, bricks and tiles.
4	Land restoration	• fill for disused facilities (for example mines and quarries) to enable either future development or site rehabilitation.
5	Landfill management	• capping completed landfill cells • daily covering of landfill waste.

As part of the project, the reconditioning of ballast would occur where practicable. It is estimated that about 60 per cent of ballast is likely to be suitable for reuse within the project area.

Waste handling and management measures are provided in Table 26.4 based on the waste hierarchy for the identified types of waste. Although the waste hierarchy has been considered for each waste type, not all waste management options apply to a given waste type. For example, some types of waste are non-recyclable.

Table 26.4 Management of construction waste

Waste type	Management
Spoil	Spoil comprising virgin excavated natural material (uncontaminated soil and crushed rock) would be managed in accordance with the spoil management hierarchy (Table 26.3).
Ballast	Where practicable, ballast would be reconditioned for reuse within the rail corridor. Excess ballast waste would be removed for reuse or disposal.
Contaminated spoil and acid sulfate soils	In situ testing of soils in areas of potential contamination concern would be undertaken to determine the appropriate waste classification. Contaminated spoil would be sampled and immobilised before being transported and disposed of at a suitably licensed offsite location.
Demolition waste (concrete, asphalt, bricks tiles, timber, metals, plasterboard, carpets, electrical and plumbing fittings and furnishing)	Demolition waste would be managed in accordance with the waste hierarchy. Demolition waste would be segregated and stockpiled on site, with materials such as bricks and tiles, timber, plastic, and metals separated and sent to a construction and demolition waste recycling facility. Electrical waste would be stored for collection by an authorised contractor for recycling offsite, where feasible, or disposal at an appropriately licenced facility. All demolition waste would be classified in accordance with the *Waste Classification Guidelines* (EPA, 2014a) and directed to a waste management facility that is lawfully permitted to accept that type of waste.
Hazardous waste including asbestos	The disturbance, movement, and disposal of asbestos containing materials would be undertaken in accordance with the *Work Health and Safety Regulations 2011* and applicable guidelines.
Liquid waste	Wastewater, sewage, and grey water would be disposed to sewer or transported to an appropriately licenced liquid waste treatment facility.

Waste type	Management
Adhesives, lubricants, waste fuels and oils, engine coolant, tyres	Waste from construction vehicle and plant maintenance activities would be collected and stored in designated waste storage areas for collection by an authorised contractor for offsite disposal. Where feasible, containers holding oil, grease, and lubricants would be washed prior to disposal, or stored separately for disposal as hazardous waste. Waste oil and oil filters would be stored in recycling bins and collected by an authorised contractor, and recycled offsite, where feasible. Tyres would be collected by an authorised contractor for recycling or disposal offsite at an appropriately licenced facility.
Office waste including kitchen waste, paper, cardboard, plastics, glass	Recyclable materials such as paper, cardboard, plastics, glass, ferrous, and non-ferrous containers would be stored at recycling bins for collection by an authorised contractor, and recycled offsite. Where recycling is not feasible, waste would be collected and stored in designated waste storage areas for collection by an authorised contractor for offsite disposal at a licenced waste facility.
Green waste	As far as practicable, green waste would be chipped, mulched and reused for vegetation management on site, or collected by an authorised contractor and recycled offsite. Noxious weeds would be disposed of in accordance with relevant guidelines/requirements.

26.2.3 Operation

Waste generation

The main types of activities with the potential to generate waste during operation are listed in Table 26.5, together with the likely waste materials and classifications.

Table 26.5 Indicative types of waste generated during operation

Activity	Waste streams that may be produced	Likely classification of waste stream
Disposal of general litter in station bins and cleaning activities associated with trains, stations and other infrastructure	General non-recyclable and putrescible waste (such as food waste from station rubbish bins)	General solid waste (putrescible)
	Recyclable wastes such as plastics and aluminium cans, office waste including paper and plastics	General solid waste (non-putrescible)
Infrastructure maintenance	Cable and conduit off-cuts from maintenance of electrical infrastructure	General solid waste (non-putrescible)
	Solvents, paints, adhesives, cleaning fluids, greases, acids and alkali materials, and spent spill kit absorbent materials used to clean up accidental spills during maintenance	Hazardous waste and/or special waste
Capture and treatment of stormwater	Sediment-laden and/or potentially contaminated wastewater and solids	Liquid waste
Use of station customer facilities (such as toilets)	Sewage and grey water	Liquid waste

The volumes of wastes generated during operation would be considerably lower than that generated during construction. Wastes would be typical of similar transport facilities, including the existing Sydney Trains network. Wastes would be managed by the implementation of standard waste management strategies (provided in Table 26.6 and Section 26.3).

Waste management

Waste handling and management measures are provided in Table 26.6, based on the waste hierarchy for the identified types of waste.

Table 26.6 Management of operational waste

Waste type	Management
General litter and station waste such as food waste, paper, cardboard, plastics, glass	Bins would be provided for collection by an authorised contractor for offsite recycling or disposal at a licenced waste facility.
Adhesives, lubricants, waste fuels and oils, engine coolant, tyres	Waste from maintenance activities would be collected and stored in designated waste storage areas, for collection by an authorised contractor for offsite disposal. Where feasible, containers holding oil, grease, and lubricants would be washed prior to disposal or stored separately for disposal as hazardous waste. Waste oil and oil filters would be stored in recycling bins and collected by an authorised contractor, and recycled offsite, where feasible.
Liquid waste	Wastewater, sewage and grey water would be disposed to sewer or transported to an appropriately licenced liquid waste treatment facility.

26.2.4 Recycling and disposal locations

There are a number of options for recycling and disposal of construction and operation waste generated by the project. Waste facilities in Sydney licensed to accept general solid waste (putrescible) include (but are not limited to):

- Clyde Transfer Terminal
- Eastern Creek Resource Recovery Park
- Kemps Creek Advanced Resource Recovery Park
- Lucas Heights Resource Recovery Park
- a number of waste transfer stations.

A larger number of licenced facilities in Sydney accept general solid (non-putrescible) waste and vegetation/green waste.

A number of waste facilities in Sydney are licenced to accept asbestos, including:

- Elizabeth Drive Landfill, Kemps Creek
- Eastern Creek Resource Recovery Park
- Genesis Xero Waste – Landfill and Recycling
- Horsley Park Waste Management Facility
- Jacks Gully Waste and Recycling Centre
- Kimbriki Recycling and Waste Disposal Centre
- Lucas Heights Resource Recovery Park
- Wetherill Park Resource Recovery Facility.

Recyclables such as containers (plastics, glass, cans, etc), paper and cardboard would be collected by an authorised contractor for off-site recycling. There are a number of materials recovery facilities in Sydney. The recycling facility would be determined by the contractor engaged to collect the material.

Specific facilities and collection contractors would be selected during the later stages of the project and documented in the construction environmental management plan.

26.3 Mitigation measures

26.3.1 Approach to mitigation and management

Waste during construction would be managed in accordance with the Construction Environmental Management Framework (as described in Chapter 28 (Synthesis of the Environmental Impact Statement)). The framework requires implementation of strategies to reduce waste volumes and report on waste generated, and provides for development and implementation of a waste management and recycling plan, to include (as a minimum):

- waste management measures
- responsibilities of key project personnel
- waste monitoring requirements
- a procedure for the assessment, classification, management and disposal of waste in accordance with the *Waste Classification Guidelines*
- compliance record generation and management.

Operational procedures would consider waste management in accordance with regulatory requirements and the waste hierarchy.

Project specific mitigation measures are provided in Table 26.7.

26.3.2 List of mitigation measures

The mitigation measures that would be implemented to manage waste are listed in Table 26.7.

Table 26.7 Mitigation measures – waste management

ID	Impact/issue	Mitigation measures	Relevant location(s)
Design/pre-construction			
WM1	Waste generation and recycling	Detailed design would include measures to minimise excess spoil generation. This would include a focus on optimising the design to minimise spoil volumes, and the reuse of material on-site.	All
WM2		A recycling target of at least 90 per cent would be adopted.	All
Construction			
WM3	Waste and spoil management	Spoil would be managed in accordance with the spoil management hierarchy.	All
WM4		Target 100 per cent reuse of reusable spoil.	All
WM5		Construction waste would be minimised by accurately calculating materials brought to the site and limiting materials packaging.	All
WM6		All waste would be assessed, classified, managed and disposed of in accordance with the *Waste Classification Guidelines* (EPA, 2014a).	All
WM7		Waste segregation bins would be located at various locations within the project area, if space permits, to facilitate segregation and prevent cross contamination.	All

26.3.3 Consideration of the interactions between mitigation measures

There are interactions between the mitigation measures for waste management and soils and contamination (provided in Chapter 20), and hazardous materials (provided in Chapter 25). The project-specific sustainability initiatives described in Chapter 24 (Sustainability and climate change) are also relevant to the management of waste. Together, all these measures would ensure appropriate handling of waste materials to minimise the potential for impacts to the community and environment.

26.3.4 Residual impacts

Construction waste quantities, including estimated spoil generation, spoil reuse, and spoil surplus, would be confirmed during detailed design. Classifications and reuse/recycling/disposal locations would also be confirmed at this stage. However, it is recognised that there is potential for unexpected volumes of potentially contaminated spoil to be generated. Any spoil classified as contaminated in accordance with *Waste Classification Guidelines* would be directed to a waste management facility that is lawfully permitted to accept that type of contaminated waste.

There are a number of solid waste landfills in Sydney that are licensed to accept contaminated soils. It is anticipated that the volumes of contaminated spoil generated by the project could be readily accommodated at these facilities.

Further information on the management of soils and contamination is provided in Chapter 20.

27. Cumulative impacts

This chapter considers the potential cumulative impacts of the project. It has been prepared to support the cumulative impact assessments undertaken as part of the assessments summarised in Chapters 10 to 23. The Secretary's environmental assessment requirement addressed in this chapter is provided in Table 27.1.

Table 27.1 Secretary's environmental assessment requirements – cumulative impacts

Ref	Secretary's environmental assessment requirements – cumulative impacts	Where addressed
2.1(o)	An assessment of the cumulative impacts of the project taking into account other projects that have been approved but where construction has not commenced, projects that have commenced construction, and projects that have recently been completed (for example WestConnex and approved construction in the relevant precincts).	Chapters 10 to 23 and this chapter

27.1 Assessment approach

For an environmental impact statement, cumulative impacts can be defined as the successive, incremental, and combined effect of multiple impacts, which may in themselves be minor, but could become significant when considered together.

The assessment of potential cumulative impacts has been undertaken in accordance with the Secretary's environmental assessment requirements, and considers the potential for impacts taking into account other projects in close proximity to the project (referred to as the 'Sydenham to Bankstown upgrade' for the purpose of this chapter). The assessment draws on the findings of Chapters 10 to 23, and environmental impact assessments for other projects, where these are available.

The potential for cumulative impacts for each environmental issue is considered in each of the key issue chapters (refer to Chapters 10 to 23).

27.1.1 Methodology

The following tasks were undertaken to assess the potential for cumulative impacts:

- identifying existing (approved or under construction) and proposed projects in the vicinity of the Sydenham to Bankstown upgrade, based on information available in the public domain
- screening identified projects for their potential to interact with the Sydenham to Bankstown upgrade
- identifying and assessing the significance of potential cumulative impacts by:
  - considering project-specific impacts for the key projects with the potential for cumulative impacts when combined with the construction and/or operation of the Sydenham to Bankstown upgrade (described in Section 27.2)
  - undertaking an issue-specific cumulative assessment for the key environmental issues listed in the Secretary's environmental assessment requirements, taking into account major projects being undertaken close to the project area for the Sydenham to Bankstown upgrade (described in Section 27.2).

The screening of projects took into account the following:

- The project location – projects in close proximity to the Sydenham to Bankstown upgrade where there is potential for impacts to spatially overlap. This included potential for shared use of roads for construction access, for example.
- The project timeframe and planning approval – only projects likely to be built concurrently with the Sydenham to Bankstown upgrade were assessed. This includes projects currently under construction and/or projects that have received planning approval. Projects at a conceptual or pre-approval stage were generally not able to be considered due to an absence of project and/or environmental impact details or development timeframes.
- The project size – projects considered are typically larger scale projects identified on the Department of Planning and Environment's Major Projects Register and council development application registers.

Projects considered to have the potential for cumulative impacts with the Sydenham to Bankstown upgrade are listed in Table 27.2.

Table 27.2 Projects with the potential for cumulative impacts

Project and date	Project details	Proponent	Status	Construction timeframe	Nearest project location
Sydney Metro City and Southwest: Chatswood to Sydenham	A new metro rail line, about 16 kilometres long (of which about 15 kilometres is located in underground rail tunnels) between Chatswood and Sydenham with six metro stations.	Transport for NSW	Approved	2017 – 2023	Marrickville Station
Sydney Metro City and Southwest: Chatswood to Sydenham – modification	Modification to include the upgrade of Sydenham Station and the construction of the Sydney Metro Trains Facility South	Transport for NSW	On exhibition	As above	Marrickville Station
WestConnex Stage 2: New M5 (Beverley Hills to St Peters)	Proposed new M5 to extend from the existing M5 East corridor at Beverly Hills via a tunnel to St Peters.	Roads and Maritime	Approved	2015 – 2019	Marrickville Station
WestConnex Stage 3: M4-M5 Link	Construction of an 8.5 kilometre motorway tunnel linking the M4 and M5 corridors. The alignment would provide a western bypass of the Sydney CBD Interchange.	Roads and Maritime	Pending approval	2019 – 2023	Marrickville Station

Project and date	Project details	Proponent	Status	Construction timeframe	Nearest project location
Sydney Airport	Upgrade of roads east of the airport and removal of the General Holmes Drive rail level crossing by constructing a road underpass.	Roads and Maritime	Under construction	2017 – 2018	Marrickville Station
Marrickville Metro redevelopment 34 Victoria Road Marrickville	Expansion of shopping centre by about 16,000 square metres in two stages.	Private	Under construction	Stage 1A commenced in 2016 and is due for completion in early 2017. Completion date for Stage 1B is unknown	Marrickville Station
401 Illawarra Road Marrickville	Demotion of existing building and construction of a six storey mixed use building above basement car parking containing a ground level shop and 21 dwellings	Private	Approved	Unknown	Marrickville Station
36 Floss Street & 118 Duntroon Street Hurlstone Park	Construction of a four storey mixed use development.	Private	Currently on exhibition	Unknown	Hurlstone Park Station
211-215 Canterbury Road, Canterbury	Demolition of existing structures and the construction of a new mixed-use development comprising 11 commercial tenancies and 69 residential apartments with basement car parking.	Private	Under construction	Unknown	Canterbury Station
10B Charles Street, Canterbury	Construction of a new ten storey residential flat building with two levels of basement parking.	Private	Under construction	Unknown	Canterbury Station
477 Burwood Road, Belmore	Construction of a new six storey mixed use commercial and residential development with basement parking.	Private	Under construction	Private	Belmore Station

Project and date	Project details	Proponent	Status	Construction timeframe	Nearest project location
Sydenham to Bankstown Urban Renewal Corridor	Potential redevelopment of areas along the Bankstown Line leading to increased densities	Department of Planning and Environment	Master planning	Unknown	All stations Marrickville to Bankstown

27.2 Potential cumulative impacts

Of the projects listed in Table 27.2, the Chatswood to Sydenham project (including the modification) is the only other major project considered to potential to result in cumulative impacts.

Surface works associated with WestConnex Stage 2: New M5 (Beverley Hills to St Peters) and Stage 3: M4-M5 Link are located approximately at Erskineville approximately 2.3 kilometres to the east and are unlikely to be additive to the project impacts.

The draft *Sydenham to Bankstown Urban Renewal Corridor Strategy* is relevant to the study area in which the project is located. The draft strategy proposes 35,400 new homes and 8,700 jobs over the next 20 years and associated infrastructure between Sydenham and Bankstown. However, due to the draft and strategic nature of this plan, there are no definitive works proposed, and it is not considered as part of the cumulative impact assessment.

27.2.1 Sydney Metro City & Southwest: Chatswood to Sydenham

Project details

The Chatswood to Sydenham project involves about 16 kilometres of new underground rail line and six new stations between Chatswood and Sydenham. The project includes a tunnel dive structure and a temporary construction compound to the north-east of Sydenham Station.

The Chatswood to Sydenham project was approved on 9th January 2017. A number of modifications are being prepared that would extend the project about 1.4 kilometres to the west of the tunnel dive structure, including the upgrade of Sydenham Station and development of the Sydney Metro Trains Facility South (stabling facility). Construction is due to commence in 2017 and is expected to be completed by 2023.

Location with respect to the Sydenham to Bankstown upgrade

The two projects form part of Sydney Metro City & Southwest and would interface with one another east of Marrickville Station. Although some construction activities would be undertaken concurrently, only works associated with the Sydenham Station upgrade and construction of the Sydney Metro Trains Facility South would be undertaken in the vicinity of the project.

Timing

Table 27.3 provides the indicative construction programs for the Chatswood to Sydenham and Sydenham to Bankstown projects. Potential interactions and cumulative impacts are considered in the following sections.

Table 27.3 Indicative construction programs for Chatswood to Sydenham and Sydenham to Bankstown upgrade

Project	2017	2018	2019	2020	2021	2022	2023	2024
Sydney Metro City and Southwest: Sydenham to Bankstown upgrade								
Sydney Metro City and Southwest: Chatswood to Sydenham								

Cumulative impacts

Potential cumulative impacts that may arise as a result of both projects are summarised in Table 27.4.

Table 27.4 Cumulative impacts of the Sydenham to Bankstown upgrade with the Chatswood to Sydenham project

Environmental impact	Potential cumulative impacts without mitigation
Construction transport and access	The following potential cumulative transport and access impacts could occur during construction: • additional road closures around Sydenham Station • additional pedestrian and passenger movements around Sydenham Station as a result of station upgrade works and rail replacement buses • safety risk to pedestrians, cyclists and other motorists due to increase in vehicle movements due to construction traffic for both projects • additional loss of on street parking.
Operational traffic and transport	Once complete, the two projects would provide cumulative transport-related benefits, including a major increase in the capacity of Sydney's rail network, with the capacity to run up to 30 trains per hour through the Sydney CBD in each direction. This provides the foundation for delivering a 60 per cent increase in the number of trains operating through Sydney's CBD during peak periods, which would cater for an extra 100,000 customers per hour. Further details of the cumulative benefits of Sydney Metro as a whole are provided in Chapter 5 (Project need).
Construction noise and vibration	Construction of the project could result in additional receivers experiencing noise levels above adopted criteria. Additional construction traffic may also result in cumulative road traffic noise, depending on routes chosen.
Operational noise and vibration	Cumulative noise impacts associated with both the Chatswood to Sydenham and Sydenham to Bankstown projects are unlikely.
Non-Aboriginal heritage	The Chatswood to Sydenham project would impact on Sydenham Station, which would increase the number of stations on the T3 Bankstown Line affected by upgrades to undertake Sydney Metro City & Southwest. Overall, any changes to the heritage elements of station are considered to be as part of the latest phase of the development of the T3 Bankstown Line, which has developed over the years as new stations were added to the line. The line would continue to operate for its original use while simply adding a modern railway infrastructure context. All stations would continue to be used for the purpose they were built and therefore still hold significance.
Aboriginal heritage	Due to developed nature of both project areas, cumulative impacts on Aboriginal heritage are considered to be minimal.
Hydrology, flooding and water quality	The flooding assessment provided in Chapter 21 (Hydrology, flooding and water quality) has considered the cumulative impacts of flooding resulting from both projects. While in most locations, flooding is not expected to worsen, in some locations around Marrickville and Sydenham stations, a reduction in flooding is anticipated.

