Chapter 19

Biodiversity

January 2020

19 Biodiversity

This chapter provides an assessment of the potential impacts of the project on terrestrial, aquatic and marine biodiversity and identifies measures to address these impacts.

A detailed assessment of terrestrial and aquatic biodiversity has been carried out for the project and is included in Appendix S (Technical working paper: Biodiversity development assessment report). A detailed assessment of marine biodiversity has been carried out for the project and is included in Appendix T (Technical working paper: Marine ecology).

The Secretary's environmental assessment requirements as they relate to biodiversity, and where in the environmental impact statement these have been addressed, are detailed in Table 19-1.

The proposed environmental management measures relevant to biodiversity are included in Section 19.5.

Table 19-1 Secretary's environmental assessment requirements – biodiversity

Secretary's requirement	Where addressed in EIS
Biodiversity	
1. Biodiversity impacts related to the proposal are to be assessed in accordance with the Biodiversity Assessment Method and documented in a Biodiversity Development Assessment Report (BDAR).	Biodiversity impacts related to project are outlined in **Section 19.4** and documented in **Appendix S** (Technical working paper: Biodiversity Development Assessment Report).
2. The BDAR must include information in the form detailed in the Biodiversity Conservation Act 2016 (s. 6.12), Biodiversity Conservation Regulation 2017 (s 6.8) and Biodiversity Assessment Method (BAM) including details of the measures proposed to address the offset obligation as follows: a. the total number and classes of biodiversity credits required to be retired for the developments/project; b. the number of classes of like-for-like biodiversity credits proposed to be retired; c. the number and classes of biodiversity credits proposed to be retired in accordance with the variation rules; d. any proposal to fund a biodiversity conservation action; and e. any proposal to make a payment to the Biodiversity Conservation Fund.	The Biodiversity Development Assessment Report is provided in **Appendix S** (Technical working paper: Biodiversity Development Assessment Report).
3. If requesting the application of the variation rules, the BDAR must contain details of what reasonable steps have been taken to attempt to obtain the required like-for-like biodiversity credits.	Not applicable.
4. The BDAR must be prepared by a person accredited in accordance with the Accreditation scheme for the Application of the	Accreditation in accordance with the Accreditation scheme for the Application of the Biodiversity Assessment Method Order

Secretary's requirement	Where addressed in EIS
Biodiversity Assessment Method Order 2017 under *s. 6.10 of the Biodiversity Conservation Act 2016*.	2017 is provided in **Appendix S** (Technical working paper: Biodiversity Development Assessment Report).
5. In accordance with section 9.1 and 9.2 of the BAM the BDAR must assess all direct and indirect impacts of the proposal on native vegetation, threatened ecological communities and threatened species habitat.	**Section 19.4** provides an assessment of biodiversity impacts related to the project with further details provided in **Appendix S** (Technical working paper: Biodiversity Development Assessment Report).
6. Impacts on biodiversity values that cannot be assessed using the BAM must also be otherwise assessed. The values include: a. marine mammals; b. wandering seabirds; and c. matters of national significance listed under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999*.	**Section 19.4** provides an assessment of biodiversity impacts related to the project with further details provided in **Appendix S** (Technical working paper: Biodiversity Development Assessment Report).
7. Species declared as threatened under the *Biodiversity Conservation Act 2016* and recorded recently (since 1990) within approximately 1.5 kilometres of the project's development corridor should be considered as likely to be affected by the proposal.	**Section 19.4** provides an assessment of the impacts to threatened species. Consideration of species recently recorded within 1.5 kilometres of the construction footprint are documented in **Appendix S** (Technical working paper: Biodiversity Development Assessment Report).

19.1 Legislative and policy framework

Chapter 2 (Assessment process) describes the environmental impact assessment and approval process for the project, including relevant NSW and Commonwealth legislation applicable to the project. The key legislative requirements and assessment guidelines specific to biodiversity are outlined below.

19.1.1 NSW Biodiversity Conservation Act 2016

The NSW *Biodiversity Conservation Act 2016* (BC Act) replaced the *Threatened Species Conservation Act 1995* (TSC Act) on 25 August 2017. The BC Act aims to maintain a healthy, productive and resilient environment for the greatest well-being of the community, now and into the future, consistent with the principles of ecologically sustainable development. It establishes a framework for assessment, and offsetting of, biodiversity impacts as well as investment in biodiversity conservation.

The Biodiversity Assessment Method is established under section 6.7 of the BC Act. The purpose of the Biodiversity Assessment Method is to assess impacts on threatened species and threatened ecological communities, and their habitats, and the impact on biodiversity values, where required under the BC Act.

19.1.2 Commonwealth Environment Protection and Biodiversity Conservation Act 1999

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) includes provisions to protect and manage matters of national environmental significance, including nationally and internationally important flora, fauna, ecological communities and migratory species, defined in the EPBC Act as matters of national environmental significance.

In accordance with sections 67 and 67A of the EPBC Act, any action that has a potential to result in an impact on any matters of national environmental significance or on Commonwealth land are considered 'controlled actions' and require a referral to the Commonwealth Minister for the Environment for approval. The significance of impacts on matters of national environmental significance is determined in accordance with the *Significant Impact Guidelines 1.1 – Matters of National Environmental Significance* (Department of the Environment, 2013).

19.1.3 Fisheries Management Act 1994

The NSW *Fisheries Management Act 1994* (FM Act) contains provisions for the conservation of fish stocks, key fish habitat, biodiversity, threatened species, populations and ecological communities. The FM Act regulates the conservation of fish, marine vegetation and some aquatic macroinvertebrates and the development and sharing of fishery resources of NSW for present and future generations. Part 7 of the FM Act identifies requirements for the protection of aquatic habitats while Part 7A of the FM Act lists threatened species, populations and ecological communities and key threatening processes for species, populations and ecological communities in NSW waters. Section 220ZZ of the FM Act outlines significant impact considerations to threatened species, populations and ecological communities listed under the FM Act.

19.1.4 Assessment guidelines

A number of assessment guidelines were used to inform the biodiversity assessment, the most relevant of which were:

- *Biodiversity Assessment Method* (Office of Environment and Heritage (OEH), 2017) – for the assessment of impacts on threatened species, threatened ecological communities, and their habitats, and the impact on biodiversity values, where required under the BC Act
- *Significant Impact Guidelines 1.1 – Matters of National Environmental Significance* (Department of the Environment, 2013) – for the assessment of significance of impacts on matters of national environmental significance under the EPBC Act
- *Policy and Guidelines for Fish Habitat Conservation and Management – Update 2013* (NSW DPI, 2013) – for the assessment of freshwater and marine biodiversity matters.

A list of all of the assessment guidelines that were used to inform the biodiversity assessment is provided in Appendix S (Technical working paper: Biodiversity development assessment report) and Appendix T (Technical working paper: Marine ecology) of this environmental impact statement.

19.2 Assessment methodology

The assessment of biodiversity impacts included consideration of:

- Potential impacts on terrestrial biodiversity, consistent with the Biodiversity Assessment Method (Section 19.2.1)
- Potential impacts on aquatic biodiversity (Section 19.2.2)

- Potential impacts on marine biodiversity (Section 19.2.3).

The key terminology adopted for the terrestrial, marine and aquatic assessments with regard to extent of assessments and identification of impacts is summarised in Table 19-2 below.

Table 19-2 Biodiversity assessment extent terminology

Term	Definition
Terrestrial biodiversity	
Construction footprint	The above ground area to be directly impacted by the project.
Terrestrial biodiversity locality	An area within 10 kilometres of the construction footprint.
Marine biodiversity	
Project area	The area to be directly impacted by the project.
Marine biodiversity study area	Estuarine areas from the highest astronomical tide encompassing the project area, and areas next to Gladesville Bridge and the open water area just to the east of Garden Island and Robertsons Point.
Marine biodiversity Study locality	An area within 10 kilometres of the project area (for the purpose of the desktop review).
Aquatic biodiversity	
Construction footprint	The above ground area to be directly impacted by the project.
Aquatic biodiversity study area	An area encompassing the construction footprint and areas immediately adjacent (about 500 metres around the project alignment).