Environmental impact	Potential cumulative impacts without mitigation
Land use and property	While total acquisitions would increase as a result of both projects, the effects would be different as the Chatswood to Sydenham modification only affects industrial land uses. There would not be a cumulative loss of residential or commercial properties due to the two projects.
Business impacts	The projects would result in cumulative acquisition and lease termination. When coupled with the impacts at Marrickville near Sydenham Station, the amount of viable alternate locations for businesses to re-establish would reduce. The provision of retail opportunities at some upgraded stations might potentially offset the impacts on some businesses. During operation, the project would increase accessibility to locations along the T3 Bankstown Line due to improved train services. This would result in benefits for businesses.
Landscape character and visual amenity	Additional temporary visual impacts during construction may occur due to the presence of multiple construction sites and out-of-hours light spill around Sydenham Station and Sydney Metro Trains Facility South. Cumulative operational impacts are expected to be negligible as the combined changes would be consistent with the character of the surrounding area.
Socio-economic impacts	During construction, there is potential for additional pedestrian and customer movements in the vicinity of Sydenham Station as a result of rail replacement buses. This could lead to an increased safety risk to pedestrians, cyclists, and other motorists as a result of increased traffic in the area (including possible detours/diversions) resulting from the two projects. Increased amenity impacts (noise, traffic, visual, and dust) may also result from simultaneous construction activities, particularly where the two projects interface east of Marrickville Station. The nature of works at this location (mainly track work) means the cumulative impacts would be limited, and could be managed effectively through mitigation measures. The operation of the two projects would improve access to areas surrounding the stations and along the line, including to the Sydney CBD. The two projects would also include aspects of an active transport corridor, which would be connected with similar facilities at Sydenham Station. This would be a positive cumulative impact. The provision of this corridor and improved accessibility would encourage healthy lifestyles for communities along the T3 Bankstown Line.
Air quality	There is potential for additional dust emissions during construction. Potential cumulative impacts are not considered to be significant.

The scale of these cumulative impacts and benefits would vary but would be additional with those of the Sydenham to Bankstown upgrade. The benefits of the project would be maximised, and the adverse impacts minimised, by implementing the mitigation measures provided in Section 27.3.

27.2.2 Other projects

Potential cumulative impacts may occur as a result of construction activities occurring simultaneously with other smaller developments within the vicinity of the project area. Potential cumulative impacts could include:

- increased construction traffic travelling through the study area and on the surrounding road network
- increase in construction noise and vibration, including road traffic noise
- increased impacts on non-Aboriginal heritage
- reduced visual amenity
- increase in dust emissions.

These other cumulative impacts are unlikely to be significant and would be minimised and managed by implementing the mitigation measures provided in Table 27.5.

27.3 Mitigation measures

The mitigation measures that would be implemented to minimise potential cumulative impacts are listed in Table 27.5.

Table 27.5 Mitigation measures – cumulative impacts

ID	Impact/issue	Mitigation measures	Applicable location(s)
Pre-construction and construction			
CI1	Cumulative impacts	Transport for NSW would manage and co-ordinate the interface with projects under construction at the same time. Co-ordination and consultation with the following stakeholders would occur, where required: • Department of Planning and Environment • Roads and Maritime Services • Sydney Trains • NSW Trains • Sydney Buses • Inner West Council • Canterbury-Bankstown Council • Sydney Motorways Corporation • emergency service providers • utility providers • construction contractors. Co-ordination and consultation with these stakeholders would include: • provision of regular updates to the detailed construction program, construction sites and haul routes • identification of key potential conflict points with other construction projects • developing mitigation strategies in order to manage conflicts. Depending on the nature of the conflict, this could involve: – adjustments to the construction program, work activities or haul routes of Sydney Metro or other construction projects – co-ordination of traffic management arrangements between projects.	All

Part D

Conclusion

28. Synthesis of the Environmental Impact Statement

This chapter provides a synthesis of the findings of the Environmental Impact Statement. It addresses the Secretary's environmental assessment requirements listed in Table 28.1.

Table 28.1 Secretary's environmental assessment requirements – synthesis

Ref	Secretary's environmental assessment requirements - synthesis	Where addressed
2.1	(q) a chapter that synthesises the environmental impact assessment and provides: • a succinct but full description of the project for which approval is sought;	Section 28.1
	• a description of uncertainties that still exist around design, construction methodologies and/or operational methodologies and how these will be resolved in the next stages of the project;	Section 28.2 and Table 28.2
	• a compilation of the impacts of the project that have not been avoided;	Section 28.3
	• a compilation of the proposed measures associated with each impact to avoid or minimise (through design refinements or ongoing management during construction and operation) or offset these impacts;	Sections 28.4 and 28.5
	• a compilation of the outcome(s) the proponent will achieve; and	Section 28.6
	• the reasons justifying carrying out the project as proposed, having regard to the biophysical, economic and social considerations, including ecologically sustainable development and cumulative impacts.	Section 28.7

28.1 Description of the project for which approval is sought

This Environmental Impact Statement considers the potential impacts of constructing the Sydenham to Bankstown upgrade, and operating it as part of Sydney Metro City & Southwest. It has been prepared to support Transport for NSW's application for approval of the project as critical State significant infrastructure, in accordance with the requirements of Part 5.1 of the EP&A Act. The Environmental Impact Statement addresses the environmental assessment requirements of the Secretary of the Department of Planning and Environment, dated 23 March 2017.

28.1.1 Project features

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

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

- stations that are accessible to people with a disability or limited mobility, the elderly, people with prams, and people travelling with luggage

- upgraded station buildings and facilities for all transport modes that meet the needs of a growing population
- interchanges that support an integrated transport network and allow seamless transfers between different modes for all customers.

The key features of the project are listed below.

Works to upgrade access at stations

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

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

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

Works to convert stations and the rail line to metro standards

Station works

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

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

Track and rail system facility works

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

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

Other works

Other works proposed to support Sydney Metro operations include:

- upgrading existing bridges and underpasses across the rail corridor
- installation of security measures, including fencing
- installation of noise barriers where required
- modifications to corridor access gates and tracks

- augmenting the existing power supply, including new traction substations and provision of new feeder cables
- utility and rail system protection and relocation works
- drainage works to reduce flooding and manage stormwater.

Active transport corridor and future rail corridor development

The project would also provide for:

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

Temporary works during construction

During construction, the project would involve:

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

Further information on the design features of the project is provided in Chapter 8.

28.1.2 Location

The project is located mainly within the existing rail corridor, from about 800 metres west of Sydenham Station in Marrickville, to about one kilometre west of Bankstown Station in Bankstown.

The location of the project is shown in Figure 1.3.

28.1.3 Construction

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

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

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

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

Further information on how the project would be constructed is provided in Chapter 9.

28.1.4 Operation

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

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

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

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

Further information on how the project would operate is provided in Section 8.3.

28.1.5 Project objectives

The primary objectives of the project are to:

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

Secondary objectives are to:

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

The project also aims to

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

28.2 Project uncertainties and approach to design refinements

28.2.1 Project uncertainties

Given the complexity of delivering the project, the design presented in this Environmental Impact Statement is indicative. The design serves to:

- confirm that the proposed performance and technical requirements can be achieved
- validates the feasibility and methodology of the required construction
- identifies key risks/constraints and environmental assessment issues.

There remain some uncertainties relating to technical requirements and how the project would be constructed. These would be resolved as the design progresses. A summary of the uncertainties that have the potential to impact on the environment, and how these would be resolved, is provided in Table 28.2.

Table 28.2 Project uncertainties

Category of impact	Key uncertainty	How uncertainties will be resolved
Transport, traffic and access	Possession strategy	A number of possession options are being considered for use for construction. The preferred option will be identified taking into consideration the final design, and construction planning undertaken by the construction contractor.
	Temporary transport arrangements - rail replacement services during construction, including: • final service provision and arrangements • services west of Bankstown • infrastructure required • rail network changes for Circle Line stations and other network changes	Transport for NSW will work to ensure disruptions to customers are minimised. In accordance with the Temporary Transport Strategy, temporary transport management plans will be implemented during possessions to cater for displaced train passengers between Sydenham and Bankstown, and stations west of Bankstown where services are impacted. Development of the plans have commenced and will continue during detailed design. Further information is provided in Appendix G.
	Program for bridge closures	Transport for NSW will work to ensure disruptions to road operations and users are minimised. Detailed design and construction planning will determine a program for the road network configurations required to undertake bridge works. This will include consideration of interfaces with the Temporary Transport Strategy and other construction traffic movements.
Noise	Final noise mitigation requirements	Further noise modelling will be undertaken during detailed design to confirm the receivers that are eligible for mitigation. Feasible and reasonable mitigation measures will be considered for each of the receivers during detailed design.
Hydrology and flooding	Flood management	Additional flood modelling will be undertaken for the area west of Marrickville Station during detailed design. This will include modifications to the design where required and practicable, to confirm and where possible reduce identified issues.
Across a number of potential impact areas	Compounds and work sites – location, layout and facilities	The final location and layout of compounds and work sites will be confirmed based on the detailed design and final construction methodology, taking into account the criteria and requirements provided in Section 9.8.

Category of impact	Key uncertainty	How uncertainties will be resolved
	Utilities – impacts to utilities to be defined in detail	Utility investigations are ongoing and will be completed during detailed design, to validate current assessments, and confirm relocation/protection requirements. To minimise potential impacts to utilities and the community, utilities would be managed in accordance with the Utilities Management Framework, provided in Appendix I.

28.2.2 Approach to design refinements

The design as described in the Environmental Impact Statement would be subject to ongoing refinements during the detailed design phase. Refinements may be made to:

- avoid services that present significant construction difficulties in terms of logistics, time and/or cost
- reduce the construction timeframe
- avoid areas of environmental sensitivity identified following approval
- reduce impacts on the community
- improve operation without increasing the potential environmental impacts.

Such refinements may include, for example:

- minor changes to the location of compounds, work sites, and construction site accesses
- minor changes to the location of key infrastructure, refinement or reorientation of site boundaries
- minor changes the features of key project components
- utility relocations outside the existing project area
- additional infrastructure to support the implementation of the Temporary Transport Strategy.

For design refinements, a screening assessment would be undertaken to consider whether the refinement would:

- result in any of the conditions of approval not being met
- be consistent with the objectives and operation of the project as described in the Environmental Impact Statement
- result in a significant change to the approved project
- result in any potential environmental or social impacts of a greater scale or impact on previously unaffected receivers than that considered by the Environmental Impact Statement.

A refinement that does not meet these criteria would be considered a design modification. Approval would be sought from the Minister for Planning for any such modifications in accordance with the requirements of Part 5.1 of the EP&A Act.

28.3 Compilation of impacts

28.3.1 Impacts that have not been avoided

Part C of the Environmental Impact Statement provides an assessment of the potential impacts during construction and operation. The key potential adverse impacts requiring mitigation and

management are summarised in Table 28.3 and Table 28.4. Further information on these impacts is provided in Chapters 10 to 27. The operational benefits are summarised in Section 28.7.2.

Impacts would be mitigated by implementing the environmental management procedures and plans described in Section 28.4, and the mitigation measures compiled in Table 28.5.

Table 28.3 Summary of key potential construction impacts

Issue	Key potential construction impacts
Traffic, transport and access	• Increase in vehicle movements on the local and regional road network due to construction traffic, resulting in increased congestion and delays. • Local traffic disruptions and short-term access restrictions and detours for road users during station and bridge works. • Access restrictions for pedestrians and cyclists within and surrounding the stations during station works. • A number of on and off-street (including commuter) parking spaces would be unavailable to the general public for the duration of construction at each station, with the main potential impacts at Hurlstone Park, Belmore, Lakemba, Punchbowl, and Bankstown stations. • Additional temporary impacts to on and off-street parking are also predicted during possession periods, with the main potential for impacts during these periods at Dulwich Hill, Canterbury, Campsie, Belmore, Lakemba, and Punchbowl stations. • The establishment of temporary bus layovers and bus stops near stations for the operation of rail replacement buses would impact some on-street and off-street parking spaces, with the main potential impacts at Campsie, Lakemba, Wiley Park, and Bankstown stations. As a result of the operation of rail replacement buses, some impacts to parking may also be experienced at other stations, including Sydenham, Birrong, Sefton, and Lidcombe stations. • Implementation of rail replacement buses during possessions, guided by the Temporary Transport Strategy, would add to road traffic and congestion, and change the amenity of public transport trips, with corresponding changes to travel times and mode choice. • Impacts to rail customers, as a result of changes to rail timetables on the T3 Bankstown Line and on the connecting lines during possession periods.
Noise and vibration	• Construction noise levels were predicted to exceed the relevant criteria at most sites for the majority of construction scenarios modelled, with a number of exceedances at residential receivers being greater than 20 decibels above the relevant criteria during the day and night. These predictions identify noise levels at the most exposed receiver, which may not be reached, or only infrequently reached, during the construction period. • There is also the potential for sleep disturbance impacts during the night. • Construction traffic movements, including both heavy vehicles and rail replacement buses, may result in road traffic noise levels above the relevant criteria. • In the event that large hydraulic rock breakers are used at the edge of the work site closest to the receiver, a large number of buildings adjacent to the project area would be located within the recommended offset distance for potential amenity and cosmetic damage resulting from vibration. • In practice, this may not be necessary and vibration impacts would be intermittent over the duration of construction. • Given the proximity of construction to a number of heritage items, particularly at stations, there is the potential for vibration impacts if appropriate mitigation measures are not implemented.
Non-Aboriginal heritage	• The project would result in the removal of one or more heritage elements at each station, which would directly impact on heritage listed items as follows:

Issue	Key potential construction impacts
	– a major impact to the State Heritage Register listed Marrickville Railway Station Group, mainly as a result of upgrading the Illawarra Road overbridge – moderate impacts to the State Heritage Register listed Canterbury and Belmore railway station groups – major impacts to four locally listed items (Dulwich Hill, Hurlstone Park, Wiley Park, and Punchbowl railway station groups) – moderate impacts to three locally listed heritage items (Campsie, Lakemba and Bankstown railway station groups) – a moderate impact to the locally listed Canterbury (Cooks River) Underbridge, as a result of the proposed removal and replacement of the parapets during bridge works. • Major visual impact to one item listed on the State heritage Register (Marrickville Station). • Moderate visual impacts to two items listed on the State Heritage Register (the Canterbury and Belmore railway station groups). • Major visual impacts to four items with a local heritage listing (the Dulwich Hill, Hurlstone Park, Wiley Park, and Punchbowl railway station groups). • Potential for impacts to significant archaeological remains at Marrickville, Canterbury, Lakemba, and Belmore stations. • Two locally listed items (Wiley Park and Punchbowl railway station groups) would no longer meet the threshold for local significance and would likely be de-listed.
Aboriginal heritage	• Construction may disturb a potential Aboriginal archaeological deposit of moderate significance and low to moderate potential for intact archaeological deposits (S2B PAD 02), located adjacent to Punchbowl Station.
Land use and property	• Acquisition of three privately owned lots under one ownership near Marrickville Station. • Partial acquisition of land from three publicly owned lots near Marrickville and Punchbowl stations, including a small area within Warren Reserve, adjacent to Punchbowl Station. • Some areas of land would need to be temporarily leased or occupied to locate some of the proposed compounds and work sites. • During construction, the use of land within the project area would change from its existing use (mainly transport) to use as a partial and temporary construction site. • Recreation use of the area of McNeilly Park in Marrickville where the underground detention basin is proposed would be temporarily restricted during construction of the basin.
Socio-economics	• Changes in existing access arrangements and connectivity across and within the station areas. • Possessions and/or station closures, and the associated alternative public transport arrangements, have the potential to impact the community, including as a result of travel time delays, and a reduced likelihood to use public transport. • Impacts on the amenity of the local community, including as a result of an increase in noise levels, traffic movements and congestion, dust, and changes in visual outlook. • Impacts on community infrastructure located near the project area, mainly as a result of changes to amenity and access arrangements.
Business	• Cessation of a total of 37 existing commercial leases at seven stations, including one lease at each of Dulwich Hill, Belmore, Lakemba, Wiley Park, Canterbury, and Punchbowl stations, and 31 leases at buildings surrounding Campsie Station. • Slight temporary potential for impacts to property values and rental return.

Issue	Key potential construction impacts
	• Station and track closures would have the potential to affect businesses, mainly those located close to the stations that have a higher reliance on passing trade, particularly during longer duration possessions. • Temporary changes to the road network could result in inefficiencies, potentially reducing revenue and providing a disincentive for visiting some local centres near stations. • Changes to parking arrangements and the temporary removal of some existing parking spaces has the potential to affect deliveries and convenience for business employees and customers, particularly for areas where parking is already in short supply, businesses close to stations, and/or retail or service-oriented businesses that require quick and efficient access for customers. • Impacts on amenity for businesses, including as a result of an increase in noise levels, traffic movements and congestion, dust, and changes in visual outlook.
Landscape character and visual impact	• Visual impacts during construction as a result of the presence of construction works, plant, and disturbance. • Loss of mature street trees providing screening and amenity, particularly in the vicinity of stations.
Hydrology, flooding and water quality	• Potential for inundation of construction areas during flood events particularly in areas where flooding is currently problematic (such as high flood risk areas at Marrickville Station, Canterbury, and Campsie). • Changes in surface water flows as a result of construction activities. • Impacts on downstream water quality if management measures are not implemented, monitored, and maintained.
Biodiversity	• It was assumed for the purpose of the biodiversity assessment that construction would require removal of all vegetation located along the rail corridor in the project area. This would involve removal of about 29.8 hectares of vegetation, the majority of which comprises exotic plants (about 21.5 hectares) or planted, often non-indigenous, native species on fill material (about 7.3 hectares). • Removing all vegetation in the rail corridor would impact about one hectare of native vegetation, including about 0.6 hectares of threatened ecological communities listed under the TSC Act. • Removing all vegetation in the rail corridor would also impact some nesting and foraging habitat, including about 7.9 hectares of foraging habitat for the threatened Grey-headed Flying-fox, Eastern Bentwing Bat, and other threatened fauna species with known or potential habitat in the study area.

Table 28.4 Summary of key potential operation impacts

Issue	Key potential operation impacts
Traffic, transport and access	• Kerbside parking arrangements around some station areas would be reconfigured to support access to the stations. This would include reallocation of kerbside space, mainly to provide/upgrade accessible parking, and areas for kiss and ride, and taxis. This reallocation would result in a loss of some on-street parking spaces in the immediate vicinity all stations. • Creation of new station forecourts and active transport facilities would impact off-street parking areas adjacent to some stations, including a loss of about 58 off-street spaces at Belmore and Bankstown stations, and about 20 spaces at Campsie. All these spaces are adjacent to the stations and/or rail corridor, and are not designated commuter parking.
Noise and vibration	• Noise levels at a number of residential receivers adjacent to the rail corridor have the potential exceed the *Rail Infrastructure Noise Guideline* criteria, and are therefore eligible for further consideration of noise mitigation (i.e. noise barriers).

Issue	Key potential operation impacts
Land use and property	• The use of the portion of Warren Reserve to be acquired near Punchbowl Station (about 15 per cent of the overall reserve, located adjacent the existing rail corridor) would change from recreation to rail infrastructure. • The use of NSW Government (RailCorp) owned land at Charles Street, Canterbury would change from parking to rail infrastructure.
Business	• Loss of parking described above may impact the availability of parking for some customers of local businesses in the vicinity of stations.
Landscape character and visual amenity	• Introduction of new structures in the visual landscape, including upgraded stations (with elevated station concourses and buildings).

28.4 Approach to environmental management

28.4.1 Environmental management during construction

The approach to environmental management during construction is shown on Figure 28.1 and involves:

- Project design – measures incorporated in the design and construction planning to avoid and minimise impacts. Further information is provided in Chapters 7 (Design development and place making) and 9 (Project description – construction).
- Mitigation measures – identified as an outcome of the environment impact assessment detailed in Chapters 10 to 27, and consolidated in Table 28.5.
- Environmental performance outcomes – future construction planning would be considered against the environmental performance outcomes provided in Section 28.6.
- Implementation of the following project specific construction environmental management frameworks/strategies (described below):
  - Construction Environmental Management Framework
  - Construction Noise and Vibration Strategy
  - Temporary Transport Strategy
  - Utilities Management Framework.

Construction Environmental Management Framework

The Construction Environmental Management Framework, provided in Appendix D, details the approach to environmental management and monitoring during construction. The framework is a linking document between the planning approval documentation and the construction environmental management documentation (including the Construction Environmental Management Plan), which would be developed by the construction contractors.

The framework details the environmental, stakeholder, and community management systems and processes that would be applied during construction. Specifically, it details the requirements in relation to the Construction Environmental Management Plan, sub-plans, and other supporting documentation for each specific environmental aspect.

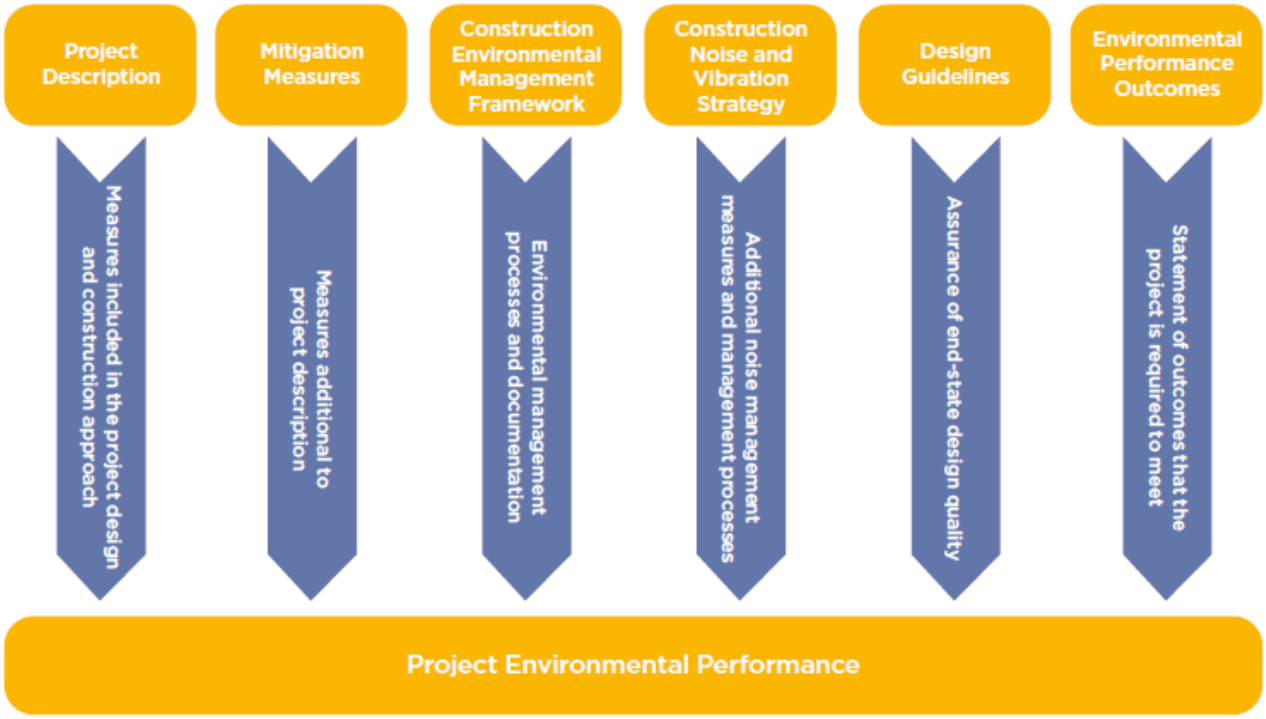


Figure 28.1 Approach to environmental mitigation and management during construction

Construction Noise and Vibration Strategy

The Construction Noise and Vibration Strategy (provided in Appendix E) defines how construction noise and vibration will be managed for the Sydney Metro City & Southwest project as a whole. The strategy provides guidance for managing construction noise and vibration impacts in accordance with the *Rail Infrastructure Noise Guideline*, to provide a consistent approach to management and mitigation across all Sydney Metro projects.

The strategy identifies the requirements and methodology to develop construction noise impact statements. These would be prepared prior to specific construction activities, based on a more detailed understanding of construction methods, including the size and type of construction equipment.

Temporary Transport Strategy

A Temporary Transport Strategy (provided in Appendix G) has been prepared to provide a guide to managing alternative public transport arrangements during construction, to minimise impacts to customers during station closures and possession periods. The strategy identifies:

- objectives for customers and bus services
- customer markets to be served by temporary transport management plans
- the process for developing temporary transport management plans to guide alternative transport arrangements, including stakeholder and community consultation
- options to maintain public transport connections to and from all affected rail stations
- impacts associated with temporary transport options and the level of assessment to be provided in temporary transport management plans
- temporary transport facilities and measures required to support the implementation of temporary transport management plans, ensuring provision of accessible services
- performance outcomes for temporary transport management plans.

Guided by the strategy, temporary transport management plans would be developed to manage, during station closures and possessions, the movement of customers who would usually use the T3 Bankstown Line. The plans would focus on what needs to happen during closures and possession periods to ensure customers have an acceptable means to travel by public transport.

Further information on the proposed approach to alternative transport arrangements, including the Temporary Transport Strategy and plans is provided in Section 9.11.

Utilities Management Framework

A Utilities Management Framework (provided in Appendix I) has been prepared, adopting a risk-based approach to avoiding and/or minimising impacts associated with the relocation and/or adjustment of public utilities affected by the project. The framework provides a consistent approach to the assessment and management of public utilities relocation/adjustment across all project activities.

28.4.2 Environmental management during operation

The approach to environmental management during operation involves:

- Project design – measures inherent in the design to avoid and minimise impacts. Further information on how the project design has been developed to minimise the potential for operational impacts is provided in Chapter 7.
- Mitigation measures – identified through the environment impact assessment in Chapters 10 to 27, and consolidated in Table 28.5.
- Environmental performance outcomes – future design development and any design changes would be considered against the environmental performance outcomes provided in Section 28.6.
- Sydenham to Bankstown Design guidelines (described below).
- Operational environmental management – the approach to environmental management during operation would be defined in the Operational Environmental Management Plan.

Sydenham to Bankstown Design Guidelines

The Sydenham to Bankstown Design Guidelines (provided in Appendix C) describes how Transport for NSW proposes to achieve a quality design for the project, which is integrated with the surrounding environment and town centres. The guidelines:

- guide the design development process
- support the development of healthy, cohesive and inclusive communities
- respond to the strategic directions and urban design strategies of the local councils
- establish the design standards, by guiding the design of the interface between stations and their surrounding locality, including:
  - stations
  - transport interchange facilities (bicycle facilities, bus stops, kiss and ride, taxi ranks and connections to existing rail and light rail infrastructure)
  - landscaping and other public domain elements
  - rail corridor works.

Operational Environmental Management Plan

Environmental performance during operation would be managed by the implementation of an Operational Environmental Management Plan. The plan would detail how the mitigation measures and performance outcomes would be implemented and achieved during operation, and specify the environmental management practices and procedures to be followed during operation. The plan would be prepared in consultation with relevant agencies and in accordance with the *Guideline for the Preparation of Environmental Management Plans* (Department of Infrastructure, Planning and Natural Resources, 2004). The plan would include, but not be limited to, the following:

- a description of activities to be undertaken during operation
- statutory and other obligations, including approvals, consultations and agreements required from authorities and other stakeholders
- overall environmental policies, guidelines and principles to be applied to operation
- a description of the roles and responsibilities, including relevant training and induction to ensure that employees are aware of their environmental and compliance obligations
- an environmental risk analysis to identify the key environmental performance issues associated with the operation phase
- details of how environmental performance would be managed and monitored.

28.5 Compilation of mitigation measures

Table 28.5 provides a compilation of the measures proposed to mitigate and manage the potential impacts of the project, as provided in the chapters in Part C of the Environmental Impact Statement. The measures described in the chapters and compiled in this table were developed based on the recommended measures in the technical papers, adapted as required to take into account the findings of all the assessments undertaken for the Environmental Impact Statement. The mitigation measures provided in the chapters and compiled in Table 28.5 also include additional measures, consistent with the commitments made by Transport for NSW for other Sydney Metro projects, including the Sydney Metro City & Southwest Chatswood to Sydenham project.

The mitigation measures compiled in Table 28.5, together with the approach to environmental management described in Section 28.4, provide Transport for NSW's commitments for the project. The mitigation measures may be revised in response to submissions raised during public exhibition and/or any design changes made following exhibition. The final list of mitigation measures would be provided in the submissions/preferred infrastructure report. If the project is approved, the conditions of approval, which would include reference to the final mitigation measures, would guide subsequent phases of the project. The project would be undertaken in accordance with the conditions of approval and the final list of mitigation measures.

The measures are broadly grouped according to the main stage of implementation. However, it is noted that the implementation of some measures may occur across a number of stages.

The location/s applicable to each mitigation measure are identified by using a unique identifier as follows:

- All – Project as a whole
- BW – Bridge works
- AS – All stations
- MA – Marrickville Station
- DU - Dulwich Hill Station
- CP – Campsie Station
- BE – Belmore Station
- LA – Lakemba Station
- WP – Wiley Park Station
- PB – Punchbowl Station.

- HP – Hurlstone Park Station
- CB – Canterbury Station
- BA – Bankstown Station
- SS – Substations.

Table 28.5 Compilation of project specific mitigation measures

ID	Impact	Mitigation measures	Relevant location(s)
Traffic, transport and access			
Design/pre-construction			
TC1	*Temporary transport arrangements*	Guided by the Temporary Transport Strategy, detailed temporary transport management plan/s would be developed prior to construction to manage the movement of people along the T3 Bankstown Line during possession periods. The plans would be developed in consultation with key stakeholders (including the Sydney Coordination Office, Roads and Maritime Services, Sydney Trains, local councils, emergency services, and bus operators), and would address the requirements specified by the Temporary Transport Strategy. The development of each plan would consider, as a minimum: • a review of the road network constraints along any proposed rail replacement bus route • further traffic analysis of key intersections used by rail replacement buses • potential impacts to local road networks affected by rail passengers diverting to cars to reach their destinations • the design of temporary facilities at bus stop locations in consultation with the relevant road authority • expected changes to parking demand at other stations, displacement of existing parking, and any upgrades that may be required.	AS
TC2		Transport for NSW would consult with Roads and Maritime Services, the State Transit Authority, and bus operators, to identify opportunities to minimise impacts to bus layovers and existing bus stops during operation of rail replacement buses.	AS
TC3	*Impacts of bridge works*	Detailed analysis of the network impacts of proposed bridge work would be undertaken, and management measures would be developed, in consultation with Roads and Maritime Services and the Sydney Coordination Office. Measures would include restricting work to some bridges during off peak and/or holiday periods, where practicable, including the following bridges as a minimum: • Charlotte Avenue underbridge • Illawarra Road overbridge • Burwood Road overbridge • Haldon Street overbridge • King Georges Road overbridge • Stacey Street overbridge.	BW

ID	Impact	Mitigation measures	Relevant location(s)
TC4		The impacts on the surrounding road network of road diversions and lane closures resulting from bridge works across the rail corridor would be assessed in detail, to identify the suite of management measures to be implemented for each diversion/closure required. This would be undertaken in consultation with Roads and Maritime Services, the Sydney Coordination Office, the Inner West and Canterbury-Bankstown councils, emergency services, and relevant bus operators. Planning for partial or full bridge closures would consider bus rerouting and timetabling, with the intention of minimising impacts to bus customers and bus operators.	BW
TC5	*Pedestrian access*	Work affecting the pedestrian underpass providing access to and from the Belmore Sports Ground would be timed, in consultation with the facility manager and owners, to ensure that suitable access is provided. This would include (if necessary) avoiding disruptions to access during events, such as game days at Belmore Oval. Local diversions would be put in place during periods of closure.	BE
TC6	*Parking impacts during construction*	Opportunities to reduce the loss of existing on and off street car parking (including the amount of spaces reduced and the time associated with this reduction) would be reviewed during detailed design and construction planning.	AS
TC7		Where parking spaces are lost or access is impeded, particularly for extended periods, alternative parking would be provided wherever feasible and reasonable. This would include consideration of other privately owned (or vacant) land within close proximity to affected stations.	AS
TO1	*Parking impacts during operation*	Further consideration of car parking management at stations would be undertaken in consultation with Roads and Maritime Services, the Sydney Coordination Office, and the Inner West and Canterbury-Bankstown councils, to minimise adverse impacts of operation on parking and other kerbside use in local streets.	AS
TC8	*Impacts of intersection performance*	Further consideration of the need for intersection modifications would be undertaken, to improve intersection performance at locations most affected by the addition of construction heavy vehicles, rail replacement buses, and diverted traffic. This would be undertaken in consultation with Roads and Maritime Services, the Sydney Coordination Office, and the relevant road authority. The improvements considered would include: • modification to the existing traffic signal phasing • lane priority changes • changing lane designations (line markings and signage) • kerbside changes (such as removing on street parking or implementing no standing zones at peak times to increase lane capacity) • physical geometric changes (such as minor kerb cut-backs to enable large vehicles to safely move through intersections) • restricting turning movements where traffic demand is low.	All
TC9	*Changes to cyclist facilities during construction*	Where existing cycle facilities (e.g. bike parking) would be temporarily unavailable at a station, suitable replacement facilities would be provided while the facility is unavailable.	AS

ID	Impact	Mitigation measures	Relevant location(s)
Construction			
TC10	*Management of traffic, transport and access*	A construction traffic management plan would be prepared and implemented prior to construction. The plan would be prepared in accordance with the Construction Environmental Management Framework, and would detail, as a minimum: • how traffic would be managed when construction works are being carried out • the activities proposed and their impact on the road network and on road users • how these impacts would be addressed. The plan would be prepared in consultation with the Traffic and Transport Liaison Group, and would be approved by the relevant authority before construction commences.	All
TC11	*Changes to public transport services and alternative transport arrangements*	Modification of existing bus stops, or implementation of new stops and alterations to service patterns, would be carried out by Transport for NSW in consultation with the Sydney Coordination Office, Roads and Maritime Services, the Inner West and Canterbury-Bankstown councils, and bus operators.	AS
TC12		Transport for NSW would undertake an extensive community awareness and information campaign before changes to public transport services are implemented. This would include a range of communication activities such as: • information at stations • wayfinding signage • clearly marked bus stop locations • letter box drops • web based information and transport 'app' where changes to travel are found in a single place • information via 131 500 • advertising in local papers • email information bulletins.	AS
TC13	*Impacts on intersection performance*	Intersection operation would be optimised, where reasonable and feasible, to improve intersection performance at the worst affected intersections along construction haulage routes and/or rail replacement bus routes. This may include modifying signal phase times or sequences at traffic signal controlled intersections.	Affected intersections
TC14	*Impacts on special events*	Consideration of special events would be undertaken as part of construction work programming. For special events that require specific traffic and pedestrian management, measures would be developed and implemented in consultation with Roads and Maritime Services, the Inner West and Canterbury-Bankstown councils, and the organisers of the event.	All
TC15	*Impacts of construction compounds and work sites*	Vehicle access to and from construction sites would be managed to ensure pedestrian, cyclist, and motorist safety. Depending on the location, this may require manual supervision, barrier placement, temporary traffic signals, modifications to existing traffic signals, or police assistance.	All

ID	Impact	Mitigation measures	Relevant location(s)
TC16	*Construction vehicles*	Construction vehicles (including contractor staff vehicles) would be managed to: • minimise parking or queuing on public roads • minimise use of residential streets to gain access to work sites or compounds • minimise vehicle movements near schools, particularly during school start and finish times.	All
TC17	*Signage*	Directional signage and line marking would be used to direct and guide drivers, pedestrians, and other road users past construction compounds and work sites, and on the surrounding road network. This may be supplemented by variable message signs to advise drivers of potential delays, traffic diversions, speed restrictions, or alternate routes.	All
TC18	*Construction parking impacts*	Construction sites would be managed to minimise construction worker parking on surrounding streets. A worker car parking strategy would be developed in consultation with the relevant local council to identify measures to reduce the impact on the availability of on street and off street parking. The strategy would identify potential mitigation measures including alternative parking locations. The strategy would encourage contractor staff to: • use public transport • car share • park in a designated off site area and access construction sites via shuttle bus.	All
TC19	*Traffic incidents*	In the event of a traffic related incident, co-ordination would be carried out with the Sydney Coordination Office and Transport Management Centre's Operations Manager.	All
TC20	*Changes to road, pedestrian and cyclist networks*	The community would be notified in advance of proposed road and pedestrian network changes through appropriate forms of community notification.	All
TC21	*Impacts on pedestrian or cyclist paths*	A condition survey would be undertaken to confirm changes to routes proposed to be used by pedestrians and/or cyclists are suitable (e.g. suitably paved and lit), with identified modification requirements discussed with the Inner West and/or Canterbury-Bankstown councils and implemented prior to use of the routes.	All
TC22	*Pedestrian, cyclist and motorist safety*	Pedestrian, cyclist, and motorist safety in the vicinity of the construction sites would be addressed during construction planning and development of the construction traffic management plan. Measures that may be implemented to assist in multi modal traffic management include: • Speed awareness signs in conjunction with variable message signs near construction sites to provide alerts to drivers. • A community engagement program to provide road safety education and awareness to road users about sharing the road safely with heavy vehicles. • Heavy vehicle training for drivers to understand route constraints, safety issues, and limiting the use of compression braking. • Safety technology and equipment installed on heavy vehicles to enhance vehicle visibility, eliminate vehicles' blind spots, and monitor vehicle location, speeding compliance, and driver behaviour.	All

ID	Impact	Mitigation measures	Relevant location(s)
TC23	*Impacts to access*	Access for residents, businesses, and community infrastructure would be maintained. Where disruption to access cannot be avoided, consultation would be undertaken with the owners and occupants of affected properties, to confirm their access requirements and to discuss alternatives.	All
TC24		Access to stations and surrounding properties for emergency vehicles would be provided at all times. Emergency service providers (i.e. police and ambulance) would be consulted throughout construction to ensure they are aware of changes to access, including lane, bridge or road closures, and changes to station or rail corridor access.	All
TC25	*Co-ordination of cumulative traffic effects*	The potential cumulative effects of construction traffic from multiple construction sites within the project (including bridge works) would be further considered during development of the construction traffic management plan. Where there is potential for cumulative impacts across the project, these issues would be addressed with the assistance of the Traffic and Transport Liaison Group.	All
Operation			
TO2	*Walking*	Transport for NSW would work with the Inner West and Canterbury-Bankstown councils to identify and provide improvements and minimise adverse impacts to the surrounding pedestrian network.	AS
TO3	*Cycling*	Transport for NSW would work with the Inner West and Canterbury-Bankstown councils and other relevant stakeholders to enhance areas around stations for cyclists.	AS
TO4	*Bus*	Transport for NSW would work with the Sydney Co-ordination Office, Roads and Maritime Services, the Inner West and Canterbury-Bankstown councils, and bus operators to identify improvements to bus stops and services.	AS
TO5	Active transport corridor	Transport for NSW would work with the Department of Planning and Environment to support the development of an active transport corridor along the alignment, including walking and cycling infrastructure. Transport for NSW would deliver sections of the active transport corridor around stations.	All
TO6	*Commuter parking*	Transport for NSW would monitor the demand for additional commuter car parking spaces and consider opportunities for, and implications of, meeting this demand between Bankstown and Marrickville stations. Transport for NSW would consider provision for additional commuter car parking, subject to consideration of local station and town centre implications, including local traffic conditions.	AS
Noise and vibration			
Design/pre-construction			
NVC1	*Predicted construction noise impacts*	A construction noise and vibration review would be undertaken during detailed design. This would include noise modelling to confirm the results of modelling previously undertaken. Where changes in noise levels and exceedances are modelled, reasonable and feasible mitigation measures would be reviewed.	All