19.2.1 Terrestrial biodiversity

The assessment of potential impacts on terrestrial biodiversity has been carried out in accordance with the Biodiversity Assessment Method (Office of Environment and Heritage, 2017). The assessment methodology is summarised below, with further detail provided in Appendix S (Technical working paper: Biodiversity development assessment report).

Desktop assessment

A desktop assessment was carried out for the project, including review of information from relevant databases, vegetation maps, topographic maps, aerial photography, reports and published literature.

The following databases were searched in June 2016, May 2017, December 2017 and then again in April 2019:

- Bionet Atlas of NSW Wildlife
- EPBC Act Protected Matters Search Tool
- Threatened biodiversity profile search.

The database searches were carried out for an area of 10 kilometres around the construction footprint.

The desktop assessment was used to identify threatened species, populations, communities and their habitats with a likelihood of occurrence in areas that may be impacted by the project.

Field surveys

Field surveys were carried out between May 2016 and November 2017, and again in February, May and June 2018, and March 2019 and included:

- Random meander surveys to verify vegetation communities and the condition of vegetation across accessible land within the construction footprint
- Targeted flora and fauna surveys for species identified as having a high or moderate likelihood of occurrence in areas that may be impacted by the project, as identified through the desktop assessment.

No vegetation integrity plot surveys were carried out for the project since none of the vegetation that would be directly impacted by the project would fall within the description of any plant community types listed in the BioNet Vegetation Classification (Office of Environment and Heritage, 2018, formerly known as the Vegetation Information System (VIS) Classification).

Opportunities to avoid and minimise impacts

Based on the outcomes of the desktop assessment and field surveys, opportunities to avoid or minimise biodiversity impacts were considered as part of the project design development process. Further details of the avoidance and minimisation of potential impacts through design is provided in Chapter 4 (Project development and alternatives).

Assessment of potential impacts

The potential impacts of the project were assessed against the relevant matters in the Biodiversity Assessment Method, including:

- Removal of native vegetation and habitat, including direct and indirect impacts on native vegetation and threatened flora
- The potential for serious and irreversible impacts on identified threatened species and ecological communities
- The prescribed biodiversity impacts under the Biodiversity Assessment Method
- The potential for impacts on relevant matters of national environmental significance under the EPBC Act.

19.2.2 Aquatic biodiversity

The freshwater aquatic habitat assessment was informed by the results of inspections carried out at seven locations across the four waterways (or their catchments) that fall within the aquatic biodiversity study area:

- Whites Creek
- Willoughby Creek
- Flat Rock Creek
- Quarry Creek.

The extent and condition of freshwater habitats within the aquatic biodiversity study area was recorded during the site inspections, based on a 100 metre reach of waterway centred at each inspection location.

No fish or macroinvertebrate sampling was carried out during the inspections. The likelihood of occurrence of aquatic species has been assessed based on the availability of suitable habitat. Further details of the inspection locations are provided in Chapter 17 (Hydrodynamics and water quality).

In summary, the aquatic assessment involved the following:

- Identification of the location, extent and condition of waterways potentially impacted by the project
- Assessment of potential impacts to freshwater ecology, including threatened species and ecological communities, and associated geomorphology due to construction and operation of the project
- Identification of environmental management measures and offsets required to manage potential impacts to aquatic ecology.

19.2.3 Marine biodiversity

The assessment methodology for marine biodiversity is summarised below, with further details provided in Appendix T (Technical working paper: Marine ecology).

Desktop assessment

A desktop assessment was carried out for the project, including review of information from relevant databases, aerial photography, reports and published literature.

The following databases were searched:

- Bionet Atlas of NSW Wildlife
- EPBC Act Protected Matters Search Tool
- Threatened biodiversity profile search
- NSW DPI Fish Communities and Threatened Species Distribution of NSW
- NSW DPI Listed Protected Fish Species website
- NSW DPI Listed Threatened Species, Populations and Ecological Communities website
- National System for the Prevention and Management of Marine Pest Incursions website
- Atlas of Living Australia.

The database searches were carried out for an area of 10 kilometres around the marine components of the project.

The desktop assessment was used to identify threatened species, populations, communities and their habitats with a likelihood of occurrence in areas to be impacted by the project.

Field surveys

Preliminary sampling and predictive habitat mapping from aerial photography captured in May 2017 was used to identify areas for field surveys. Sites for field surveys also took into account the outcomes of the desktop assessment, including consideration of relevant species, communities, populations and habitats, and their likelihood of occurrence in areas that may be impacted by the project.

Field surveys were carried out within Sydney Harbour in November and December 2017, between the Gladesville Bridge to the west and Garden Island, Potts Point and Robertsons Point. The field surveys included mapping and confirmation of seagrass, subtidal rocky reef, intertidal rocky reef and deep water soft sediment habitats. Surveys of macroalgae and sessile invertebrate coverage, fish numbers and epibiota coverage were also carried out in relevant habitats.

Assessment of potential impacts

A risk based approach was applied to the assessment of potential direct and indirect impacts of the project on marine biodiversity, including impacts associated with:

- Removal of habitat
- Turbidity
- Sedimentation
- Mobilisation of contaminants
- Introduction/spread of marine pests
- Altered hydrodynamics
- Underwater noise
- Boat strike to marine mammals and reptiles
- Spill of contaminants.

The assessment took into account the sensitivity of key fish habitat types, including Type 1 (highly sensitive), Type 2 (moderately sensitive) and Type 3 (minimally sensitive) habitats.

The likelihood and consequence of direct and indirect impacts on each key fish habitat were evaluated to determine an anticipated level of risk. The levels of risk applied to the assessment are summarised in Table 19-3.

Table 19-3 Risk levels applied to the assessment of potential marine biodiversity impacts

Level of risk	Description
Extreme	The risk is unmanageable and unjustified. Measures to reduce the risk to a lower level are required.
High	The risk is significant and requires substantial measures for risk reduction and/or management.
Medium	The risk may be acceptable and requires routine management measures.
Low	The risk is acceptable and requires either routine management measures or no further measures.

19.3 Existing environment

This section summarises the existing key biodiversity values along and around the project alignment, including:

- Terrestrial flora (Section 19.3.1)
- Terrestrial fauna (Section 19.3.2)
- Aquatic biodiversity (Section 19.3.3)

- Marine biodiversity (Section 19.3.6).

19.3.1 Terrestrial flora

Vegetation communities

Vegetation communities within the construction footprint are summarised in Table 19-4 and shown on Figure 19-1 to Figure 19-5.

The following construction support sites have not been considered further with regards to impacts to terrestrial flora:

- The Rozelle Rail Yards construction support site (WHT1), as any vegetation at this location has been assumed to be removed by the approved M4-M5 Link project
- The White Bay construction support site (WHT3), given there is no vegetation within or next to the construction support site.

Field surveys carried out for the project identified one native vegetation community within the construction footprint. This community is consistent with plant community type 1778: Smooth-barked Apple - Coast Banksia/Cheese Tree open forest on sandstone slopes on the foreshores of the drowned river valleys of Sydney and covers around 0.13 hectares in the north-west corner of the Berrys Bay construction support site (WHT7).

Other vegetation within the construction footprint is also described in Table 19-4 and shown in Figure 19-1 to Figure 19-5 and includes:

- Native plantings
- Native plantings (planted medians)
- Urban exotic/native
- Weeds and exotics.

This vegetation covers around 7.6 hectares within the construction footprint.

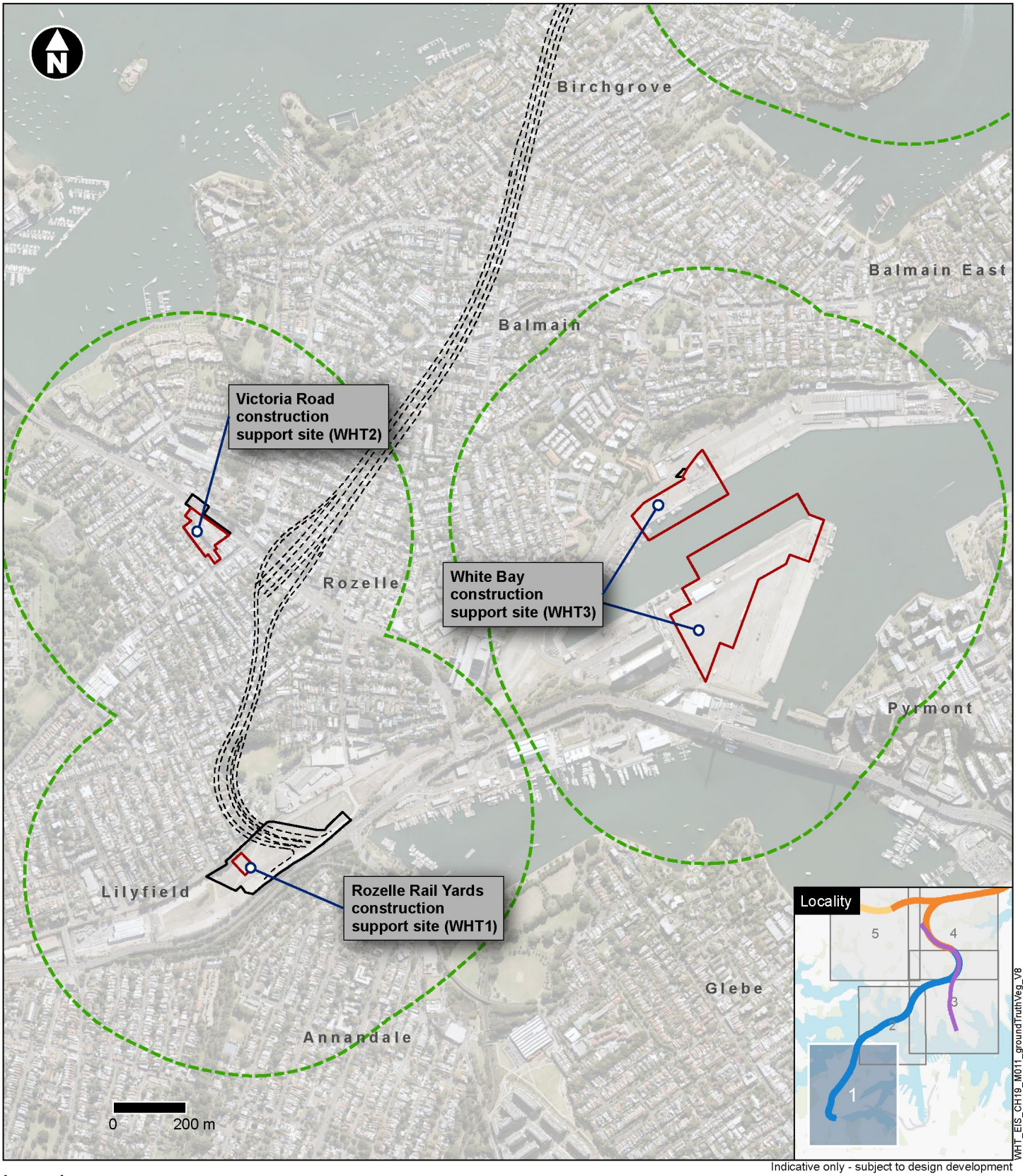
Threatened ecological communities

No threatened ecological communities were identified as likely to occur within the construction footprint.

Table 19-4 Vegetation communities within the construction footprint

Mapped vegetation[1]	Corresponding plant community type	Location within the construction footprint	Area within the construction footprint (ha)
Native vegetation community	Plant community type 1778: Smooth-barked Apple - Coast Banksia/Cheese Tree open forest on sandstone slopes on the foreshores of the drowned river valleys of Sydney	In the south-western corner of the Berrys Bay construction support site (WHT7), forming part of a larger patch of native vegetation extending southwards across Balls Head.	0.13
Native plantings	Not consistent with the definition of any plant community type	Planted trees along road verges and within parklands to the north-east of The Crescent, Annandale, within the Yurulbin Point construction support site (WHT4) and next to the existing Warringah Freeway.	3.30
Native plantings (planted medians)	Not consistent with the definition of any plant community type	Planted vegetation on the median strips between carriageways on the Warringah Freeway, as well as between the carriageways and ramps.	2.84
Urban exotic/native	Not consistent with the definition of any plant community type	Highly modified landscaped vegetation in gardens, parks and road verges including an area within the Berrys Bay construction support site (WHT7), and areas next to the existing Warringah Freeway.	1.11
Weeds and exotics	Not consistent with the definition of any plant community type	Planted exotic trees and grassy weeds within a cleared area to the east of the Warringah Freeway, at the southbound on ramp from High Street.	0.35
Total vegetation area within construction footprint (including native vegetation communities)			**7.73**

Note 1: Vegetation mapped by project ecologists as part of field surveys carried out for the biodiversity assessment

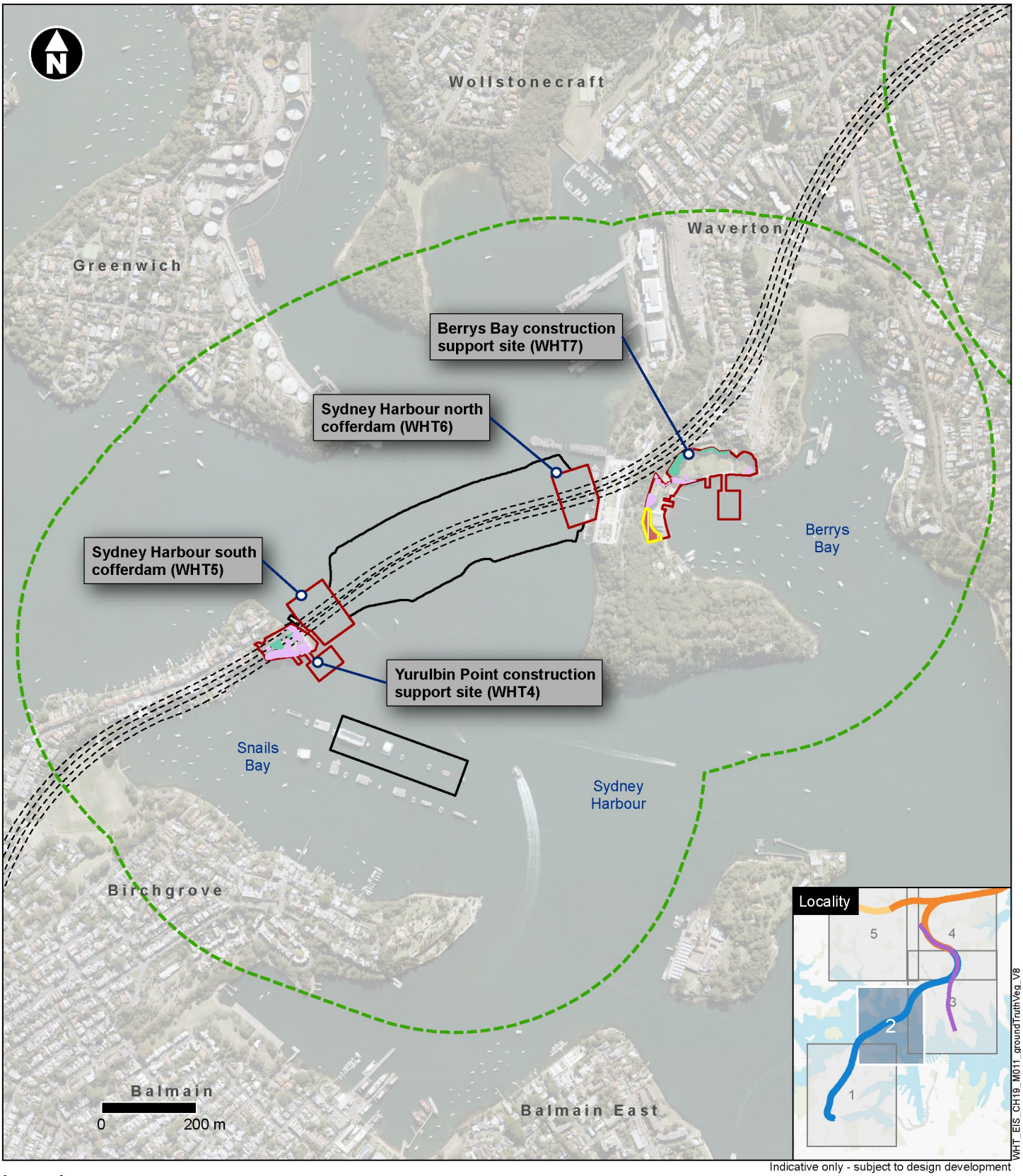


Legend

Construction features

- Construction footprint
- Assessment area
- Construction support site
- Tunnel section