ID	Impact	Mitigation measures	Relevant location(s)
NVC2		In accordance with the *Construction Noise and Vibration Strategy*, all employees, contractors and subcontractors would receive an environmental induction. The induction must at least include: • relevant project specific and standard noise and vibration mitigation measures • relevant licence and approval conditions • permissible hours of work • any limitations on high noise generating activities • location of nearest sensitive receivers • designated loading/unloading areas and procedures • site opening/closing times (including deliveries).	All
NVC3	*Predicted vibration impacts*	Where vibration levels are predicted to exceed the screening criteria, a more detailed assessment of the structure would be carried out to determine the appropriate vibration limits for that structure.	All
NVC4		For heritage items where screening vibration levels are predicted to be exceeded, the more detailed assessment would include condition assessment and specifically consider the heritage values of the structure in consultation with a heritage specialist to ensure sensitive heritage fabric is adequately monitored and managed.	Heritage items along the project area
NVO1	*Predicted operational noise impacts*	An operational noise and vibration review would be undertaken to guide the approach to identifying reasonable and feasible mitigation measures to incorporate in the detailed design. This would include noise modelling to confirm the results of modelling previously undertaken. Where changes in noise levels and exceedances are modelled, reasonable and feasible mitigation measures would be reviewed.	All
NVO2		The height and extent of noise barriers adjacent to the project would be confirmed during detailed design with the aim of not exceeding trigger levels from the *Rail Infrastructure Noise Guidelines* (EPA, 2013). At-property treatments would be offered either on their own or in combination with a noise barrier where there are exceedances residual exceedances of the noise trigger levels.	All
NVO3		Operational noise from substations would be controlled by inclusion of appropriate mitigation, such as shielding or enclosures, and specification of equipment selection, to comply with the *Industrial Noise Policy* (EPA, 2000).	All

ID	Impact	Mitigation measures	Relevant location(s)
Construction			
NVC5	*Construction noise and vibration management*	The *Construction Noise and Vibration Strategy* would be implemented with the aim of achieving the noise management levels where feasible and reasonable. This may include the following example mitigation measures alone or in combination, where feasible and reasonable: • The provision of noise barriers around each construction site. • The coincidence of noisy plant working simultaneously close together would be avoided. • Offset distances between noisy plant and sensitive receivers would be increased. • Residential grade mufflers would be fitted to all mobile plant. • Dampened rock hammers would be used. • Non-tonal reversing alarms would be fitted to all permanent mobile plant. • High noise generating activities would be scheduled for less sensitive periods considering the nearby receivers, where reasonable and feasible. • The layout of construction sites would consider opportunities to shield receivers from noise. • Stationary noise sources would be enclosed or shielded whilst ensuring that the occupational health and safety of workers is maintained. • Loading and unloading of materials/deliveries is to occur as far as possible from noise sensitive receivers. • Select site access points and roads as far as possible away from noise sensitive receivers. • Dedicated loading/unloading areas to be shielded if close to noise sensitive receivers wherever feasible and reasonable. • Use quieter and less vibration emitting construction methods where feasible and reasonable. • The noise levels of plant and equipment must have operating Sound Power Levels compliant with the criteria in the *Construction Noise and Vibration Strategy.* • Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site. • Where feasible and reasonable, the offset distance between noisy plant items and nearby noise sensitive receivers would be as great as possible. • Where reasonable and feasible heavy vehicle movements would be limited to daytime and evening hours, with night-time movements avoided where possible. • Active community consultation and the maintenance of positive, cooperative relationships with schools, local residents and building owners and occupiers, through: – periodic notification or work activities and progress (eg regular letterbox drops, e-consult) – specific notification (letter-box drop) prior to especially noisy activities – comprehensive website information – project information and construction response telephone line – email distribution lists.	All

ID	Impact	Mitigation measures	Relevant location(s)
NVC6		Ballast tamping and hydraulic breaking would not be undertaken during the night-time period (10pm to 7am). Other noise intensive construction activities such as platform demolition, earthworks and track works would generally be limited to day time and evening periods (between 7am and 10pm), unless technical constraints exist such as: • works requiring a rail shutdown • requirements of road authorities, emergency services or Sydney Coordination Office.	All
NVC7		When working adjacent to schools, medical facilities and childcare centres, particularly noisy activities would be scheduled outside normal working hours, where reasonable and feasible.	All
NVC8		When working adjacent to churches and places of worship, particularly noisy activities would be scheduled outside services, where reasonable and feasible.	All
NVC9		Alternative accommodation may be offered to residents living in close proximity to construction works, where detailed design investigations confirm unreasonably high noise impacts over a prolonged period. Alternative accommodation arrangements will be offered and discussed with residents on a case-by-case basis.	All
NVC10		High noise and vibration generating activities including rock breaking, ballast tamping, demolition and ground and track earthworks may only be carried out in continuous blocks, not exceeding 3 hours each, with a minimum respite period of one hour between each block and these works.	All
NVC11		Ongoing noise monitoring during construction at sensitive receivers during critical periods (ie times when noise emissions are expected to be at their highest - eg piling and hammering) to identify and assist in managing high risk noise events.	All
NVC12	*Vibration monitoring*	Where vibration levels are predicted to exceed the screening criteria, attended vibration monitoring would be carried out to ensure vibration levels remain below appropriate limits for that structure.	All
NVC13	*Groundborne noise*	Reasonable and feasible measures would be implemented to minimise groundborne noise where exceedances are predicted.	All
NVC14	*Utility adjustments/ relocation works*	Reasonable and feasible mitigation measures would be implemented where power supply works would result in elevated noise levels at receivers. This would include: • carrying out works during the daytime period when in the vicinity of residential receivers • where out of hours works are required, scheduling the noisiest activities to occur in the evening period (up to 10pm) • use of portable noise barriers around particularly noisy equipment.	All
NVC15	*Road traffic noise*	The routes for construction haulage vehicles and bus services associated with the Temporary Transport Strategy would be selected on the basis of compliance with the relevant night time road traffic noise criteria, where reasonable and feasible.	All

ID	Impact	Mitigation measures	Relevant location(s)
Operation			
NVO4	*Predicted vibration impacts*	Where vibration levels are predicted to exceed the screening criteria, a more detailed assessment of the structure and vibration monitoring would be carried out to ensure vibration levels remain below appropriate limits for that structure. For heritage items where screening vibration levels are predicted to be exceeded, the more detailed assessment would specifically consider the heritage values of the structure in consultation with a heritage specialist to ensure sensitive heritage fabric is adequately monitored and managed.	All
Non-Aboriginal heritage			
Design/pre-construction			
NAH1	*Minimising impacts during design*	The project design would be sympathetic to impacted items (including retained significant elements) and surrounding heritage items by minimising impacts to sight lines, views and setting. Detailed design would be carried out in accordance with the relevant specific element principles, including the significant fabric strategy, provided in the Design Guidelines.	All heritage items
NAH2		Except for the heritage significant elements affected by the project, direct impacts to other heritage significant items and elements would be avoided.	All heritage items
NAH3		The appropriately qualified and experienced heritage architect who is part of the Sydney Metro City & Southwest Design Review Panel would provide independent review periodically throughout detailed design.	All heritage items
NAH4		Where heritage significant items or elements are to be retained within the operational area, detailed design would consider appropriate retrofitting and reuse in consultation with a heritage architect and the Design Review Panel. Where retrofitting and reuse is not practicable for significant elements, justification would be provided to the Design Review Panel, and for State Heritage Register listed items, to the NSW Heritage Council.	All heritage items
NAH5		Design and construction planning within the Marrickville Station State Heritage register curtilage would consider the recommendations of the 2016 Conservation Management Plan and the significant fabric strategy.	MA
NAH6	*Interpretation*	Appropriate heritage interpretation would be incorporated into the design in accordance with the *NSW Heritage Manual*, the NSW Heritage Office's *Interpreting Heritage Places and Items: Guidelines* (August 2005), and the NSW Heritage Council's *Heritage Interpretation Policy*.	AS Hurlstone Park Railway Underbridge Overbridge - Illawarra Road Canterbury (Cooks River) Underbridge Canterbury (Cooks River/Charles St) Underbridge - Main Line

ID	Impact	Mitigation measures	Relevant location(s)
			Post-war bus shelter and public lavatories Bankstown Parcels Office (former)
NAH7	*Management of moveable heritage and heritage fabric*	A moveable heritage item strategy would be prepared by a suitably qualified heritage consultant in consultation with Sydney Trains, and would include a comprehensive record of significant railway elements to be impacted. This would include items contained within station and platform buildings as well as of any other significant equipment within the curtilage of the heritage railway stations. The moveable heritage item strategy would form part of the broader interpretation strategy.	Bankstown Line: AS apart from BA and Bankstown Parcels Office (former)
NAH8		Fabric of high and exceptional significance of items proposed for removal would be identified and catalogued according to the significant fabric strategy prior to design development, and would be re-used where possible. Where not able to be re-used, the significant fabric strategy would indicate appropriate storage locations, as well as appropriate types of buildings and structures where salvaged elements may be reused in the future. Where large elements are impacted, a sample of fabric may be appropriate.	MA: Overbridge-Illawarra Road DU: overhead booking office and access stairs HP: Platform 1 building CP: overhead booking office and Parcels office WP: Platform 1 building, Platform 2 building and overhead booking office PB: overhead booking office and footbridge
NAH9	*Impacts to the Old Sugarmill*	A landscape scheme would be prepared for the Old Sugarmill to re-instate planting within and close to the curtilage of the item. The scheme would consider appropriate period plants and trees. Any boundary wall treatment would be designed in consultation with a heritage architect.	Old Sugarmill
NAH10	*Impacts to archaeology*	An archaeological research design would be prepared and implemented to identify the need for archaeological testing or monitoring. Archaeological mitigation measures recommended in the archaeological research design would be implemented in accordance with relevant guidelines, and where identified in the archaeological research design, would be supervised by a suitably qualified Excavation Director with experience in managing State significant archaeology.	MA Catchment (specific requirements) CB Catchment and work site (specific requirements) BE Catchment (specific requirements) LA Catchment (specific requirements)

ID	Impact	Mitigation measures	Relevant location(s)
NAH11	*Archival recording*	Photographic archival recording and reporting would be carried out in accordance with the NSW Heritage *Office's How to Prepare Archival Records of Heritage Items* (1998), and *Photographic Recording of Heritage Items Using Film or Digital Capture* (2006).	Overbridge-Illawarra Road Hurlstone Park Railway Underbridge Canterbury (Cooks River) Underbridge Canterbury (Cooks River/Charles St) Underbridge - Main Line Post-war bus shelter and public lavatories Bankstown Parcels Office (former)
NAH12	*Conservation management*	A conservation management plan would be prepared for all State Heritage Register listed stations, in accordance with NSW Heritage Council guidelines. The plan would address any changes to the item, including updated assessment of significance of elements and recommendations on curtilage changes. It would also provide suggested site specific exemptions and management policies.	MA, CA, BE
NAH13		A conservation management strategy would be prepared for nominated Section 170 register listed stations not listed on the State Heritage Register, in accordance with NSW Heritage Council guidelines.	HP, CP, LA, BA
NAH14	*Unexpected finds*	An unexpected finds procedure would be developed and included in the construction heritage management plan.	All
Construction			
NAH15	*Minimising impacts during construction*	Methodologies for the removal of existing structures and construction of new structures would be developed and implemented during construction to minimise direct and visual impacts to other elements within the curtilages of the heritage items, or to heritage items located in the vicinity of works.	All heritage items
NAH16	*Unexpected finds*	In the event that unexpected archaeological remains, relics, or potential heritage items are discovered during construction, all works in the immediate area would cease, and the unexpected finds procedure would be implemented.	All
NAH17	*Human skeleton material*	In the event that a potential burial site or potential human skeletal material is exposed during construction, the procedure recommended by the historic heritage impact assessment would be followed in accordance with the Policy Directive – *Exhumation of Human Remains* (NSW Department of Health, 2008), *Skeletal Remains – Guidelines for the Management of Human Skeletal Remains under the Heritage Act 1977* (NSW Heritage Office, 1998) and the *Aboriginal Cultural Heritage Standards and Guidelines Kit* (NPWS, 1997).	All

ID	Impact	Mitigation measures	Relevant location(s)
Aboriginal heritage			
Design/pre-construction			
AH1	*Consultation*	Aboriginal stakeholder consultation would continue to be undertaken in accordance with *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECC, 2010b).	All
AH2	*Avoiding impacts to Aboriginal heritage*	An Aboriginal cultural heritage assessment report would be prepared in accordance with the *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (Office of Environment and Heritage, 2011a). The report would include: • details of Aboriginal stakeholder consultation conducted • an assessment of cultural significance for the project area and identification of any specific areas of cultural significance based on consultation with Aboriginal stakeholders • a methodology for archaeological test excavation and salvage, to be undertaken by suitably qualified personnel • procedures for any unexpected finds.	All (this item has already commenced)
AH3	*Managing impacts to identified PADs*	Direct impacts to S2B PAD02 at Punchbowl Station would be avoided where practicable. If impacts to S2B PAD02 cannot be avoided, archaeological test excavation (and salvage when required) would be undertaken prior to construction in accordance with the methodology defined by the Aboriginal cultural heritage assessment report.	S2B PAD02
AH4	*Interpretation*	Appropriate Aboriginal heritage interpretation would be incorporated into the design in consultation with Aboriginal stakeholders.	All
Construction			
AH5	*Unexpected finds*	If potential Aboriginal items are uncovered, works within 10 metres of the item would cease. The item would then be assessed and managed by a suitability qualified person in accordance with the unexpected finds procedure in the Aboriginal cultural heritage report. During pre-work briefings, employees would be made aware of the unexpected finds procedures and obligations under the NPW Act.	All
Land use and property			
Design/pre-construction			
LU1	*Acquisitions*	All acquisitions/adjustments would be undertaken in consultation with landowners and in accordance with the requirements of the *Land Acquisition (Just Terms Compensation) Act 1991*.	All
LU2	*Future planning*	Transport for NSW will continue to work the Department of Planning and Environment and the Greater Sydney Commission in relation to future planning for the Sydenham to Bankstown corridor.	All
LU3		Transport for NSW will contribute funding towards, and work with, the Department of Planning and Environment and Canterbury-Bankstown Council, on a master plan and business case for the Bankstown town centre, including how the station fits with the centre.	BA

ID	Impact	Mitigation measures	Relevant location(s)
Construction			
LU4	*Temporary use*	Temporary use areas, including public open space, would be restored to their pre-existing condition (as a minimum) as soon as practicable following completion of construction. This would be undertaken in consultation with the relevant council and/or the landowner.	All
Socio-economic impacts			
Design/pre-construction			
SO1	*Socio-economic impacts*	Transport for NSW would continue to work with stakeholders and the community to ensure they are informed about the project and have opportunities to provide feedback to the project team. The existing community contact and information tools would remain in place throughout the duration of the project. Consultation prior to and during construction would involve the use of appropriate tools, including, but not limited to, tools such as community information sessions, forums, briefings, and displays; distribution of project materials in a variety of languages; door knocks; Place Managers; and site signage.	All
SO2	*Community facilities*	Prior to construction, consultation would be undertaken with sensitive community facilities (including aged care, childcare centres, educational institutions, and places of worship). Consultation would aim to identify and develop measures to manage the specific construction impacts for individual sensitive community facilities. These measures would be incorporated into the relevant management plans.	All
Construction			
SO3	*Community facilities and infrastructure*	Access to community facilities and infrastructure would be maintained during construction. Where alternative access arrangements need to be made, these would be developed in consultation with relevant service providers, and communicated to users.	All
SO4	*Employment*	A workforce development plan would be prepared and implemented during construction, to support local employment and business opportunities, provide skills development, and increase workplace diversity.	
Business impacts			
Design/pre-construction			
BI1	*Managing construction impacts*	A business management plan would be prepared and implemented during construction, to define the location specific measures and strategies to minimise impacts on individual businesses during construction. The plan would also include: • a business consultation forum • roles and responsibilities • monitoring, auditing, reporting, and complaints management procedures.	All

ID	Impact	Mitigation measures	Relevant location(s)
BI2	*Supporting businesses during construction*	A small business owners support program would be developed and implemented to provide assistance to small business owners adversely impacted by construction. The program would be administered by a retail advisory/support panel established by Transport for NSW.	All
Landscape and visual impacts			
Design/pre-construction			
LV1	*General visual impacts*	The design would continue to be guided by the *Sydney Metro City & Southwest Sydenham to Bankstown Design Guidelines*.	All
LV2		Urban design and landscaping would be incorporated as part of the detailed station designs and precinct plans to provide a consistent approach to the management and mitigation of landscape and visual impacts across the project, and implementation of the proposed mitigation strategies.	All
LV3		Fencing would be designed to be of a high quality urban finish near stations.	AS
LV4	*Impacts to trees and screening vegetation*	The management of trees during detailed design and construction planning would be guided by the project's tree management strategy. Where removal cannot be avoided, trees would be replaced in accordance with the tree management strategy. Opportunities to retain and protect existing trees would be defined during detailed design and construction planning, in accordance with the project's tree management strategy. The design would aim to reduce tree removal to the extent practicable, particularly where they contribute to screening vegetation or landscape character.	All
LV5	*Light spill*	Lighting would be designed in accordance with *AS 4282 Control of the Obtrusive Effects of Outdoor Lighting*. Lighting would be designed to minimise light spill and glare into adjoining areas.	All
LV6	*Impacts of noise barriers*	The selection of materials and colours for noise barriers and hoardings would aim to minimise their visual prominence.	Noise barrier locations
LV7		The use of transparent panels in noise barriers would be considered where views to local landscape features and district views would be obstructed.	Noise barrier locations
LV8	Substations	The detailed design of the substations would ensure that they incorporate appropriate architectural treatments and landscaping, guided by the design guidelines, to minimise the potential for visual impacts.	Substations
Construction			
LV9	*Visual impacts*	A visual amenity management plan would be prepared and implemented during construction, to define the measures to minimise visual impacts during construction. The plan would include requirements in relation to construction site remediation.	All
LV10		Mitigation measures for landscape and visual impacts would be implemented as soon as feasible and reasonable after the commencement of construction, and remain for the duration of the construction period.	All

ID	Impact	Mitigation measures	Relevant location(s)
LV11	*Impacts to trees*	Trees to be retained would be protected prior to the commencement of construction in accordance with *AS4970-2009 Protection of trees on development sites* and the project's tree management and replacement strategy. Any tree pruning would be undertaken in accordance with the project's tree management strategy, guided by a tree report prepared by a qualified arborist.	All
LV12	*Impacts from construction, including compounds and work sites*	The design and maintenance of construction compound hoardings would aim to minimise visual amenity and landscape character impacts. Graffiti would be removed promptly, and public art opportunities would be considered.	All
LV13		The selection of materials and colours would aim to minimise their visual prominence.	All
LV14		Lighting of work areas, compounds and work sites would be oriented to minimise glare and light spill impact on adjacent receivers.	All
LV15		Following completion of construction, site restoration would be undertaken in accordance with the visual amenity management plan. Temporary impacts to public open space would be rehabilitated in consultation with the relevant local council and/or landowner.	All
Soils and contamination			
Design/pre-construction			
SC1	*General soil and erosion management*	Erosion and sediment control measures would be implemented in accordance with *Managing Urban Stormwater: Soils and Construction Volume 1* (Landcom, 2004) and *Managing Urban Stormwater: Soils and Construction Volume 2A* (DECC, 2008a). Measures would be designed as a minimum for the 80th percentile, five day rainfall event.	All
SC2	*Acid sulfate soils*	Prior to ground disturbance in high probability acid sulfate areas, testing would be carried out to determine the presence of acid sulfate soils. If acid sulfate soils are encountered, they would be managed in accordance with the *Acid Sulfate Soil Manual* (Acid Sulfate Soil Management Advisory Committee, 1998) and the *Waste Classification Guidelines* - Part 4: Acid Sulfate Soils (EPA, 2014).	MA, CB, CP
SC3	*Saline soils*	Prior to ground disturbance in areas of potential soil salinity, testing would be carried out to confirm the presence of saline soils. If saline soils are encountered, they would be managed in accordance with *Site Investigations for Urban Salinity* (DLWC, 2002).	PB, BA
SC4	*Contamination*	WorkCover dangerous goods searches would be carried out for properties that have potential contamination near Belmore Station, to provide additional site characterisation and identify the risk of contamination in these areas.	BE
SC5		A detailed contamination assessment would be undertaken in areas with a medium to high risk of contamination, to confirm the nature and extent of contamination, specific requirements for further investigation and remediation, and/or management requirements of any contamination.	MA, CP, BE, PB, BA