Figure 19-1 Distribution of plant community types and other vegetation (map 1)



Legend

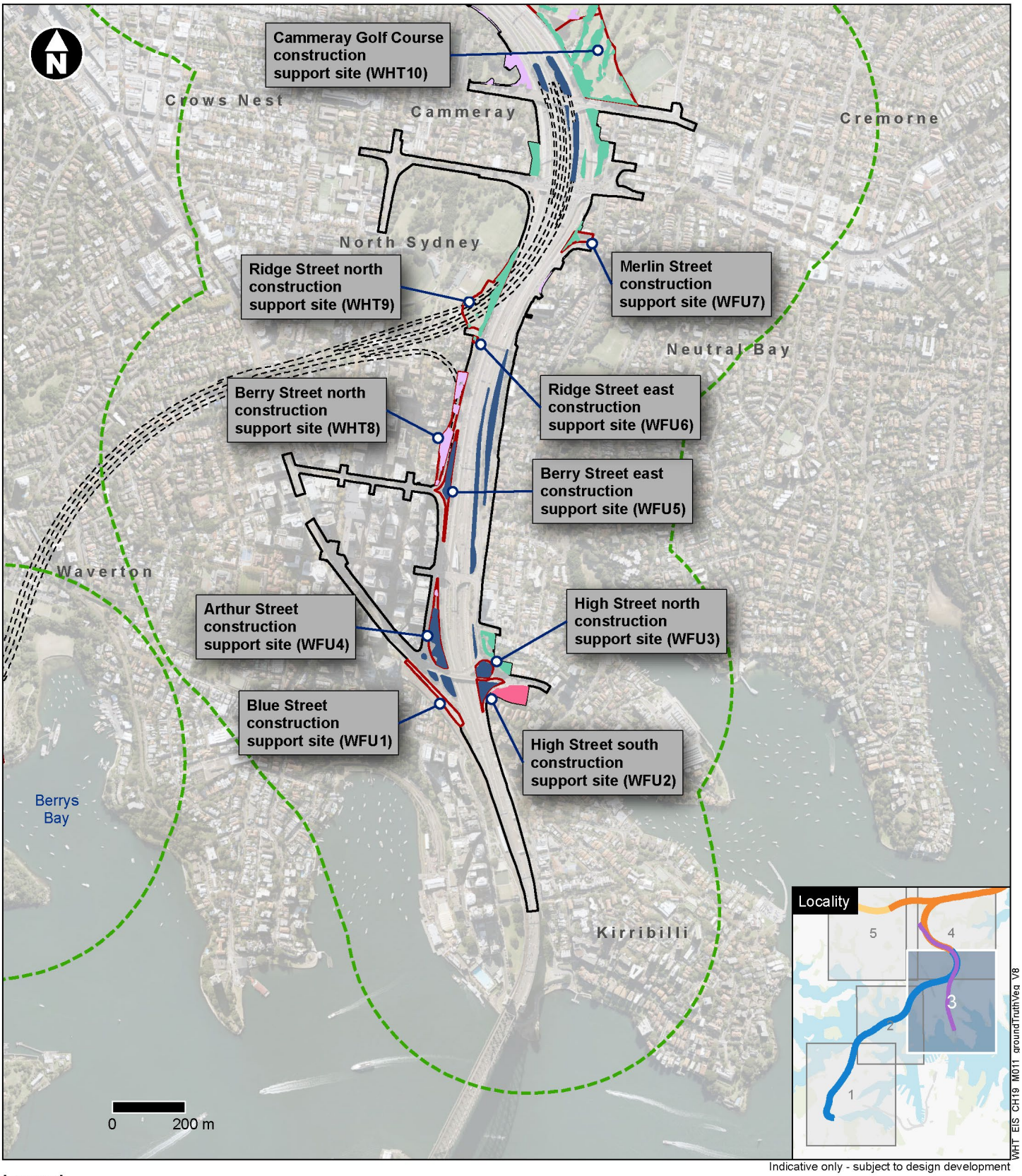
Construction features

- Construction footprint
- Construction support site
- Tunnel section
- Exclusion zone
- Assessment area

Plant community types and other vegetation

- Native Plantings
- PCT 1778 / BVT ME65 - Coastal Sandstone Foreshores Forest
- Urban Exotic/Native

Figure 19-2 Distribution of plant community types and other vegetation (map 2)



Indicative only - subject to design development

Legend

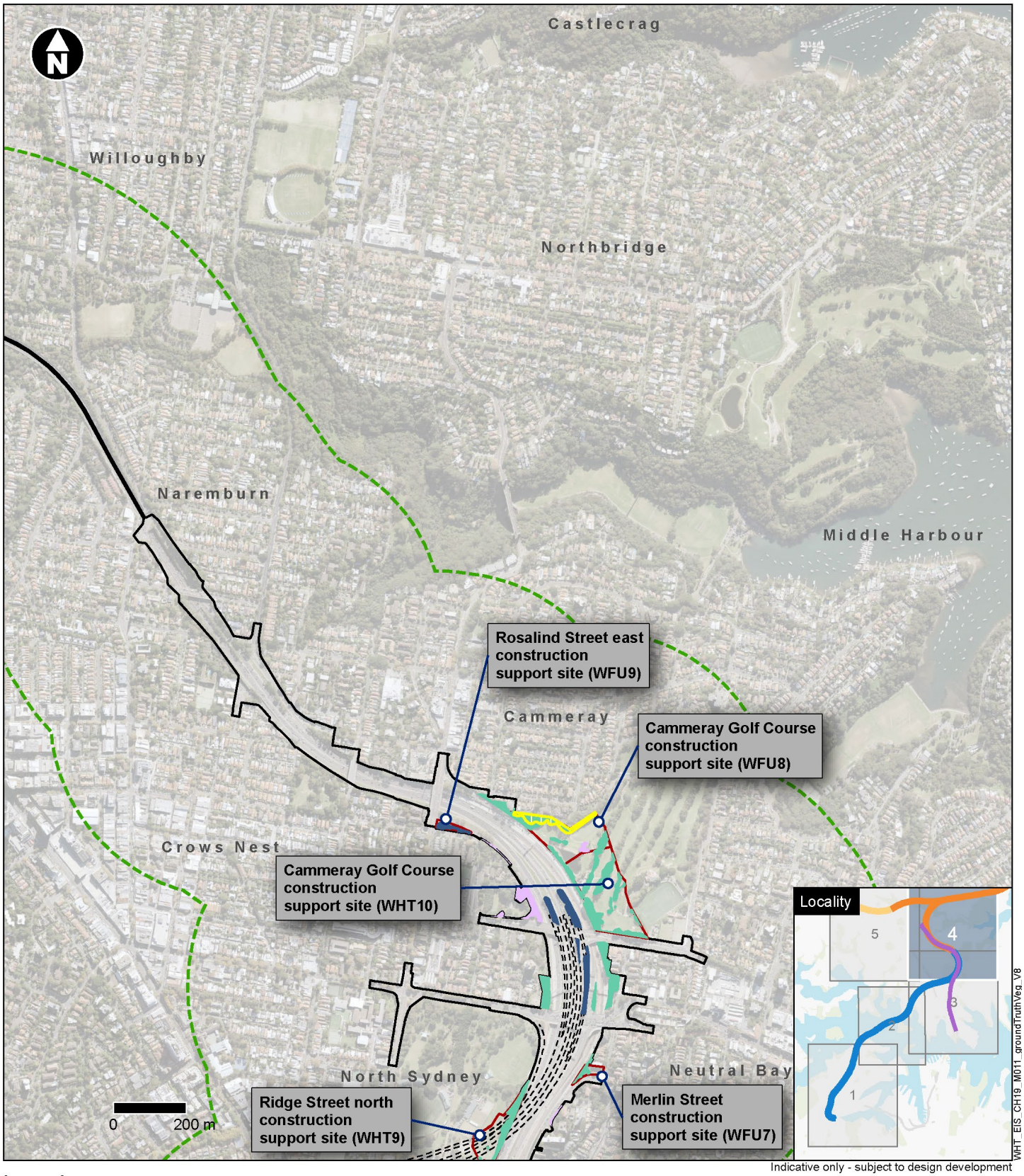
Construction features

- Construction footprint
- Construction support site
- Tunnel section
- Assessment area

Plant community types and other vegetation

- Exotic Plantings
- Native Plantings
- Plantation (median)
- Urban Exotic/Native

Figure 19-3 Distribution of plant community types and other vegetation (map 3)



Legend

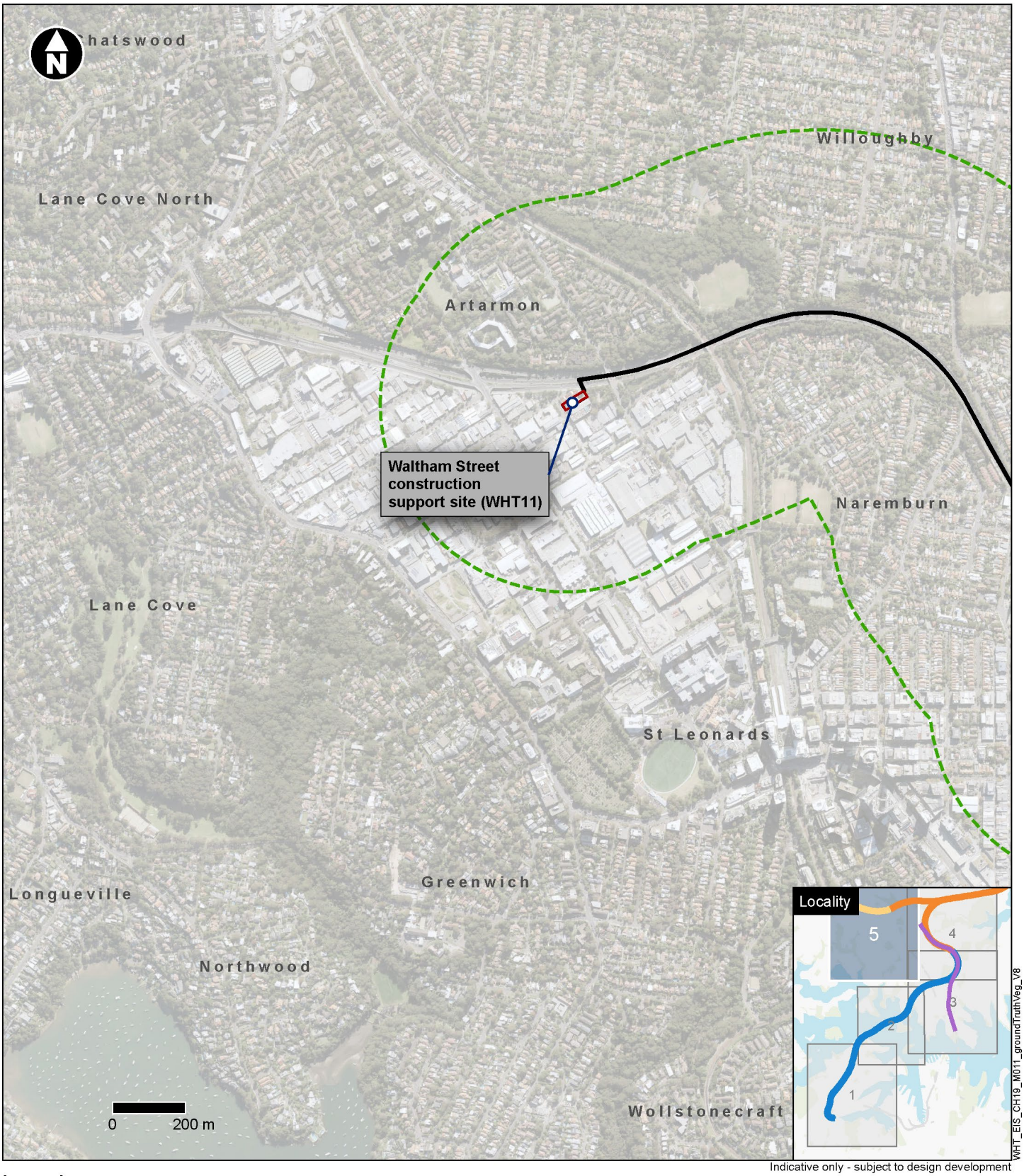
Construction features

- Construction footprint
- Construction support site
- Tunnel section
- Exclusion zone
- Assessment area

Plant community types and other vegetation

- Native Plantings
- Plantation (median)
- Urban Exotic/Native

Figure 19-4 Distribution of plant community types and other vegetation (map 4)



Legend

Construction features

Construction footprint

Assessment area

Construction support site

Figure 19-5 Distribution of plant community types and other vegetation (map 5)

Threatened flora

Field surveys carried out for the project identified four listed threatened flora species within or next to the construction footprint:

- Magenta Lilly Pilly (*Syzygium paniculatum*)
- Narrow-leaved Black Peppermint (*Eucalyptus nicholii*)
- Wallangarra White Gum (*Eucalyptus scoparia*)
- Sunshine Wattle (*Acacia terminalis* subsp. *terminalis*).

The *Acacia terminalis* subsp. *terminalis* is possibly natural regrowth. The remaining three species are well outside their known geographic range and/or known habitat. As these species occur as individual trees, it is assumed that these species have been planted.

No listed threatened species were identified as having a moderate or high likelihood of occurrence within the construction footprint.

Details of these four species are provided in Table 19-5, with the locations of species recorded during field surveys for the project shown in Figure 19-7.

Table 19-5 Threatened flora species known or to occur in the construction footprint

Species	Conservation significance	Occurrence in the construction footprint
Magenta Lilly Pilly (*Syzygium paniculatum*)	Endangered (BC Act) Vulnerable (EPBC Act)	Recorded next to the construction footprint. Planted specimens were recorded within the Warringah Freeway corridor just outside the construction footprint. Unlikely to occur naturally as the construction footprint does not represent suitable habitat for the species.
Narrow-leaved Black Peppermint (*Eucalyptus nicholii*)	Vulnerable (BC Act and EPBC Act)	Recorded within the construction footprint. Planted specimens were recorded within the Warringah Freeway corridor. Unlikely to occur naturally as the construction footprint is outside the known naturally occurring distribution of the species.
Wallangarra White Gum (*Eucalyptus scoparia*)	Endangered (BC Act) Vulnerable (EPBC Act)	Recorded within the construction footprint. Planted specimens were recorded in the Warringah Freeway corridor. Unlikely to occur naturally as the construction footprint is outside the known naturally occurring distribution of the species.
Sunshine Wattle (*Acacia terminalis* subsp. *terminalis*)	Endangered (BC Act and EPBC Act)	Recorded within the construction footprint. One individual specimen in disturbed vegetation adjoining the Warringah Freeway. There are records of the species in bushland adjoining Sydney Harbour, including near the construction footprint. However, most of the vegetation within and adjoining the construction footprint does not represent suitable habitat for the species.