ID	Impact	Mitigation measures	Relevant location(s)
SC6		Hazardous materials surveys would be undertaken during detailed design for all proposed demolition activities, and for utility adjustments as required.	All
SC7		In the event a Remediation Action Plan is required, it would be developed in accordance with *Managing Land Contamination: Planning Guidelines SEPP 55 – Remediation of Land* (Department of Urban Affairs and Planning and Environment Protection Authority, 1998) and a NSW Environment Protection Authority Accredited site auditor would be engaged to audit the works.	MA, CP, BE, PB, BA
Construction			
SC8	*Unexpected contamination*	In the event that indicators of contamination are encountered during construction (such as odours or visually contaminated materials), work in the area would cease, and the finds would be managed in accordance with the unexpected contamination finds procedure.	All
Operation			
SC9	*Soil erosion and sedimentation*	During any maintenance work where soils are exposed, sediment and erosion control devices would be installed in accordance with *Managing Urban Stormwater: Soils and Construction* (Landcom, 2004).	All
Hydrology, flooding and water quality			
Design/pre-construction			
FHW1	*Flooding*	The design would be reviewed to, where feasible and reasonable, not worsen existing flooding characteristics up to and including the one per cent AEP event (incorporating a 10 per cent allowance for climate change) in the vicinity of the project. Detailed flood modelling would consider: • potential changes to flood prone land and flood levels, including areas of flood risk not already addressed • potential changes to overland flow paths • redistribution of surface runoff as a result of project infrastructure • behaviour of existing stormwater runoff, including the results of any recent flood events • results of detailed asset surveys (e.g. floor levels) • potential changes required to flood evacuation routes, flood warning systems and signage. Flood modelling to support detailed design would be carried out in accordance with the following guidelines: • *Floodplain Development Manual* (DIPNR, 2005) • *Floodplain Risk Management Guideline: Practical Consideration of Climate Change* (DECC, 2007) • *Floodplain Risk Management Guide: Incorporating Sea Level Rise Benchmarks in Flood Risk Assessments* (DECCW, 2010c) • *New guideline and changes to section 117 direction and EP&A Regulation on flood prone land, Planning Circular PS 07-003* (NSW Department of Planning, 2007). Flood modelling and consideration of mitigation measures would be carried out in consultation with the relevant local councils, and the NSW State Emergency Service.	All

ID	Impact	Mitigation measures	Relevant location(s)
FHW2	*Stormwater runoff*	Where feasible and reasonable, detailed design would result in no net increase in stormwater runoff rates in all storm events, unless it can be demonstrated that increased runoff rates as a result of the project would not increase downstream flood risk.	All
FHW3		Where space permits, on-site detention of stormwater would be introduced where stormwater runoff rates are increased. Where there is insufficient space for the provision of on-site detention, the upgrade of downstream infrastructure would be implemented where feasible and reasonable.	All
FHW4	*Consultation*	Where relevant, detailed design would occur in consultation with the NSW State Emergency Service, and the Inner West and Canterbury-Bankstown councils, to ensure that flood related outcomes are consistent with floodplain risk management studies.	All
FHW5	*Scour potential*	Further analysis of potential scour would be undertaken during detailed design. This would include the development of appropriate mitigation measures where required, including the installation of detention basins for the duration of construction.	All
FHW6	*Water quality*	The project would be designed to ensure there is minimal potential for water quality impacts, including incorporating water sensitive urban design elements.	All
Construction			
FHW7	*Flooding*	Detailed construction planning would consider flood risk for all compounds and work sites. This would include identification of measures to not worsen existing flooding characteristics. Not worsen is defined as: • a maximum increase in flood levels of 50 mm in a one per cent AEP event • a maximum increase in time of inundation of one hour in a one per cent AEP event • no increase in the potential for soil erosion and scouring from any increase in flow velocity in a one per cent AEP flood event.	All
FHW8		The site layout and staging of construction activities would: • avoid or minimise obstruction of overland flow paths and limit the extent of flow diversion required • consider how works would affect the existing stormwater network such that alternatives are in place prior to any disconnection or diversion of stormwater infrastructure.	All
FHW9	*Watercourse impacts*	Works within or near watercourses (including the Cooks River) would be undertaken with consideration given to the NSW Office of Water's guidelines for controlled activities.	All
FHW10	*Water quality*	Erosion and sediment mitigation measures would be installed and maintained for the duration of the construction period.	
FHW11	*Water quality monitoring*	A water quality monitoring program would be developed and implemented, to monitor water quality at identified discharge points. The program would include relevant water quality objectives, parameters, and criteria and specific monitoring locations identified in consultation with DPI (Water) and the EPA.	All

ID	Impact	Mitigation measures	Relevant location(s)
FHW12		Discharges from construction water treatment devices would be monitored to ensure compliance with the discharge criteria in the environment protection licence.	All
Operation			
FHW13	*Water quality*	Operational water discharges would be managed in accordance with the water quality management requirements specified in the environment protection licence.	All
Biodiversity			
Design/pre-construction			
B1	*Direct impacts to biodiversity*	Detailed design and construction planning would minimise direct impacts to vegetation mapped as threatened ecological communities as far as practicable, and have regard to the habitat management measures provided in the biodiversity assessment report.	All
B2		Pre-clearing surveys and inspections for endangered and threatened flora and fauna species would be undertaken by qualified ecologists prior to any clearing occurring. The surveys and inspections, and any subsequent relocation of species, would be undertaken in accordance with the measures provided in the biodiversity assessment report.	All
B3	*Biodiversity offsets*	The biodiversity offset strategy prepared for the Environmental Impact Statement would be updated to confirm the approach to retiring the required biodiversity credits (including appropriate biobank sites). It would also include a timeframe to retire the required credits based on the confirmed construction schedule and biobank site owner agreements/requirements.	All
Construction			
B4	*Direct impacts to biodiversity*	Areas of biodiversity value outside the project area would be marked on plans, and fenced or signposted where practicable, to prevent unnecessary disturbance.	All
B5		Impacts to Downy Wattle would be avoided. The locations of Downy Wattle stems would be marked on plans, fenced on site, and avoided.	PB, BA
B6		Equipment storage and stockpiling would be restricted to identified compound sites and already cleared land.	All
B7		A trained ecologist would be present during the clearing of native vegetation or removal of potential fauna habitat to avoid impacts on resident fauna and to salvage habitat resources as far as is practicable.	All
B8	*Management of weeds*	Noxious weeds would be managed in accordance with the *Noxious Weeds Act 1993*. Weeds of national environmental significance would be managed in accordance with the *Weeds of National Significance Weed Management Guide*.	All
Operation			
B9	*Management of weeds*	Annual inspections would be undertaken for weed infestations and to assess the need for control measures.	All
B10		Any outbreak of noxious and/or weeds of national environmental significance would be managed in accordance with the relevant guidelines.	All

ID	Impact	Mitigation measures	Relevant location(s)
Air quality			
Design/pre-construction			
AQ1	*Air quality impacts*	An air quality management plan would be prepared and implemented during construction, to define the measures to minimise air quality impacts during construction.	All
Sustainability and climate change			
Design/pre-construction			
SCC1	*Sustainability*	Sustainability initiatives and targets would be reviewed and incorporated into the detailed design to support the achievement of the project's sustainability objectives. A best practice level of performance would be targeted using relevant sustainability rating tools eg ISCA as built 'excellent' level rating.	All
SCC2		A sustainable procurement strategy would be developed and implemented to apply to Principal Contractors, their subcontractors and their suppliers.	All
SCC3		A workforce development and industry participation strategy would be developed covering both construction and operation.	
SCC4	*Climate change*	Climate change risk treatments would be incorporated into the detailed design, including ensuring that adequate flood modelling is carried out and integrated with design.	All
SCC5	*Greenhouse gas emissions*	An iterative process of greenhouse gas assessments and design refinements would be carried out during detailed design and construction to identify opportunities to minimise greenhouse gas emissions. Performance would be measured in terms of a percentage reduction in greenhouse gas emissions from a defined reference footprint.	All
Construction			
SCC6	*Sustainability*	Sustainability reporting (and corrective action where required) would be undertaken during construction.	All
SCC7		The construction workforce development would be implemented.	All
SCC8	*Greenhouse gas emissions*	25 per cent of the greenhouse gas emissions associated with consumption of electricity during construction would be offset.	All
Operation			
SCC9	*Sustainability*	Prior to operation commencing, sustainability initiatives would be reviewed and updated, and relevant initiatives would be implemented to support the achievement of the project's sustainability objectives.	All
SCC10		The operation workforce development plan would be implemented.	All
SCC11	*Climate change risks*	Periodic review of climate change risks would be carried out to ensure ongoing resilience to the impacts of climate change.	All

ID	Impact	Mitigation measures	Relevant location(s)
SCC12	*Greenhouse gas emissions*	100 per cent of the greenhouse gas emissions associated with consumption of electricity during operation would be offset.	All
Hazards, risks and safety			
Design/pre-construction			
HRS1	*Public safety*	A hazard analysis would be undertaken during the detailed design stage to identify risks to public safety from the project, and how these can be mitigated through safety in design.	All
Construction and operation			
HRS2	*Hazardous materials and substances*	All hazardous substances that may be required for construction and operation would be stored and managed in accordance with the *Storage and Handling of Dangerous Goods Code of Practice* (WorkCover NSW, 2005) and the *Hazardous and Offensive Development Application Guidelines: Applying SEPP* 33 (Department of Planning, 2011).	All
Waste management			
Design/pre-construction			
WM1	*Waste generation and recycling*	Detailed design would include measures to minimise excess spoil generation. This would include a focus on optimising the design to minimise spoil volumes, and the reuse of material on-site.	All
WM2		A recycling target of at least 90 per cent would be adopted.	All
Construction			
WM3	*Waste and spoil management*	Spoil would be managed in accordance with the spoil management hierarchy.	All
WM4		Target 100 per cent reuse of reusable spoil.	All
WM5		Construction waste would be minimised by accurately calculating materials brought to the site and limiting materials packaging.	All
WM6		All waste would be assessed, classified, managed and disposed of in accordance with the *Waste Classification Guidelines* (EPA, 2014a).	All
WM7		Waste segregation bins would be located at various locations within the project area, if space permits, to facilitate segregation and prevent cross contamination.	All
Cumulative impacts			
Pre-construction and construction			
CI1	*Cumulative impacts*	Transport for NSW would manage and co-ordinate the interface with projects under construction at the same time. Co-ordination and consultation with the following stakeholders would occur, where required: • Department of Planning and Environment • Roads and Maritime Services • Sydney Trains • NSW Trains • Sydney Buses	All

ID	Impact	Mitigation measures	Relevant location(s)
		• Inner West Council • Canterbury-Bankstown Council • Sydney Motorways Corporation • emergency service providers • utility providers • construction contractors. Co-ordination and consultation with these stakeholders would include: • provision of regular updates to the detailed construction program, construction sites and haul routes • identification of key potential conflict points with other construction projects • developing mitigation strategies in order to manage conflicts. Depending on the nature of the conflict, this could involve: – adjustments to the construction program, work activities or haul routes; or adjustments to the program, activities or haul routes of Sydney Metro or other construction projects – co-ordination of traffic management arrangements between projects.	

28.6 Compilation of performance outcomes

The Secretary's environmental assessment requirements identify a number of desired performance outcomes for the project. These desired performance outcomes outline the broader objectives to be achieved during design, construction, and operation. Based on the outcomes of the environmental impact assessment summarised in Part C, and implementation of the mitigation measures compiled in Section 28.4.2, environmental performance outcomes have been established. These are listed in Table 28.6. The first and second columns provide the key issue and desired performance outcome from the Secretary's environmental assessment requirements, and the third column provides the project specific environmental performance objectives to achieve the desired outcome.

Future design development and any design changes would be considered against these environmental performance outcomes.

Table 28.6 Compilation of environmental performance outcomes

Key issue (as listed in the SEARs)	**SEARs desired performance outcomes**	**Project specific environmental performance outcomes**
5 . Biodiversity	The project design considers all feasible measures to avoid and minimise impacts on terrestrial and aquatic biodiversity. Offsets and/or supplementary measures are assured which are equivalent to any remaining impacts of project construction and operation.	The project is designed to minimise impacts on biodiversity. Where practicable, the design minimises the need to clear vegetation. Potential impacts on biodiversity are managed in accordance with relevant legislation, including the EP&A Act, TSC Act, EPBC Act, and the *Noxious Weeds Act 1993*. The biodiversity outcome is consistent with the *Framework for Biodiversity Assessment* (OEH, 2014a). Offsets are provided in accordance with the *NSW Biodiversity Offsets Policy for Major Projects* (OEH, 2014).

Key issue (as listed in the SEARs)	**SEARs desired performance outcomes**	**Project specific environmental performance outcomes**
6. Flooding and hydrology	The project minimises adverse impacts on existing flooding characteristics. Construction and operation of the project avoids or minimises the risk of, and adverse impacts from, infrastructure flooding, flooding hazards, or dam failure. Long term impacts on surface water and groundwater hydrology (including drawdown, flow rates and volumes) are minimised. The environmental values of nearby, connected and affected water sources, groundwater and dependent ecological systems including estuarine and marine water (if applicable) are maintained (where values are achieved) or improved and maintained (where values are not achieved). Sustainable use of water resources.	Construction is undertaken in a manner that minimises the potential for adverse flooding impacts, through staging of works and the implementation of mitigation measures. Construction compounds and work sites are laid out such that flows are not significantly impeded. The project maintains or reduces flood levels within and adjacent to the rail corridor. The project avoids long term impacts to surface water. Opportunities to reuse water resources are considered during the design process. The use of water during construction is minimised.
7. Heritage	The design, construction and operation of the project facilitates, to the greatest extent possible, the long term protection, conservation and management of the heritage significance of items of environmental heritage and Aboriginal objects and places. The design, construction and operation of the project avoids or minimises impacts, to the greatest extent possible, on the heritage significance of environmental heritage and Aboriginal objects and places.	The design is sympathetic to the historic significance of existing stations and the heritage significance of surrounding listed heritage items, and where practicable, avoids and minimises impacts to heritage. The design and mitigation strategies are reviewed by the Sydney Metro Design Review Panel. Impacts on heritage are managed in accordance with relevant legislation, including the EP&A Act, the *Heritage Act 1977*, and relevant guidelines. The potential impacts identified are mitigated by the mitigation measures provided.
8. Noise and vibration – amenity	Construction noise and vibration (including airborne noise, ground-borne noise and blasting) are effectively managed to minimise adverse impacts on acoustic amenity. Increases in noise emissions and vibration affecting nearby properties and other sensitive receivers during operation of the project are effectively managed to protect the amenity and well-being of the community.	The project minimises impacts to the local community by: • controlling noise and vibration at the source • controlling noise and vibration on the source to receiver transmission path • controlling noise and vibration at the receiver • implementing practicable and reasonable measures to minimise the noise and vibration impacts of construction activities on local sensitive receivers.
9. Noise and vibration – structural	Construction noise and vibration (including airborne noise, ground-borne noise and blasting) are effectively managed to minimise adverse impacts on the structural integrity of buildings, items including Aboriginal places and environmental	The project minimises impacts to structures by: • controlling vibration at the source • controlling vibration on the source to receiver transmission path • implementing practicable and reasonable measures to minimise vibration impacts of construction activities on structures.

Key issue (as listed in the SEARs)	**SEARs desired performance outcomes**	**Project specific environmental performance outcomes**
	heritage, and nearby road infrastructure. Increases in noise emissions and vibration affecting environmental heritage as defined in the Heritage Act 1977 during operation of the project are effectively managed.	
10. Socio-economic, land use and property	The project minimises adverse social and economic impacts and capitalises on opportunities potentially available to affected communities. The project minimises impacts to property and business and achieves appropriate integration with adjoining land uses, including maintenance of appropriate access to properties and community facilities, and minimisation of displacement of existing land use activities, dwellings and infrastructure.	The project minimises impacts to the local community, community infrastructure, and businesses. Impacts to existing land use and properties are minimised. The project is appropriately integrated with adjoining land uses, and access to private properties is maintained. The project is appropriately integrated with local and regional land use planning strategies, including the *Sydenham to Bankstown Corridor Urban Renewal Strategy*. During operation, the project would improve access to local facilities, services and destinations, supporting opportunities for community interaction.
11. Soils	The environmental values of land, including soils, subsoils and landforms, are protected. Risks arising from the disturbance and excavation of land and disposal of soil are minimised, including disturbance to acid sulfate soils and site contamination.	Site-specific soil characteristics are taken into consideration during detailed design and construction. Any contamination is managed in accordance with relevant regulatory requirements. Any soil waste is assessed, classified, managed and disposed of in accordance with the *Waste Classification Guidelines* (EPA, 2014).
12. Sustainability	The project reduces the NSW Government's operating costs and ensures the effective and efficient use of resources. Conservation of natural resources is maximised.	Sustainability considerations are integrated throughout design, construction, and operation. The project would be carried out in accordance with the Sydney Metro City & Southwest Sustainability Policy.
13. Traffic, transport and access	Network connectivity, safety and efficiency of the transport system in the vicinity of the project are managed to minimise impacts. The safety of transport system customers is maintained. Impacts on network capacity and the level of service are effectively managed. Works are compatible with existing infrastructure and future transport corridors.	The project would reduce station crowding, increase rail network reach and use, improve network resilience, and improve travel times within the global economic corridor. Impacts to traffic and transport are minimised. Motorist, pedestrian and cyclist safety will be maintained or improved. Safe access to properties is maintained. The project is integrated with existing and future local and regional transport infrastructure and planning strategies. Metro customers would be provided with a safe and secure service.
14. Place making and urban design	The project capitalises on opportunities to improve place, character and quality of the surrounding build and natural	The project is designed to have regard to the surrounding landscape and visual environment and to minimise the potential for visual impacts.

Key issue (as listed in the SEARs)	**SEARs desired performance outcomes**	**Project specific environmental performance outcomes**
	environment (including adjoining public spaces). The project contributes to the accessibility and connectivity of communities.	The project is visually integrated with its surroundings. The stations provide a sense of place, and contribute positively to the surrounding urban environment. The design takes into account future planning for the *Sydenham to Bankstown Corridor Urban Renewal Strategy*. Vegetation providing screening to the rail corridor is retained where practicable.
15. Water - quality	The project is designed, constructed and operated to protect the NSW Water Quality Objectives where they are currently being achieved, and contribute towards achievement of the Water Quality Objectives over time where they are currently not being achieved, including downstream of the project to the extent of the project impact including estuarine and marine waters (if applicable).	Impacts to water quality during construction and operation are minimised. Erosion and sediment controls during construction are implemented in accordance with *Managing Urban Stormwater: Soils and Construction Volume 1* (Landcom, 2004) and Managing Urban Stormwater: Soils and Construction Volume 2 (Department of Environment and Climate Change, 2008a). The project would protect or contribute to achieving the Water Quality Objectives, during construction and operation. Construction water quality discharge would comply with the requirements of an environment protection licence issued to the project.
16. Utilities	The project is designed, constructed and operated to minimise impacts to utilities and provision of such to the public.	Impacts to utilities during construction are minimised. The design takes into account the input of utility providers and owners.

28.7 Project justification

28.7.1 Summary of project justification

The project forms a key part of Sydney Metro, which is Australia's largest public transport project. A new standalone railway, this 21st century network will deliver 31 metro stations and 66 kilometres of new metro rail for Australia's biggest city – revolutionising the way Sydney travels.