19.3.2 Terrestrial fauna

Terrestrial fauna habitat

Table 19-6 provides a summary of the terrestrial fauna habitat types within and next to the construction footprint, and the known or potential fauna species occurring within those habitats.

The key terrestrial fauna habitat types identified for the project include:

- Vegetated habitats
- Man-made structures and built environments (including existing buildings, jetties and wharves)
- Marine and intertidal habitats. The assessment of marine and intertidal habitats in relation to marine species is discussed in Section 19.3.6.

Table 19-6 Terrestrial fauna habitats

Habitat type	Location	Known or potential fauna species
Vegetated habitats	Vegetated habitats (ie landscaped parks, private gardens and street verges) within or next to the following: • Yurulbin Point construction support site (WHT4) • Berrys Bay construction support site (WHT7) • Cammeray Golf Course construction support sites (WHT10 and WFU8) • Warringah Freeway Upgrade component • Jeaffreson Jackson reserve.	• Flowering and fruiting trees and shrubs throughout the construction footprint may offer foraging, nesting and roosting habitat to bats, birds and arboreal mammals, such as: Grey-headed Flying-fox (*Pteropus poliocephalus*); Australian Magpie (*Cracticus tibicen*); Noisy Miner (*Manorina melanocephala*); Rainbow Lorikeet (*Trichoglossus moluccanus*); Grey Butcherbird (*Cracticus torquatus*); Common Brushtail Possum (*Trichosurus vulpecula*); and Common Ringtail Possum (*Pseudocheirus peregrinus*) • Landscaped areas and garden beds may offer marginal foraging habitat for birds, small mammals and reptiles • The area of native vegetation within and next to the Berrys Bay construction support site (WHT7) is contiguous with a larger tract of bushland at Balls Head Reserve and offers potential foraging habitat to the Powerful Owl (*Ninox strenua*) • The following threatened fauna species have also been previously recorded in Balls Head Reserve, next to the construction footprint: White-bellied Sea Eagle (*Haliaeetus leucogaster*); Eastern Bentwing-bat (*Miniopterus schreibersii*); and Grey-headed Flying-fox (*Pteropus poliocephalus*) • One potential hollow-bearing tree was identified (*Eucalyptus saligna*) in Jeaffreson Jackson Reserve. Hollow entrances were not visible from the ground, but if present, may support common urban fauna such as Brushtail Possum (*Trichosurus vulpecula*) and Sulphur-crested Cockatoo (*Cacatua galerita*).
Man-made structures and built environments	Within the coal loader tunnels on the western side of Waverton peninsula, near the Sydney Harbour north cofferdam (WHT6).	• A roost habitat known to be occupied during autumn and winter by hibernating Eastern Bentwing-bats (*Miniopterus schreibersii*) is located within one of the four coal loader tunnels. The number of Eastern Bentwing-bats occupying this winter roost in recent years has fluctuated between zero and about 500 individuals.
	Buildings and sheds at Berrys Bay construction support site (WHT7).	• Potential roosting habitat for microbats within small wall and ceiling cavities in buildings and sheds. However, no evidence of microbat occupation or threatened microbat recordings were identified in the area.

Habitat type	Location	Known or potential fauna species
	Within built structures, including warehouses, buildings, wharves, jetties at: • White Bay construction support site (WHT3) • Yurulbin Point construction support site (WHT4) • Berrys Bay construction support site (WHT7).	• Limited and marginal potential roosting habitat for microbats, including Southern Myotis (*Myotis macropus*), which is known to roost in jetties and wharves in Sydney Harbour.
Marine and intertidal habitats*	Intertidal sand and mudflats below rock and sandstone retaining walls at: • The western and south-western shore of Rozelle Bay (next to Federal Park), near the Rozelle Rail Yards construction support site (WHT1) • A small foreshore area of Yurulbin Point near the Yurulbin Point construction support site (WHT4) • The western shore of Snails Bay (next to Birchgrove Park) • The southern shore of Berrys Bay, in proximity to Berrys Bay construction support site (WHT7).	• Provides marginal foraging habitat to threatened shorebird species, where worms, bivalves, crustaceans and other invertebrates occur within soft substrate tidal areas that are exposed during low tide. However, no threatened shorebird species were identified during database searches as having a high likelihood of occurrence within the construction footprint • No nesting or roosting habitat provided as these areas are inundated at high tide.
	Intertidal rocky shores and artificial seawalls along bays including: Rozelle Bay; White Bay; Snails Bay; Balls Head Bay; and Berrys Bay.	• Supports a high abundance of Sydney Rock Oysters (*Saccostrea glomerata*), which comprise limited foraging resources for threatened shorebirds. However, no threatened shorebird species were identified during database searches as having a high likelihood of occurrence within the construction footprint • No nesting or roosting opportunities for threatened shorebird species, as these areas are inundated at high tide.

Habitat type	Location	Known or potential fauna species
	Open water within Sydney Harbour	Foraging habitat for a number of threatened bird species that forage for fish or other marine prey species, including: • Little Penguin (*Eudyptula minor*) which has been previously recorded at several locations within the construction footprint, including Snails Bay, Berrys Bay, Balls Head Bay, and in the main channel of the harbour • White-bellied Sea Eagle (*Haliaeetus leucogaster*) which has been recorded flying over Sydney Harbour near the construction footprint next to Balls Head and flying above Goat Island, due to the presence of preferred prey species (ie fish, turtles and sea snakes), as well as potential perching habitat in trees along the harbour foreshore at Balls Head, Birchgrove and Waverton • Southern Myotis (*Myotis macropus*) due to the presence of preferred prey species (ie fish), particularly within Balls Head Bay • Eastern Osprey (*Pandion cristatus*) due to the presence of preferred prey species (ie fish) • Not a preferred habitat for wandering seabirds with no wandering seabird species identified as having a high likelihood of occurrence within the construction footprint.

Threatened fauna species and endangered populations

Field surveys carried out for the project identified three listed threatened fauna species within or next to the construction footprint:

- Eastern Bentwing-Bat (*Miniopterus schreibersii oceanensis*) recorded within one of the coal loader tunnels near the construction footprint at Waverton
- Grey-headed Flying-fox (*Pteropus poliocephalus*) recorded flying over the construction footprint at Berrys Bay
- White-bellied Sea Eagle (*Haliaeetus leucogaster*) flying over Sydney Harbour near the construction footprint next to Balls Head and flying above Goat Island.

Another four listed threatened species were identified as having a high likelihood of occurrence within the construction footprint, despite not being identified during field surveys. These species were:

- Eastern Freetail-bat (Mormopterus norfolkensis)
- Little Bentwing-Bat (*Miniopterus australis*)
- Southern Myotis (*Myotis macropus*)
- Powerful Owl (*Ninox strenua*).

In addition, the Eastern Osprey (*Pandion cristatus*) was identified as having a moderate likelihood of occurrence, despite not being identified during field surveys.

One threatened population is known to occur in the construction footprint on occasion, being the population of Little Penguins in the Manly Point Area, about 10 kilometres north-east of the project.

Details of these nine threatened species and one endangered population are provided in Table 19-7 with the locations of species recorded during field surveys for the project shown in Figure 19-6 to Figure 19-9.

Migratory bird species

As identified above, one migratory bird species listed under the EPBC Act, the White-bellied Sea Eagle (*Haliaeetus leucogaster*), was recorded flying over Sydney Harbour near the construction footprint next to Balls Head and flying above Goat Island.

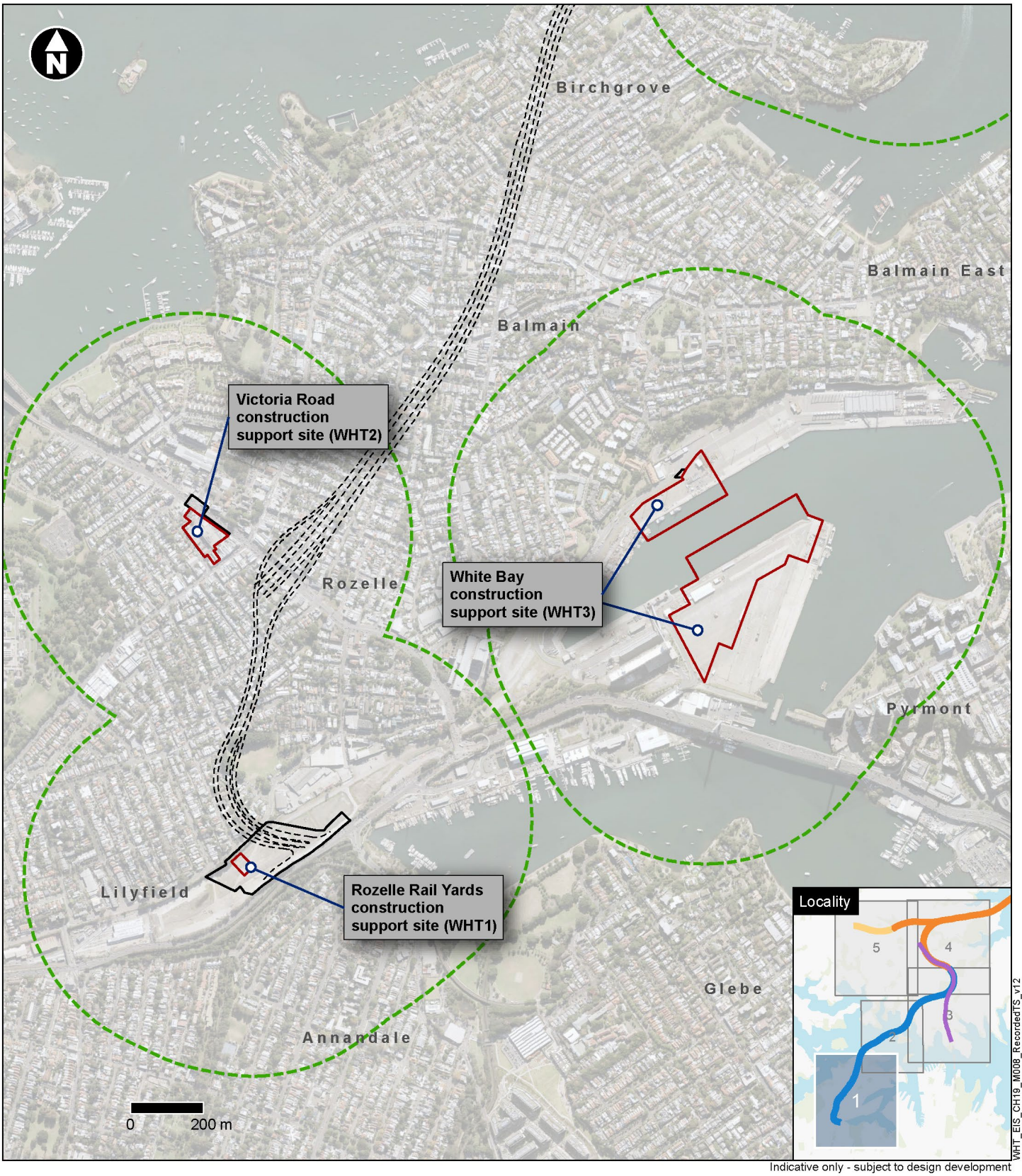
Migratory marine and freshwater species such as whales, turtles and fish are discussed in Section 19.3.3 and Section 19.3.6.

Table 19-7 Threatened fauna species known or likely to occur in the construction footprint

Species	Conservation significance	Likelihood of occurrence in the construction footprint
Threatened species		
Eastern Bentwing-Bat (*Miniopterus schreibersii oceanensis*)	Vulnerable (BC Act)	Recorded. This species is known to roost in one of the four coal loader tunnels near the construction footprint at Waverton (during autumn and winter), and was identified during field surveys for the project. Other potential roosting habitat includes in built structures throughout the construction footprint. There is also potential foraging habitat for the species within and next to the construction footprint in well-vegetated areas such as Balls Head Reserve. Recorded in Sydney Harbour in close proximity to the construction footprint.
Grey-headed Flying-fox (*Pteropus poliocephalus*)	Vulnerable (BC Act and EPBC Act)	Recorded. This species was observed flying over a number of locations within the construction footprint at Berrys Bay during field surveys for the project. Potential foraging habitat for the species is present within vegetated areas throughout the construction footprint.
White-bellied Sea Eagle (*Haliaeetus leucogaster*)	Vulnerable (BC Act) Migratory (EPBC Act)	Recorded. This species was observed flying over Sydney Harbour near the construction footprint next to Balls Head and flying above Goat Island. Potential foraging habitat occurs within the construction footprint due to the presence of preferred prey species that inhabit Sydney Harbour. Potential perching habitat also occurs within and next to the construction footprint due to the presence of trees along the harbour foreshore at Balls Head, Birchgrove and Waverton. The construction footprint is not known to support nesting habitat for the species.

Species	Conservation significance	Likelihood of occurrence in the construction footprint
Eastern Freetail-bat (*Mormopterus norfolkensis*)	Vulnerable (BC Act)	High. This species has been previously recorded within the construction footprint. Potential roosting habitat for the species is present in built structures within the construction footprint, such as existing buildings at the Berrys Bay construction support site (WHT7). Potential foraging habitat is also present in well-vegetated areas such as Balls Head Reserve in proximity to the construction footprint.
Little Bentwing-Bat (*Miniopterus australis*)	Vulnerable (BC Act)	High. Potential roosting habitat for this species is present in built structures throughout the construction footprint including stormwater drains, culverts and buildings, such as those located at the Berrys Bay construction support site (WHT7). Potential foraging habitat is also present in well-vegetated areas within and next to the construction footprint such as Balls Head Reserve.
Powerful Owl (*Ninox strenua*)	Vulnerable (BC Act)	High. This species has been previously recorded within the construction footprint and surrounding areas. A small area of native vegetation within the Berrys Bay construction support site (WHT7), contiguous with a larger tract of bushland at Balls Head Reserve, provides potential foraging habitat for the species. No nesting or roosting/breeding habitat is available within the construction support site.
Southern Myotis (*Myotis macropus*)	Vulnerable (BC Act)	High. This species has been previously recorded within and next to the construction footprint at Berrys Bay and Balls Head. The species is known to roost in a jetty structure in a sheltered bay in Sydney Harbour. The construction footprint supports potential roosting habitat for the species, due to the presence of jetties, wharves and other man-made structures along the harbour foreshore, including the large Coal Loader wharf at Waverton, and smaller wharves and jetties at Berrys Bay, Snail Bay and Birchgrove. Sydney Harbour, particularly sheltered bays, also provides potential foraging habitat for the species, particularly Balls Head Bay.

Species	Conservation significance	Likelihood of occurrence in the construction footprint
Eastern Osprey (*Pandion cristatus*)	Vulnerable (BC Act) Migratory (EPBC Act)	Moderate. Relatively recent records of this species exist in the vicinity of the construction footprint. Potential foraging habitat for the species is present in Sydney Harbour.
Endangered population		
Little Penguin (*Eudyptula minor*)	Endangered population (BC Act) Marine (EPBC Act)	High. This species has been previously recorded at several locations including Snails Bay, Berrys Bay, Balls Head Bay, and in the main channel of the harbour. Potential foraging habitat for the species is present within the construction footprint. No nesting habitat is present within the construction footprint, with nesting limited to the Manly area.