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

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

Sydney's current suburban system can reliably carry 24,000 people an hour per line. As population and employment continue to grow, rail is forecast to experience the highest growth in travel demand, with about an additional 100,000 trips expected on Sydney's rail network during the morning peak by 2036. This will place additional pressure on the rail network.

It is forecast that without further investment, Sydney's rail network will reach capacity in the Sydney CBD and on critical suburban rail lines by the mid to late 2020s. Sydney Metro (including the project) will have a long-term target capacity of about 40,000 customers per hour in each direction, similar to other metro systems worldwide. Sydney Metro, together with signalling and infrastructure

upgrades across the existing Sydney rail network, will increase the capacity of train services entering the Sydney CBD – from about 120 an hour today to up to 200 services beyond 2024. This is an increase of up to 60 per cent capacity across the network to meet demand.

Over the next 15 years, NSW will require infrastructure to support 40 per cent more train trips, 30 per cent more car trips and 31 per cent more households. Sydney Metro, including the project, is identified as a key infrastructure project as part of the NSW Government's infrastructure investment program.

Sydney Metro will transform Sydney, cutting travel times, reducing congestion and delivering economic and social benefits for generations to come. It will boost economic activity by more than $5 billion a year, supporting major jobs and business growth along its route with better connectivity and land development opportunities, and greatly improving business logistics, especially for knowledge-based businesses.

With at least1 5 trains an hour in the peak when services start in 2024, the conversion of the T3 Bankstown Line to metro operations would address one of Sydney's biggest rail bottlenecks, delivering benefits across Sydney's rail network. These benefits would further increase when the number of trains increases to 20 per hour as part of the ultimate operations.

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

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

28.7.2 Summary of project benefits

The project would have the following benefits:

- all stations fully accessible, with lifts and level access between trains and platforms
- more job opportunities faster, more frequent and direct access to key employment centres
- better access to education, with fast, more frequent and direct connections
- no timetable required – customers can just turn up and go
- new and direct access to major CBD stations, including Martin Place, Pitt Street, Barangaroo and North Sydney
- increased train frequency in AM and PM peak services – a train at least every four minutes
- improved interchange with bus, light rail, pedestrian and cycling networks, and provision of taxi, kiss and ride and bike parking facilities at key stations
- fast, safe and reliable – a new generation of 21st century metro trains.

28.7.3 Consequence of not proceeding

The project is a section of Sydney Metro as a whole, and one of two components of Sydney Metro City & Southwest. Without the project, the benefits of Sydney Metro City & Southwest would not be fully realised. The bottleneck created by the T3 Bankstown Line would remain. There would not be sufficient rail capacity to provide for Sydney's growth, as summarised in Section 28.7.1.

28.7.4 Environmental considerations

Environmental investigations were undertaken during preparation of the Environmental Impact Statement to assess the potential impacts of the project. These included specialist assessments of traffic and transport, noise and vibration; heritage; hydrology, flooding and water quality; landscape and visual amenity; biodiversity; socio-economics; and business impacts. The Environmental Impact Statement has documented the potential environmental impacts, considering both potential positive and negative impacts, and identifies mitigation measures to protect the environment where required.

The key potential impacts on the biophysical, social and cultural environments are summarised in Section 28.3.

As described in Chapters 7 to 9 and Section 28.4, the project would incorporate environmental management and design features to ensure that potential impacts are managed and mitigated as far as practicable.

28.7.5 Ecologically sustainable development

The EP&A Act adopts the definition of ecologically sustainable development contained in the *Protection of the Environment Administration Act 1991*. An assessment of the project against the principles of ecologically sustainable development as per clause 7(4) of Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* is provided below.

Precautionary principle

A range of environmental investigations, as described in Part C of the Environmental Impact Statement, have been undertaken during the development of the project and the environmental assessment process, to ensure that potential impacts are understood with a high degree of certainty. The assessment of the potential impacts of the project is considered to be consistent with the precautionary principle. The assessments undertaken are consistent with accepted scientific and assessment methodologies, and have taken into account relevant statutory and agency requirements. The assessments have applied a conservative approach with regard to construction and operational arrangements, and the modelling used.

Examples of the application of the precautionary principle include the biodiversity assessment, and the noise and vibration assessment. For the biodiversity assessment, although the Long-nosed Bandicoot population in inner western Sydney was considered unlikely to occur in the project area, the potential impacts on this species were still assessed.

The noise and vibration assessment involved a ‘worst case’ construction noise impact assessment, even though the likelihood of the worst-case is considered to be low and therefore potential noise impacts are considered to be lower than assessment. Due to much of the works being undertaken during possession periods many of the predicted noise impacts would be limited to these periods and therefore would not occur throughout the construction period.

The project has evolved to avoid impacts where possible, and to reflect the findings of the assessments undertaken. A number of safeguards have been proposed to minimise potential impacts. These safeguards would be implemented during construction and operation. No safeguards have been postponed as a result of lack of scientific certainty.

Principle of inter-generational equity

Construction along a long linear corridor has the potential for some degree of environmental and social disturbance. These disturbances include the clearing of vegetation; amenity impacts during construction; impacts to heritage items; and changes to traffic movements and access. However,

the potential for environmental and social disturbance as a result of construction has to be balanced against the long term benefits of Sydney Metro overall.

Once operational, the project (in conjunction with other Sydney Metro projects) would benefit future generations. The project would provide long-term benefits by strengthening connections and access across Sydney, through the provision of a more efficient means of public transport. These benefits would be most felt by future generations as the population along the project area increases in line with future development proposed by the draft *Sydenham to Bankstown Urban Renewal Strategy*.

In addition to the broader Sydney transport operational benefits, the 'door-to-door' experience provided by Sydney Metro would also result in long-term health benefits with the creation of safer and more appealing conditions for pedestrians, cyclists, and other transit users. The would make modes of transport like walking and cycling more desirable, which would result in increased health of future generations.

The project would also facilitate future delivery of active transport corridor that would further improve the health of the community including future generations. In addition, the project would promote better access for all people, by upgrading stations to meet statutory accessibility requirements.

Conservation of biological diversity and ecological integrity

The majority of the project area is located within an existing transport corridor, with minimal habitat value. The few areas of Downy Wattle (*Acacia pubescens)* located between Punchbowl and Bankstown stations have been excluded from the project area.

A biodiversity assessment was undertaken in accordance with the *Framework for Biodiversity Assessment* to identify potential adverse impacts on biodiversity. The main potential impact on biodiversity would occur as a result of clearing of vegetation to enable the project to be constructed. It was assumed for the purpose of the assessment that construction would require removal of all vegetation located along the rail corridor in the project area. This would involve removal of 29.8 hectares of vegetation, the majority of which comprises exotic plants (about 21.5 hectares) or planted, often non-indigenous, native species on fill material (about 7.3 hectares). Removing all vegetation in the rail corridor would impact on one hectare of native vegetation.

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

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

Improved valuation and pricing of environmental resources

Economic appraisal draws on a number of established methodologies that provide for the valuation of externalities, including environmental externalities, and their inclusion in the appraisal process. Environmental parameters that can be valued include air pollution, greenhouse gas emissions, noise pollution and water run-off. Valuations typically adopt broad average values.

The assessment has identified the environmental and other consequences of the project, and identified mitigation measures where appropriate to manage potential impacts. If approved, construction and operation would be undertaken in accordance with relevant legislation, the conditions of approval, and the environmental management plans described in Section 28.4. These requirements would result in an economic cost to the proponent. The implementation of mitigation

measures would increase the capital and operating costs of the project. This signifies that environmental resources have been given appropriate valuation.

The design has been developed with an objective of minimising potential impacts on the surrounding environment. This indicates that the design has been developed with an environmental objective in mind.

28.8 Conclusion

The project involves upgrading 10 existing stations west of Sydenham (Marrickville to Bankstown inclusive), and a 13 kilometre long section of the Sydney Trains T3 Bankstown Line, between west of Sydenham Station and west of Bankstown Station, to improve accessibility for customers and meet the standards required for metro operations. The project is needed to support the development of Sydney Metro, in line with the objectives of *Sydney's Rail Future*.

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

To manage the potential impacts identified by the Environmental Impact Statement, and in some cases remove them completely, the assessment chapters detail a range of management and mitigation measures that would be implemented during construction and operation. The project's environmental performance would be managed in accordance with the approach described in Section 28.4. This includes implementing the Construction Environmental Management Framework, Construction Environmental Management Plan, Construction Noise and Vibration Strategy, Temporary Transport Strategy, Utilities Management Framework, and the Operational Environmental Management Plan. These plans would also ensure compliance with relevant legislation and any conditions of approval.

Section 28.5 compiles the mitigation measures that would be implemented.

With the implementation of the proposed management and mitigation measures, the potential environmental impacts of the project are considered manageable.

29. Reference list, definitions and abbreviations

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Abbreviations

Abbreviation	Definition
µg/m^3	micrograms per cubic metre
AEP	annual exceedance probability
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal heritage impact permit
Air NEPM	*National Environment Protection (Ambient Air Quality) Measure*
ANZECC	Australian and New Zealand Environment and Conservation Council
ARTC	Australian Rail Track Corporation
AS	Australian Standard
ASSMAC	Acid Sulfate Soils Management Advisory Committee
BoM	Bureau of Meteorology
BS	British Standard
CBD	central business district
CEMP	construction environmental management plan
CH_4	methane
Clean Air Regulation	*Protection of the Environment Operations (Clean Air) Regulation 2010*
CO	carbon monoxide
CO_2	carbon dioxide
CPTED	crime prevention through environmental design
CSIRO	Commonwealth Scientific and Industrial Research Organisation
dB	Decibel (A-weighted)
DDA	*Disability Discrimination Act 1992*
DEC	NSW Department of Environment and Conservation
DECC	Department of Environment and Climate Change
DECCW	Department of Environment, Climate Change and Water
DIPNR	NSW Department of Infrastructure, Planning and Natural Resources
DPI	Department of Primary Industries
DSAPT	*Disability Standards for Accessible Public Transport 2002*
EIS	environmental impact statement
EP&A Act	*Environmental Planning and Assessment Act 1979*
EP&A Regulation	*Environmental Planning and Assessment Regulation 2000*
EPA	Environment Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
ESD	*ecologically sustainable development*
FM Act	*Fisheries Management Act 1994*
HFCs	hydrofluorocarbons
Hz	hertz
ICNG	*Interim Construction Noise Guideline*
Infrastructure SEPP	*State Environmental Planning Policy (Infrastructure) 2007*
km	kilometres

Abbreviation	Definition
km/hr	kilometres per hour
LEP	local environmental plan
LGA	local government area
m	metres
m/s	metres per second
m^3	cubic metre
mg	milligram
N_2O	nitrous oxide
NCA	noise catchment areas
NEPC	National Environment Protection Council
NO_2	nitrogen dioxide
NPW Act	*National Parks and Wildlife Act 1974*
NSW	New South Wales
NW Act	*Noxious Weeds Act 1993*
OEH	Office of Environment and Heritage
PAD	potential archaeological deposit
PFCs	perfluorocarbons
PMF	probable maximum flood
POEO Act	*Protection of the Environment Operations Act 1974*
RAP	remediation action plan
RBL	rating background level
RING	*Rail Infrastructure Noise Guideline* (EPA, 2013)
RNP	*Road Noise Policy 2011*
Roads and Maritime	Roads and Maritime Services
SEPP	State environmental planning policy
SEPP 33	*State Environmental Planning Policy No 33 – Hazardous and Offensive Development*
SF_6	sulphur hexafluoride
SHR	State heritage register
SO_2	sulphur dioxide
State and Regional Development SEPP	*State Environmental Planning Policy (State and Regional Development) 2011*
Waste Regulation	*Protection of the Environment Operations (Waste) Regulation 2014*
TSC Act	*Threatened Species Conservation Act 1995*
WARR Act	*Waste Avoidance and Resource Recovery Act 2007*

Definitions

Term	Definition
100-year flood	A 100-year flood is the flood that will occur or be exceeded on average once every 100 years. It has a one per cent probability of occurring in any given year. The same principle applies to other flooding events, such as the 10-year, 20-year and 50-year floods.
Aboriginal object	Defined by the *National Parks and Wildlife Act 1974* as 'any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area that comprises New South Wales, being habitation before or concurrent with (or both) the occupation of that area by persons of non-Aboriginal extraction, and includes Aboriginal remains'.
Aboriginal site	A place where physical remains or modification of the natural environment indicate past and 'traditional' activities by Aboriginal people. Site types include artefact scatters, isolated artefacts, burials, shell middens, scarred trees, quarries, and contact sites. Includes sites listed on the AHIMS. Also known as Aboriginal objects.
Aboriginal place	Declared by the Minister for the Environment, in accordance with Section 84 of the *National Parks and Wildlife Act 1974* and by an order published in the Gazette, as a place that, in the opinion of the Minister, is or was of special significance with respect to Aboriginal culture.
Aboriginal places of heritage significance	Defined in the *Standard Instrument - Principal Local Environmental Plan* as an area of land, the general location of which is identified in an Aboriginal heritage study adopted by the Council, and that may be shown on the Heritage Map. The term may include (but is not limited to) places that are declared as Aboriginal places under section 84 of the *National Parks and Wildlife Act 1974.*
Accessibility	A public transport customer's ability to reach their destination unhindered and as independently as possible. Includes compliance with relevant disability standards such as the *Disability Discrimination Act 1992* and the *Disability Standards for Accessible Public Transport 2002*. Also refers to a measure of the ability or ease of customers to travel between various origins and destinations.
Annual exceedance probability	The annual exceedance probability (AEP) is a measure of the frequency of a rainfall event. It is the probability that a given rainfall total, accumulated over a given duration, will be exceeded in any one year. A one per cent AEP event is a rainfall event with a one per cent chance of being exceeded in magnitude in any year.
Anti-throw screen	Installed on structures such as bridges or overhead walkways to prevent injury and damage resulting from objects being thrown off the structure.
Archaeological potential	The likelihood of unregistered surface and/or subsurface archaeological materials to be present at a location.
Australian height datum	A common reference surface level used in Australia which is approximately equivalent to the height above mean sea level.
Average delay	Duration, in seconds, of the average vehicle waiting time at an intersection.
Average recurrence interval	The long-term average number of years between the occurrence of a flood larger than the selected event.
Ballast	Crushed rock, stone etc used to provide a foundation for a railway track. Ballast usually provides the bed on which railway sleepers are laid, transmits the load from train movements, and restrains the track from movement.
Biobank site	A site to which a biobanking agreement applies.
Biobanking agreement	Landowners enter into a biobanking agreement with the Minister for the Environment to establish a biobank site. A biobanking agreement is a conservation covenant that is attached to the land title. It specifies the management actions to be undertaken on biobank sites to improve biodiversity values and allow biodiversity credits to be created.
Biodiversity credits	In accordance with the *Framework for Biodiversity Assessment* (OEH, 2014b), biodiversity credits, which consist of ecosystem credits and species credits, represent the impacts on threatened species as a result of a proposal. A decision support tool produced by OEH is used to determine the number of biodiversity credits required to offset the impacts of a development.

Term	Definition
Biodiversity offsets	Biodiversity offsets are measures that benefit biodiversity by compensating for the adverse impacts elsewhere of an action, such as clearing for development. Biodiversity offsets work by protecting and managing biodiversity values in one area in exchange for impacts on biodiversity values in another.
Biodiversity offset strategy	The section of a Biodiversity Assessment Report prepared in accordance with the *Framework for Biodiversity Assessment,* which presents the approach to the delivery of biodiversity offsets for a project, including the quantum of offsets required, options to deliver these offsets, an estimate of the costs involved, and the additional steps required to finalise their delivery.
Biodiversity values	The composition, structure and function of ecosystems, including native species, populations and ecological communities, and their habitats.
Biophysical environment	The physical environment (water, soil etc) as well as the biological activity within it (plants, animals etc.).
Catchment	The area drained by a stream or body of water, or the area of land from which water is collected.
Chatswood to Sydenham project	One of the two components of the Sydney Metro City & Southwest project, the other being the Sydenham to Bankstown upgrade.
Classified road	A road that meets the definition of a classified road and is listed as such under the *Roads Act 1993* – includes main roads, highways, freeways etc.
Climate	The average weather experienced at a site or region over a period of many years, ranging from months to many thousands of years. The relevant measured quantities are most often surface variables such as temperature, rainfall, and wind.
Community	A physical or cultural grouping of stakeholders with common interests created by shared proximity or use.
Concourse	The paved open area at a station – can be located either behind or in front of ticket barriers.
Construction compound	An area used as the base for construction activities, usually for the storage of plant, equipment and materials, and/or construction site offices and worker facilities.
Crossover	Points and tracks enabling trains to switch from one line to another.
Cutting	Excavation from the surface down, so that the new surface level sits below the adjacent ground level.
Dangerous goods	Dangerous goods are substances or articles that pose a risk to people, property or the environment, due to their chemical or physical properties. They are usually classified with reference to their immediate risk.
Degree of saturation	The ratio between traffic volumes and capacity of an intersection used to measure how close to capacity an intersection is operating. Degree of saturation is a direct measure of the congestion level at the intersection. As it approaches 1.0, both queue length and delays increase rapidly. Satisfactory operations usually occur with a degree of saturation between 0.8-0.9 or below.
Discharge	The quantity of water per unit of time flowing in a stream, for example cubic meters per second or megalitres per day.
Ecologically sustainable development	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.
Ecosystem credit	A measurement of the value of endangered ecological communities, critically endangered ecological communities, and threatened species habitat for species that can be reliably predicted to occur with a plant community type. Ecosystem credits measure the loss in biodiversity values as a result of a proposal, and the gain in biodiversity values at an offset site.
Emission	A substance discharged into the air.
Embankment	A structure to allow rail lines (or other infrastructure) to be located above the natural ground surface.
Erosion	A natural process where wind or water detaches a soil particle and provides energy to move the particle.

Term	Definition
Flood	The inundation of normally dry land by water which escapes from, is released from, is unable to enter, or overflows from the normal confines of a natural body of water or watercourse, such as rivers, creeks or lakes, or any altered or modified body of water, including dams, canals, reservoirs and stormwater channels.
Flood liable land	Land which is within the extent of the probable maximum flood and therefore prone to flooding.
Floodplain	The area of land subject to inundation by floods up to and including the probable maximum flood.
Flora and fauna	Plants and animals
Formation	Refer to track formation
Glare	The uncomfortable brightness of a light source when viewed against a dark background.
Groundwater	All waters occurring below the land surface. The upper surface of the soils saturated by groundwater in any particular area is called the water table.
Habitat tree	A tree that is recognised as being of value as a shelter, roosting, and/or nesting resource for fauna species. Includes hollow-bearing trees, stags (standing dead trees), and trees with nests or other signs of fauna occupancy.
Heritage listed	An item, building or place included on statutory heritage lists maintained by local, State and/or the Australian Government.
Impervious	Surfaces that are not permeable to water, such as paved areas.
Infiltration	The downward movement of water into soil and rock, which is largely governed by the structural condition of the soil, the nature of the soil surface (including presence of vegetation), and the moisture content of the soil.
Interchange	A location where customers transfer from one mode of transport to another or between two services of the same mode. Also includes a place where customers join or leave the public transport system on foot, by bicycle, motorcycle, or car.
Kiss and ride	An area allocated for cars to pull out of the active traffic lane and drop passengers off at a station.
$L_{A90(period)}$	The sound pressure level exceeded for 90 per cent of the measurement period.
$L_{Aeq(1\ hour)}$	The busiest one hour 'equivalent continuous noise level', representing the typical L_{Aeq} noise level from all the proposal noise events during the busiest one hour of the assessment period.
$L_{Aeq(15\ hour)}$	The daytime 'equivalent continuous noise level', representing the cumulative effects of all the proposal noise events occurring in the daytime period from 7am to 10pm.
$L_{Aeq(24\ hour)}$	The 'equivalent continuous noise level', sometimes also described as the 'energy-averaged noise level', representing the cumulative effects of all the proposal noise events occurring in one day.
$L_{Aeq(9\ hour)}$	The night-time 'equivalent continuous noise level', representing the cumulative effects of all the proposal noise events occurring in the night-time period from 10pm to 7am.
$L_{Aeq(time)}$	Typically used to describe ambient (background) noise levels.
L_{Amax}	The maximum sound level recorded during the measurement period.
Landform	A specific feature of the landscape or the general shape of the land.
Landscape	All aspects of a tract of land, including landform, vegetation, buildings, villages, towns, cities, and infrastructure.
Landscape character	The combined quality of built, natural and cultural aspects that make up an area and provide its unique sense of place.
Landscape character zone	An area of landscape with similar properties or strongly defined spatial qualities, distinct from areas immediately adjacent.
Landscape feature	A component, part or feature of the landscape that is prominent or eye-catching, e.g. hills, buildings, vegetation.
Landscape quality	Largely subjective judgement based on particular characteristics that influence the way in which the environment is experienced, including special interests such as cultural associations or heritage interests, the presence and/or type of elements, and condition.

Term	Definition
Level of service	Defined by Austroads as a measure for ranking operating road and intersection conditions, based on factors such as speed, travel time, freedom to manoeuvre, interruptions, comfort, and convenience.
Light spill	The spilling of light beyond the boundary of a property or lit area.
Local road	Road used mainly to access properties located along the road.
pH	A measure of the degree of acidity or alkalinity expressed on a logarithmic scale of one to four, with one being most acid, seven neutral, and 14 most basic (alkaline).
PM_{10}	Particulate matter 10 micrometres or less in diameter. Particles in this size range make up a large proportion of dust that can be drawn deep into the lungs. This is a classification of particles by size rather than chemical properties.
Platform screen doors	Screens the platform from an approaching train. The doors open after the train doors have opened to let passengers move between the train and platform, and close before the train doors have been closed, to improve safety and efficiency.
Possession	A period of time during which a rail line is shut down to trains, to permit work to be carried out on or near the line.
Potential archaeological deposit	An area where sub-surface stone artefacts and/or other cultural materials are likely to occur.
Power supply feeder	Electricity distribution line
Probable maximum flood	The largest flood that could conceivably occur (a worst-case flood event). It is typically estimated from probable maximum precipitation coupled with the worst flood-producing catchment conditions. The probable maximum flood extent defines the floodplain and incorporates all flood-prone land.
Project	The construction and operation of the Bankstown to Sydenham upgrade component of Sydney Metro City & Southwest.
Project area	The area that would be directly affected by construction works (also known as the construction footprint). It includes the location of project infrastructure, the area that would be directly disturbed by the movement of construction plant and machinery, and the location of the storage areas/compounds sites etc, that would be used to construct that infrastructure.
Rail alignment	The exact positioning of the track, accurately defined both horizontally and vertically, along which the rail vehicles operate.
Rail corridor	The corridor within which the rail tracks and associated infrastructure are located.
Rail junction	A point where two or more rail lines either meet or cross.
Rating background level	The underlying level of noise present in an area once transient and short-term noise events are filtered out.
Relic	A relic is defined by the NSW *Heritage Act 1977* as 'any artefact, object or material evidence which relates to the settlement of the area that comprises New South Wales, not being Aboriginal settlement, and which is of State or local heritage significance.'
Riparian	Pertaining to, or situated on, the bank of a river or other water body.
Runoff	The amount of rainfall which ends up as streamflow, also known as rainfall excess.
Salinity	The total soluble mineral content of water or soil (dissolved solids), with concentrations of total salts are expressed as milligrams per litre (equivalent to parts per million).
Sediment	Material of varying sizes that has been, or is being moved from its site of origin by the action of wind, water or gravity.
Sky glow	The brightening of the night sky above towns, cities, and countryside.
Surface water	Water that is derived from precipitation or pumped from underground and may be stored in dams, rivers, creeks and drainage lines.
Section 170 register	Under section 170 of the *Heritage Act 1977*, all state government agencies must keep and administer a database of heritage assets called a Section 170 Heritage and Conservation Register.
Sensitive receivers	Land uses which are sensitive to potential noise, air, and visual impacts, such as residential dwellings, schools and hospitals.

Term	Definition
Sensitivity	The sensitivity of a landscape character area or view and its capacity to absorb change. In the case of visual impact this also relates to the type of viewer and number of viewers.
Species credit	The class of biodiversity credits created or required for the impact on threatened species that cannot be reliably predicted to use an area of land. based on habitat surrogates. Species that require species credits are listed in the threatened species profile database.
Spoil	Material generated by construction
Station area	A subset of the project area. It includes the station and the area around the station where works are proposed as part of the project – mainly to provide facilities/space for customers to transfer between other forms of transport (such as bus stops, taxi parking bays, kiss and ride bays, cycle parking/storage).
Station catchment	That part of each suburb located within a radius of about 400 metres of a station.
Study area	The study area is defined as the wider area including and surrounding the project area, with the potential to be directly or indirectly affected by the project (for example, by noise and vibration, visual or traffic impacts). The actual size and extent of the study area varies according the nature and requirements of each impact assessment technical report.
Sydenham to Bankstown upgrade	The Sydenham to Bankstown upgrade forms the project for the purposes of this EIS. It is one of the two components of the Sydney Metro City & Southwest project, the other being the Chatswood to Sydenham project.
Sydney Metro	Sydney Metro is a new standalone automated rapid transit rail network under construction in Sydney. The Sydney Metro network consists of Sydney Metro Northwest (under construction) and Sydney Metro City & Southwest, which together would provide 66 kilometres of metro rail line and 31 metro railway stations.
Sydney Metro City & Southwest	Part of the Sydney Metro network proposed between Chatswood and Bankstown, comprising two core components - the Chatswood to Sydenham project and the Sydenham to Bankstown upgrade.
Sydney Trains	The agency responsible for the provision of suburban passenger train services in/around Sydney.
Tree	A long lived woody perennial plant growing to greater than (or usually greater than) three metres in height, with one or relatively few main stems or trunks.
Threatened biota	Threatened species, populations or communities listed under the EPBC Act, FM Act and/or the TSC Act.
Topography	Representation of the features and configuration of land surfaces.
Track	The structure consisting of the rails, fasteners, sleepers, and ballast, which sits on the track formation.
Track formation	The earthworks/material on which the ballast, sleepers, and tracks are laid.
Trackside intruder detection system	A system where information is fed to the control centre whenever a large object moves from the platform to the tracks.
Traction substation	An electrical substation that converts electric power from the form provided by the electricity provider to an appropriate voltage, current type and frequency, which can be used to supply the rail network with power.
View	The visual experience from the viewer's perspective.
Visual amenity	The value of a particular area or view in terms of what is seen.
Visual catchment	Extent of potential visibility to or from a specific area, feature or proposal.
Visual impact	The impacts on the views from residences, workplaces, and public places. This can be positive (i.e. benefit or an improvement) or negative (i.e. adverse or a detraction).
Waste	Waste is defined by the EPA as any matter (whether liquid, solid, gaseous or radioactive) that is discharged, emitted, or deposited in the environment in such volume, constituency, or manner as to cause an alteration to the environment.
Waste management hierarchy	The waste management hierarchy is a set of priorities for the efficient use of resources, which underpins the objectives of the *Waste Avoidance and Resource Recovery Act 2001*. The waste management hierarchy progresses from avoidance (most preferred), to re-use/recycling, to disposal (least preferred).

Term	Definition
Watercourse	Refers to waterways, such as rivers, streams and creeks
Water quality	Chemical, physical and biological characteristics of water, including the degree (or lack) of contamination.
Water sharing plan	A legal document prepared under the *Water Management Act 2000* (NSW) that establishes rules for sharing water between the environmental needs of the river or aquifer and water users and also different types of water use.
Water table	The surface of saturation in an unconfined aquifer, or the level at which pressure of the water is equal to atmospheric pressure.

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
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Appendices

Appendix A

Secretary's environmental assessment requirements

Table A.1 General standard SEARs

Item	Requirement	Where addressed?
1. Environmental Impact Assessment Process	1. The Environmental Impact Statement must be prepared in accordance with Part 3 of Schedule 2 of the Environmental Planning and Assessment Regulation 2000 (the Regulation).	Certification page, Section 3.1.3 and Appendix B
	2. It is the Proponent's responsibility to determine whether the project needs to be referred to the Commonwealth Department of the Environment for an approval under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The Proponent must contact the Commonwealth Department of the Environment immediately if it is determined that an approval is required under the EPBC Act, as supplementary environmental assessment requirements may need to be issued to ensure a streamlined assessment under the Bilateral agreement can be achieved.	No approval is required. Refer to Section 3.2.2
	3. Where the project requires approval under the EPBC Act and is being assessed under the Bilateral Agreement the EIS should address: (a) Consideration of Protected Matters that may be impacted by the development where the Commonwealth Minister has determined that the proposal is a Controlled Action (b) Identification and assessment of those Protected Matters that are likely to be significantly impacted (c) Details of how significant impacts to Protected Matters have been avoided, mitigated and, if necessary, offset (d) Consideration of, and reference to, relevant conservation advices, recovery plans and threat abatement plans	No approval is required. Refer to Section 3.2.2
	4. The onus is on the Proponent to ensure legislative requirements relevant to the project are met.	The statutory context and approval pathway is provided in Chapter 3
2. Environmental Impact Statement	1. The EIS must include, but not necessarily be limited to, the following:	
	(a) executive summary	Executive summary
	(b) a description of the project, including all components and activities (including ancillary components and activities) required to construct and operate it	Chapter 8 and Chapter 9
	(c) a statement of the objective(s) of the project	Section 28.1.5
	(d) a summary of the strategic need for the project with regard to its critical State significance and relevant State Government policy	Chapter 5
	(e) an analysis of any feasible alternatives to the project	Sections 6.1 and 6.4
	(f) a description of feasible options within the project	Sections 6.3, 6.5 and 6.6
	(g) a description of how alternatives to and options within the project were analysed to inform the selection of the preferred alternative / option. The description must contain sufficient detail to enable an understanding of why the preferred alternative to and options(s) within the project were selected	Sections 6.1, 6.3, 6.5 and 6.6
	(h) describe opportunities for further network expansion and consideration of relationship to other Government public transport initiatives	Section 6.8
	(i) a concise description of the general biophysical and socio-economic environment that is likely to be impacted by the project (including offsite impacts). Elements of the environment that are not likely to be affected by the project do not need to be described	Chapter 2
	(j) a demonstration of how the project design has been developed to avoid or minimise likely adverse impacts	Section 7.3

Item	Requirement	Where addressed?
	(k) the identification and assessment of key issues as provided in the 'Assessment of Key Issues' performance outcome	Chapters 10 to 27
	(l) a statement of the outcome(s) the proponent will achieve for each key issue	Chapters 10 to 27
	(m) measures to avoid, minimise or offset impacts must be linked to the impact(s) they treat, so it is clear which measures will be applied to each impact	Section 28.5
	(n) consideration of the interactions between measures proposed to avoid or minimise impact(s), between impacts themselves and between measures and impacts	Chapters 10 to 27
	(o) an assessment of the cumulative impacts of the project taking into account other projects that have been approved but where construction has not commenced, projects that have commenced construction, and projects that have recently been completed (for example WestConnex and approved construction in the relevant precincts)	Chapter 27
	(p) statutory context of the project as a whole, including:	Section 3.1
	• how the project meets the provisions of the EP&A Act and EP&A Regulation	
	• a list of approvals that must be obtained under other Acts or laws before the project may lawfully be carried out	Section 3.2
	(q) a chapter that synthesises the environmental impact assessment and provides:	Chapter 28
	• a succinct but full description of the project for which approval is sought	Section 28.1
	• a description of uncertainties that still exist around design, construction methodologies	Section 28.2 and Table 28.2
	• and/or operational methodologies and how these will be resolved in the next stages of the project	Section 28.4.2
	• a compilation of the impacts of the project that have not been avoided	Section 28.3
	• a compilation of the proposed measures associated with each impact to avoid or minimise (through design refinements or ongoing management during construction and operation) or offset these impacts	Sections 28.5 and 28.6
	• a compilation of the outcome(s) the proponent will achieve	Section 28.6
	• the reasons justifying carrying out the project as proposed, having regard to the biophysical, economic and social considerations, including ecologically sustainable development and cumulative impacts	Section 28.7
	(r) relevant project plans, drawings, diagrams in an electronic format that enables integration with mapping and other technical software.	Throughout the EIS
	2. The EIS must only include data and analysis that is reasonably needed to make a decision on the proposal. Relevant information must be succinctly summarised in the EIS and included in full in appendices. Irrelevant, conflicting or duplicated information must be avoided.	Throughout the EIS
3. Assessment of key issues	1. The level of assessment of likely impacts must be proportionate to the significance of, or degree of impact on, the issue, within the context of the proposal location and the surrounding environment. The level of assessment must be commensurate to the degree of impact and sufficient to ensure that the Department and other government agencies are able to understand and assess impacts	Chapters 10 to 27
	2. For each key issue the Proponent must:	

Item	Requirement	Where addressed?
	(a) describe the biophysical and socio-economic environment, as far as it is relevant to that issue	A general description of the biophysical and socio-economic environment is provided in Sections 2.3 and 2.4. Further detail is provided in Chapters 10 to 27.
	(b) describe the legislative and policy context, as far as it is relevant to the issue	Section 3.2 and Chapters 10 to 27
	(c) identify, describe and quantify (if possible) the impacts associated with the issue, including the likelihood and consequence (including worst case scenario) of the impact (comprehensive risk assessment), and the cumulative impacts	Chapters 10 to 27 and Technical papers 1 to 9.
	(d) demonstrate how potential impacts have been avoided (through design, or construction or operation methodologies);	An overview of how the design has been developed to minimise potential impacts is provided in Section 7.5. A description of how further impacts would be avoided during construction and operation are provided in Chapters 10 to 27.
	(e) detail how likely impacts that have not been avoided through design will be minimised, and the predicted effectiveness of these measures (against performance criteria where relevant)	A description of how impacts would be further refined during detailed design to minimise potential impacts is provided in Chapters 10 to 27.
	(f) detail how residual impacts will be managed or offset, and the approach and effectiveness of these measures.	Chapters 10 to 27
	3. Where multiple reasonable and feasible options to avoid or minimise impacts are available, they must be identified and considered and the proposed measure justified taking into account the public interest.	Refer to the approach to mitigation and management in Chapters 10 to 27.
4. Consultation	1. The project and its assessment must be informed by consultation, including with relevant government agencies (including the Department of Planning and Environment (Growth, Designs and Programs) and within the Transport for NSW cluster (such as Roads and Maritime Services and Sydney Trains), local councils, infrastructure and service providers, special interest groups, affected landowners, businesses and the community. The consultation process must be undertaken in a manner commensurate with expected levels of impact and stakeholder significance.	Chapter 4
	2. The Proponent must document the consultation process, and demonstrate how the project has responded to the inputs received (inclusive of a strategy of engagement with key stakeholders on key design elements of the project).	Sections 4.1, 4.2 and 4.3
	3. The Proponent must describe the timing and type of community consultation proposed during the design and delivery of the project, the mechanisms for community feedback, the mechanisms for keeping the community informed, and procedures for complaints handling and resolution.	Section 4.4

Table A.2 Key issue requirements

Key issue	Requirement	Where addressed?
5. Biodiversity	1. The Proponent must assess biodiversity impacts in accordance with the current guidelines including the Framework for Biodiversity Assessment (FBA).	A summary of the results of the biodiversity assessment is provided in Chapter 22. The full results are provided as Technical paper 9.
	2. The Proponent must assess impacts on biodiversity values not covered by the FBA as specified in s2.3.	Section 22.3.7
	3. The Proponent must assess impacts on the Long-nosed Bandicoot Inner Western Sydney Population (including an assessment of vehicle strike (from more frequent trains) and a loss of threatened species and their habitat which is not associated with vegetation (e.g. building demolition, bridge reconstruction, etc.). and provide the information specified in s9.2 of the FBA.	Sections 22.3.2, 22.3.3 and 22.3.5
	4. The Proponent must identify whether the project as a whole, or a component of the project, would be classified as a Key Threatening Process (KTP) in accordance with the listings in the *Threatened Species Conservation Act 1997* (TSC Act), *Fisheries Management Act 1994* (FM Act) and *Environmental Protection and Biodiversity Conservation Act 2000* (EPBC Act).	Section 22.3.4
6. Flooding and hydrology	1. The Proponent must assess and model (where appropriate), taking into account any relevant Council-adopted flood model or latest flood data available from Councils, the impacts on flood behaviour during construction and operation for a full range of flood events up to the probable maximum flood (taking into account storm intensity due to climate change) including:	A summary of the results of the hydrology, flooding and water quality assessment is provided in Chapter 21. The full results are provided as Technical paper 8.
	(a) detrimental increases in the potential flood affectation of other properties, assets and infrastructure	Sections 21.3.2 and 21.3.4
	(b) consistency (or inconsistency) with applicable Council floodplain risk management plans	Sections 21.3.2 and 21.3.4
	(c) compatibility with the flood hazard of the land	Sections 21.3.2 and 21.3.4
	(d) compatibility with the hydraulic functions of flow conveyance in flood ways and storage areas of the land	Sections 21.3.2 and 21.3.4
	(e) downstream velocity and scour potential	Sections 21.3.2 and 21.3.4
	(f) impacts the development may have upon existing community emergency management arrangements for flooding. These matters must be discussed with the State Emergency Services and Council	Sections 21.3.2 and 21.3.4
	(g) impacts the development may have on the social and economic costs to the community as consequence of flooding.	Sections 21.3.2 and 21.3.4
	2. The Proponent must describe (and map) the existing hydrological regime for any surface and groundwater resource (including reliance by users and for ecological purposes) likely to be impacted by the project, including stream orders, as per the Framework for Biodiversity Assessment (FBA).	Section 21.2

Key issue	Requirement	Where addressed?
	3. The Proponent must assess (and model if appropriate) the impact of the construction and operation of the project and any ancillary facilities (both built elements and discharges) on surface and groundwater hydrology in accordance with the current guidelines, including:	
	(a) minimising the effects of proposed stormwater and wastewater management during construction and operation on natural hydrological attributes (such as volumes, flow rates, management methods and re-use options) and on the conveyance capacity of existing stormwater systems where discharges are proposed through such systems	Sections 21.3.2 and 21.3.4
	(b) water take (direct or passive) from all surface and groundwater sources with estimates of annual volumes during construction and operation.	Section 21.3.2
	4. The Proponent must identify any requirements for baseline monitoring of hydrological attributes.	Section 21.4.1
7. Heritage	1. The Proponent must identify and assess direct and/or indirect impacts (including cumulative impacts) to the heritage significance of:	A summary of the results of the non-Aboriginal heritage impact assessment is provided in Chapter 14. The full results are provided as Technical paper 3. A summary of the results of the Aboriginal heritage impact assessment is provided in Chapter 15. The full results are provided as Technical paper 4.
	(a) Aboriginal places and objects, as defined under the *National Parks and Wildlife Act 1974* and in accordance with the principles and methods of assessment identified in the current guidelines	Section 15.3
	(b) Aboriginal places of heritage significance, as defined in the Standard Instrument – Principal Local Environmental Plan	Section 15.2.6
	(c) environmental heritage, as defined under the *Heritage Act 1977*	Section 14.3
	(d) items listed on the National and World Heritage lists.	No such items would be impacted by the project
	2. Where impacts to State or locally significant heritage items are identified, the assessment must: (a) include a statement of heritage impact for all heritage items (including significance assessment)	Section 14.3
	(b) consider impacts to the item of significance caused by , but not limited to, vibration, demolition, archaeological disturbance, altered historical arrangements and access, visual amenity, landscape and vistas, curtilage, subsidence and architectural noise treatment (as relevant)	Section 14.3
	(c) outline measures to avoid and minimise those impacts in accordance with the current guidelines	Section 14.4
	(d) be undertaken by a suitably qualified heritage consultant(s) (note: where archaeological excavations are proposed the relevant consultant must meet the NSW Heritage Council's Excavation Director criteria)	Section 14.1.2 and Section 1.5 of Technical paper 3

Key issue	Requirement	Where addressed?
	(e) have regard to the specific and broader values of historic structures (such as footbridges, overhead booking offices, platforms and platform buildings) and conservation approaches provided in the relevant conservation strategies and design guides and conservation management plans, as applicable	Section 14.3
	(f) identify potential uses for heritage items to be retained within the corridor.	Section 14.3
	3. Where archaeological investigations of Aboriginal objects are proposed these must be conducted by a suitably qualified archaeologist, in accordance with section 1.6 of the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010).	Section 15.4.2
	4. Where impacts to Aboriginal objects and/or places are proposed, consultation must be undertaken with Aboriginal people in accordance with the current guidelines. The significance of cultural heritage values for Aboriginal people who have a cultural association with the land must be assessed.	Sections 15.1.3 and 15.3.3
8. Noise and Vibration - Amenity	1. The Proponent must assess construction and operational noise and vibration impacts in accordance with relevant NSW noise and vibration guidelines. The assessment must include consideration of impacts to sensitive receivers including small businesses, and include consideration of sleep disturbance and, as relevant, the characteristics of noise and vibration (for example, low frequency noise).	A summary of the results of the construction and operational noise and vibration assessment is provided in Chapters 12 and 13. The full results are provided as Technical paper 2. Construction amenity impacts and sleep disturbance impacts are considered in Section 12.5. Operational amenity impacts and sleep disturbance impacts are considered in Section 13.4.2. The characteristics of noise and vibration are explained in Technical paper 2.
	2. The EIS must include a framework for both an Out of Hours Works Strategy and the development of an Out of Hours Works Plan which incorporates community consultation.	Sections 9.7.4 and 12.6.1

Key issue	Requirement	Where addressed?
9. Noise and Vibration - Structural	1. The Proponent must assess construction and operation noise and vibration impacts in accordance with relevant NSW noise and vibration guidelines. The assessment must include consideration of impacts to the structural integrity and heritage significance of items (including Aboriginal places and items of environmental heritage).	A summary of the results of the construction vibration assessment is provided in Chapter 12. The full results are provided as Technical paper 2. Operational vibration impacts are considered in Chapter 13. Consideration of potential construction impacts to structural integrity and heritage items is provided in Section 12.5. Impacts to the heritage significance of items is considered in Chapter 14 (Non-Aboriginal Heritage).
	2. The Proponent must demonstrate that blast impacts are capable of complying with the current guidelines, if blasting is required.	Blasting would not be required.
10. Socio-economic, Land Use and Property	1. The Proponent must assess social and economic impacts of the project. This must be done having regard to issues raised by relevant communities and businesses.	Chapters 17 and 18. Amenity impacts are also a key potential socio-economic impact. As such Chapter 17 and Technical paper 5, also consider the potential impacts of the project on amenity.
	2. The Proponent must assess impacts from construction and operation on:	
	• potentially affected properties	Section 16.4
	• businesses	Chapter 18
	• recreational users	Section 16.4
	• land and water users	Section 16.4 No water users would be impacted by the project.
	• including property acquisitions/adjustments	Section 16.4.2
	• access	Chapters 10 and 11
	• amenity	Chapter 17
	• relevant statutory rights.	Section 16.4.2 and Chapter 17

Key issue	Requirement	Where addressed?
11. Soils	1. The Proponent must assess whether the land is likely to be contaminated and identify if remediation of the land is required, having regard to the ecological and human health risks posed by the contamination in the context of past, existing and future land uses. Where assessment and/or remediation is required, the Proponent must document how the assessment and/or remediation would be undertaken in accordance with current guidelines.	The potential for contamination is considered in Section 20.2.4. The need for remediation would be confirmed as an outcome of the more detailed contamination assessment to be undertaken for the detailed design, as described in Sections 20.3.2 and 20.4.1.
12. Sustainability	1. The Proponent must assess the sustainability of the project in accordance with the Infrastructure Sustainability Council of Australia (ISCA) *Infrastructure Sustainability Rating Tool* or equivalent and relevant rating tool.	Section 24.3.1
	2. The Proponent must review the project against the current guidelines including targets and strategies to improve Government efficiency in use of water, energy and transport.	Sections 24.2 and 24.3
13. Transport and Traffic	1. The Proponent must assess construction transport and traffic (vehicle, pedestrian and cyclists) impacts, including, but not necessarily limited to:	A summary of the results of the operation traffic, transport and access assessment is provided in Chapter 10. The full results are provided as Technical paper 1.
	(a) a considered approach to route identification and scheduling of transport movements	Section 9.7.4 and 9.8.8
	(b) the number, frequency and size of construction related vehicles (passenger, commercial and heavy vehicles, including spoil management movements)	Sections 9.8.9
	(c) blank	
	(d) need to upgrade roads proposed for construction vehicle routes including impacts of road closures, construction worker parking and impacts on availability of public parking	Section 10.3.3
	(e) the nature of existing traffic (types and number of movements) on construction access routes (including consideration of peak traffic times and sensitive road users and parking arrangements)	Section 10.2.2
	(f) information on how construction and scheduling of works will be coordinated in regard to cumulative traffic impacts resulting from concurrent work on WestConnex and other approved key construction projects	Section 10.4.8
	(g) access constraints and impacts on public transport, pedestrians and cyclists including: • impacts on customers and the reliability of suburban and intercity rail services {including increased demand for rail services on other lines, particularly the T2 Inner West, T1 North Shore, Northern and Western Lines) during possession periods and testing and commissioning of metro trains	Section 10.4.5

Key issue	Requirement	Where addressed?
	• alternative transport arrangements for customers during rail possessions and closure of the rail line (including how the Temporary Transport Plan will be developed in consultation with relevant Councils and the community)	Sections 9.11 and 10.3.4
	• identification of key traffic performance issues in the surrounding areas during rail shutdowns and implementation of alternate transport arrangements.	Section 10.4.2 and 10.4.5
	(h) the need to close, divert or otherwise reconfigure elements of the road and cycle network associated with construction of the project.	Sections 10.3.3 and 10.4.3
	2. The Proponent must assess the operational transport impacts of the project, including the wider transport interactions:	A summary of the results of the operation traffic, transport and access assessment is provided in Chapter 11. The full results are provided as Technical paper 1.
	• local and regional roads	Section 11.4.2
	• changes to commuter parking and loading zones	Section 11.4.2, 11.4.4 and 11.4.13
	• provision of kiss and ride facilities, cycling, public and freight transport	Sections 11.4.2, 11.4.4 to 11.4.13
	The EIS must define a transport hierarchy and a framework for an active transport strategy.	Sections 11.3.2 and 11.3.4
14. Place Making and Urban Design	1. The Proponent must deliver functional 'place' outcomes of public benefit, inclusive of how the project integrates with proposed land use changes occurring within the corridor, and how it contributes to the accessibility and connectivity of existing and future communities {with specific consideration given to the Sydenham to Bankstown Urban Renewal Corridor Strategy {as updated)). This must be done in collaboration with the Department of Planning and Environment and Councils, and must include but is not limited to:	Chapter 7 and Appendix H
	(a) the defining of existing and proposed station precincts including implications for urban renewal	Section 7.2
	(b) identifying design principles, strategies and opportunities to enhance healthy, cohesive and inclusive communities (including consideration of government strategies and plans)	Section 7.3
	(c) identifying the urban design and landscaping aspects and user facilities of the project and its components	Section 7.3.8
	(d) assessing the impact of the project on the urban and natural fabric	Section 7.3.4
	(e) incorporating the use of Crime Prevention Through Environmental Design (CPTED) principles during the design development process.	Section 7.2.5
	2. The Proponent must describe the accessibility elements of the project including relevant accessibility legislation and guidelines and:	Chapters 7 and 11
	(a) impacts on pedestrian access in and around stations and connecting streets (including consideration of land use change)	Section 11.4.4 to 11.4.13
	(b) enhancing the accessibility of each station and the general vicinity of walking and cycling catchments	Sections 7.3.8, 11.4.2 and 11.4.4 to 11.4.13

Key issue	Requirement	Where addressed?
	(c) the provision of infrastructure to support accessible paths of travel and interchange	Sections 7.3.8 and 11.4.4 to 11.4.13
	(d) impacts on cyclists (including provision of and integration with active transport routes) and pedestrian access and safety	Sections 7.3.8, 11.4.4 to 11.4.13
	(e) minimising barriers across the rail corridor and opportunities to integrate cycling and pedestrian elements with surrounding networks and in the project.	Section 7.2.4 and 11.4.3
	3. The Proponent must assess the visual and landscape impacts of the project and ancillary infrastructure on:	
	(a) views and vistas	Section 19.3
	(b) streetscapes, key sites and buildings	Section 19.3
	(c) landscaping, green spaces and existing trees	Section 19.3
	(d) heritage items including Aboriginal places and environmental heritage	The project would not impact any Aboriginal places Visual impacts on environmental heritage are considered in Chapter 14.
	(e) the local community.	Section 19.3
	4. The Proponent must provide artist impressions and perspective drawings of the project from key receiver locations to illustrate the project.	Section 8.1
15. Water - Quality	1. The Proponent must:	
	(a) state the ambient NSW Water Quality Objectives (NSW WQO) and environmental values for the receiving waters relevant to the project, including the indicators and associated trigger values or criteria for the identified environmental values	Section 21.5
	(b) identify pollutants that may be introduced into the water cycle and describe the nature and degree of impact that discharge(s) may have on the receiving environment, including consideration of all pollutants that pose a risk of non-trivial harm to human health and the environment	Sections 21.3.3 and 21.3.5
	(c) identify the rainfall event that the water quality protection measures will be designed to cope with	Requirements (c) to (f) - limited water quality modelling was undertaken as described in Section 21.1.2. Further information is provided in Appendix A and Technical Paper 8.
	(d) assess the significance of identified impacts including consideration of the relevant ambient water quality outcomes	
	(e) demonstrate how construction and operation of the project will, to the extent that the project can influence, ensure that: • where the NSW WQOs for receiving waters are currently being met they will continue to be protected • where the NSW WQOs are not currently being met, activities will work toward their achievement over time.	
	(f) justify, if required, why the WQOs cannot be maintained or achieved over time	
	(g) demonstrate that all practical measures to avoid or minimise water pollution and protect human health and the environment from harm are investigated and implemented	Section 21.4
	(h) identify sensitive receiving environments (which may include estuarine and marine waters downstream) and develop a strategy to avoid or minimise impacts on these environments	Section 21.2 and 21.4

Key issue	Requirement	Where addressed?
	(i) identify proposed monitoring locations, monitoring frequency and indicators of surface water quality.	Section 21.4.1
16. Utilities	1. The Proponent must identify and assess potential impacts on key identified active or disused public trunk utilities infrastructure (including communications, electricity, gas, and water and sewerage).	Section 9.10
	2. Where impacts on utilities are expected, the Proponent must prepare a utilities management framework, to identify a management strategy for options, including relocation or adjustment of the utilities.	Section 9.10 and Appendix I
	3. The utilities management framework must identify ways in which opportunities to integrate with and support initiatives adopted by Councils and utilities providers and how access to assets will be maintained during construction.	Section 9.10 and Appendix I

Table A.3 Agency requirements – responses to the SEARs

Agency	Issues raised	Where addressed in the EIS
Ausgrid	A number of assets are located within the corridor and would potentially be impacted. These assets need to be accounted for in designs and during construction.	Section 9.10
	Specifically concerned with ensuring that safety risks associated with operating in the vicinity of high voltage cables is addressed.	Sections 9.10 and 25.3.2
Canterbury-Bankstown Council	Would like to be involved in the design to ensure that place making is captured in the design, including the development of urban design principles.	Chapter 4
	The project is a good opportunity to transform the Bankstown CBD and connect the CBD which is currently severed by the existing train line. This could include the provision of an at grade crossing of the corridor.	Table 7.5
	The project should include the provision of an active transport corridor which connects into existing active transport routes.	Section 8.1.4
	Concerned about impacts to business and the community during construction.	Chapter 17 and 18
	Flooding mitigation considered as part of the project should be based on future growth associated with the Draft Sydenham to Bankstown Urban Renewal and not existing flood conditions.	Sections 21.3 and 21.4
	Any over station development associated with metro should be considered as part of the Draft Sydenham to Bankstown Urban Renewal Strategy and not through the State Significant Development process due to reduced opportunities for sound place making.	Chapter 8
Department of Primary Industries and Department of Industry - Lands	Standard SEARs provided adequately addressed their requirements.	Tables A.1 and A.2
Environment Protection Authority	Standard SEARs adequately address their requirements.	Tables A.1 and A.2
Heritage Council of NSW	Standard SEARs provided are adequate with the exception of the below additional requirements:	Tables A.1 and A.2
	• Requirement for an assessment of the impacts to the broader heritage assets of the Sydenham to Bankstown Railway Line. This should include a history, assessment of significance of the broader Bankstown to Sydenham Line, and an assessment of its contribution to the heritage significance of the NSW suburban network.	Section 14.3 Technical paper 3 (Section 9.1)
	• Consider conservation approaches and rarity/integrity values of historic structures.	Technical paper 3 (Section 6)
	• Consideration of the Conservation Management Plans for all impacted items listed on the State Heritage Register.	Technical paper 3 (Section 6)
	• Consider alternate uses for heritage items no longer required for operational activities.	Sections 7.2.3 and 14.3.1
	• Consideration of the guideline, Assessing Significance for Historical Archaeological Sites and Relics.	Section 14.1.2 Technical paper 3 (Section 2.3)
	• Due to impacts on heritage (particularly at stations) key stakeholders should be consulted throughout the project.	Sections 4.3.2 and 14.4
Inner West Council	Fully independent access should be provided across the project including at station. This should not be limited to the stations only but the wider station precincts.	Chapter 8 and Section 11.4

Agency	Issues raised	Where addressed in the EIS
	A detailed accessibility report should be provided to examine each aspect of the travel journey from a best practice access perspective, to ensure functional and seamless independent provision to/from and within the surrounding precinct of each station.	A description of how accessibility has been incorporated into the design is provided in Chapter 7. Chapter 11 provides an assessment of impacts in terms of accessibility.
	Project should include flood management solutions rather than just saying negative impacts would be reduced.	Section 21.4
	The project should refer to the NSW Government WSUD Guideline (2016) for NSW transport projects.	The project would be designed to incorporate water sensitive urban design elements. Refer to Section 21.4.2.
	Contribution to climate change during both construction and operation. The project should include performance outcomes to minimise contribution to climate change during the works and in the final product.	Section 24.3
Office of Environment and Heritage	Identification and description of Aboriginal cultural heritage values that exist within the project area and the assessment of impacts on these areas of value. This should be guided by the *Guide to Investigating ,assessing and reporting on Aboriginal Cultural heritage in NSW (*DECCW, 2011). The assessment must demonstrate attempts to avoid impact upon cultural heritage values and identify any conservation outcomes. Where impacts are unavoidable, measures to mitigate impacts must be outlined. Any objects recorded as part of the assessment must be documented and notified to OEH.	Sections 15.2 and 15.3 The full assessment is provided as Technical paper 4.
	Consultation with Aboriginal people should be undertaken where high values are identified in accordance with the *Aboriginal cultural heritage consultation requirements for proponents 2010* (DECCW). The significance of cultural heritage values for Aboriginal people who have cultural association with the land must also be documented.	Section 15.1.3 and 15.4.1
	Biodiversity impacts to be assessed in accordance with the *NSW Biodiversity Offsets Policy for Major Projects 2014* and the Framework for Biodiversity Assessment, by a person accredited in accordance with s142B(1) of *the Threatened Species Conservation Act 1995.*	Chapter 22. The full assessment is provided as Technical paper 9.
	Impacts on the Long-nosed Bandicoot Inner Western Sydney Population (including an assessment of vehicle strike for more frequent trains and a loss of threatened species and their habitat not associated with vegetation) are to be considered in line with the requirements of the Framework for Biodiversity Assessment.	Section 22.2.2, 22.2.3 and 22.2.5. The full assessment is provided as Technical paper 9.
Sydney Water	Demands and servicing arrangements for drinking water, wastewater and recycled water to be considered.	Section 9.10.1
	Consideration of impacts on Sydney Water assets during both construction and operation. The proponent should seek confirmation from Sydney Water to ensure that the project does not impact on Sydney Water's assets. Landscaping options should avoid tree species that cause cracking or blockages to Sydney Water pipes.	Section 9.10.2

Agency	Issues raised	Where addressed in the EIS
	Ensure satisfactory protection for stormwater assets, building bridges over stormwater assets, potential flood, water quality, heritage impacts and creation of easements.	Sections 9.10, 21.3 and 21.4
	Flood mitigation assets and water quality for drainage into the Cooks River (and its tributaries) should be factored in as part of the project.	Section 21.4
	Impacts to Sydney Water owned State Heritage items, Sydenham Pit and Drainage Pumping Station and Sewage Pumping Station 271.	Section 14.3.2. Impacts to Sydenham Pit and Drainage Pumping Station would not occur as part of the project.
	Sustainability initiatives that would reduce the demand for drinking water including any proposed alternative water supply, proposed end uses of drinking and non-drinking water, demonstration of water sensitive urban design and any proposed water conservation measures should be outlined.	Sections 24.3.1, 24.4 and 24.5

Appendix B

Environmental Planning and Assessment Regulation 2000 checklist

Table B.1 Requirements of Schedule 2 (Part 3) of the Regulation

Requirement	EIS reference
6. Form of the environmental impact statement	
An environmental impact statement must contain the following information:	
(a) the name, address and professional qualifications of the person by whom the statement is prepared	Refer certification at the front of the EIS with respect to a-f
(b) the name and address of the responsible person	
(c) the address of the land: (i) in respect of which the development application is to be made, or (ii) on which the activity or infrastructure to which the statement relates is to be carried out	
(d) a description of the development, activity or infrastructure to which the statement relates	
(e) an assessment by the person by whom the statement is prepared of the environmental impact of the development, activity or infrastructure to which the statement relates, dealing with the matters referred to in this Schedule	
(f) a declaration by the person by whom the statement is prepared to the effect that: (i) the statement has been prepared in accordance with this Schedule, and (ii) the statement contains all available information that is relevant to the environmental assessment of the development, activity or infrastructure to which the statement relates, and (iii) that the information contained in the statement is neither false nor misleading.	
7. Content of environmental impact statement	
(1) An environmental impact statement must also include each of the following:	
(a) a summary of the environmental impact statement	Executive summary
(b) a statement of the objectives of the development, activity or infrastructure	Chapter 28
(c) an analysis of any feasible alternatives to the carrying out of the development, activity or infrastructure, having regard to its objectives, including the consequences of not carrying out the development, activity or infrastructure	Chapter 6
(d) an analysis of the development, activity or infrastructure, including: (i) a full description of the development, activity or infrastructure, and	Chapters 8 and 9
(ii) a general description of the environment likely to be affected by the development, activity or infrastructure, together with a detailed description of those aspects of the environment that are likely to be significantly affected, and	Chapter 2 and Part C
(iii) the likely impact on the environment of the development, activity or infrastructure, and	Part C
(iv) a full description of the measures proposed to mitigate any adverse effects of the development, activity or infrastructure on the environment, and	Part C
(v) a list of any approvals that must be obtained under any other Act or law before the development, activity or infrastructure may lawfully be carried out	Chapter 3
(e) a compilation (in a single section of the environmental impact statement) of the measures referred to in item (d) (iv)	Chapter 28
(f) the reasons justifying the carrying out of the development, activity or infrastructure in the manner proposed, having regard to biophysical, economic and social considerations, including the principles of ecologically sustainable development set out in subclause (4).	Chapter 28

SYDENHAM TO BANKSTOWN

ENVIRONMENTAL IMPACT STATEMENT

> Volume 1B