Legend

Construction features

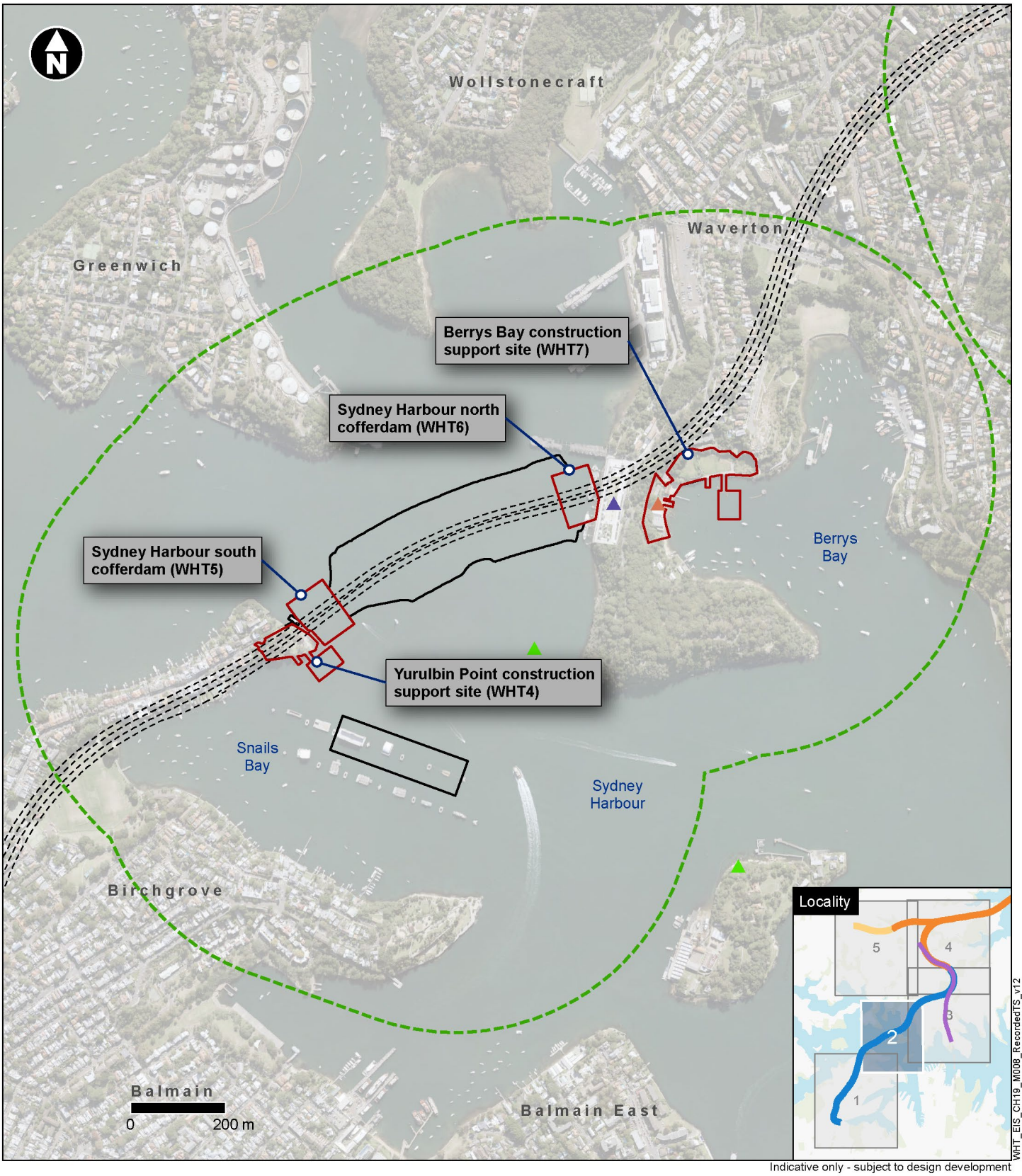
Assessment area

Construction footprint

Construction support site

Tunnel section

Figure 19-6 Recorded threatened species (map 1)



Legend

Construction features

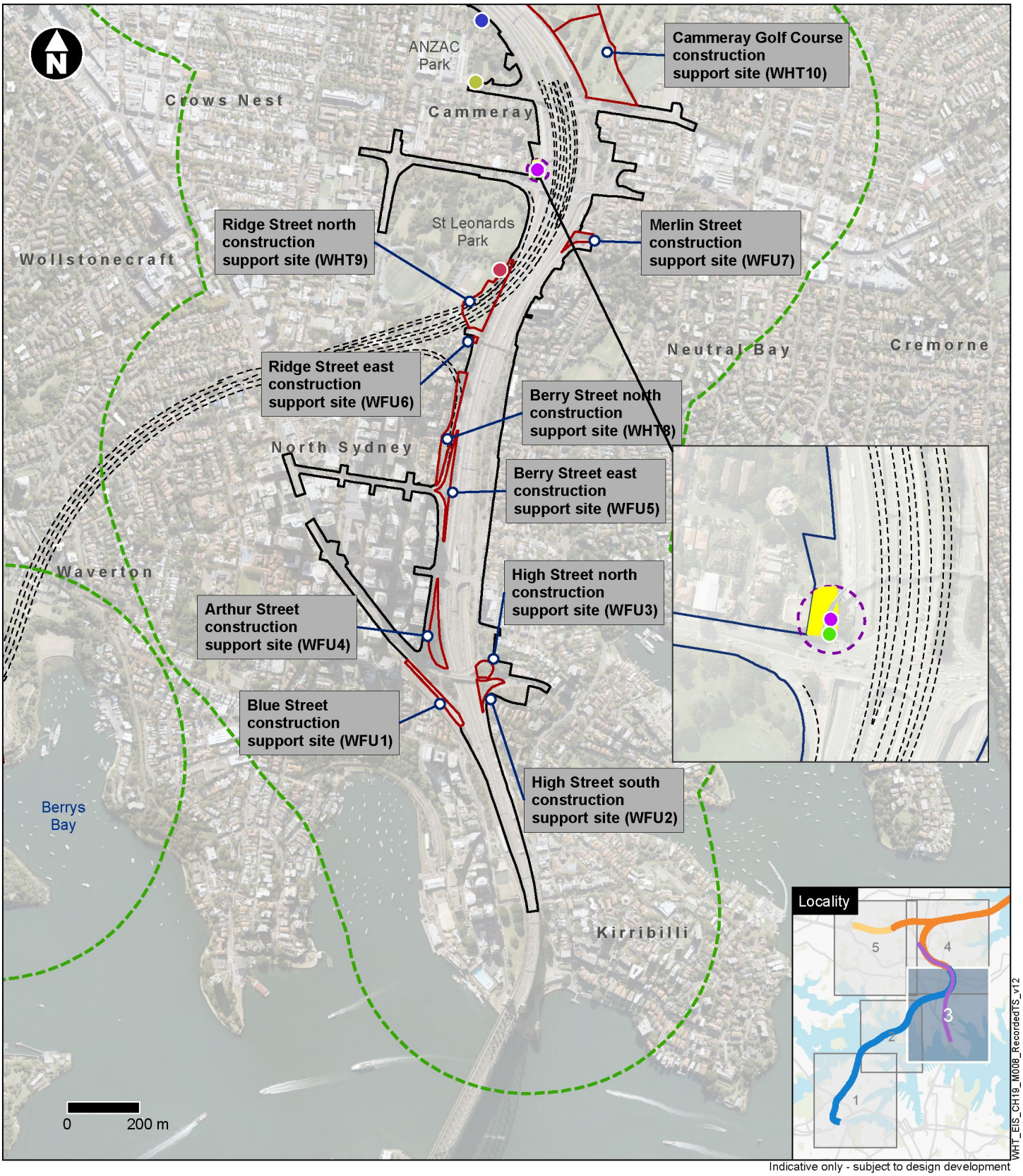
- Construction footprint
- Construction support site
- Tunnel section

Threatened fauna species

- Eastern Bentwing-bat
- Grey-headed Flying-fox
- White-bellied Sea Eagle

- Assessment area

Figure 19-7 Recorded threatened species (map 2)



Legend

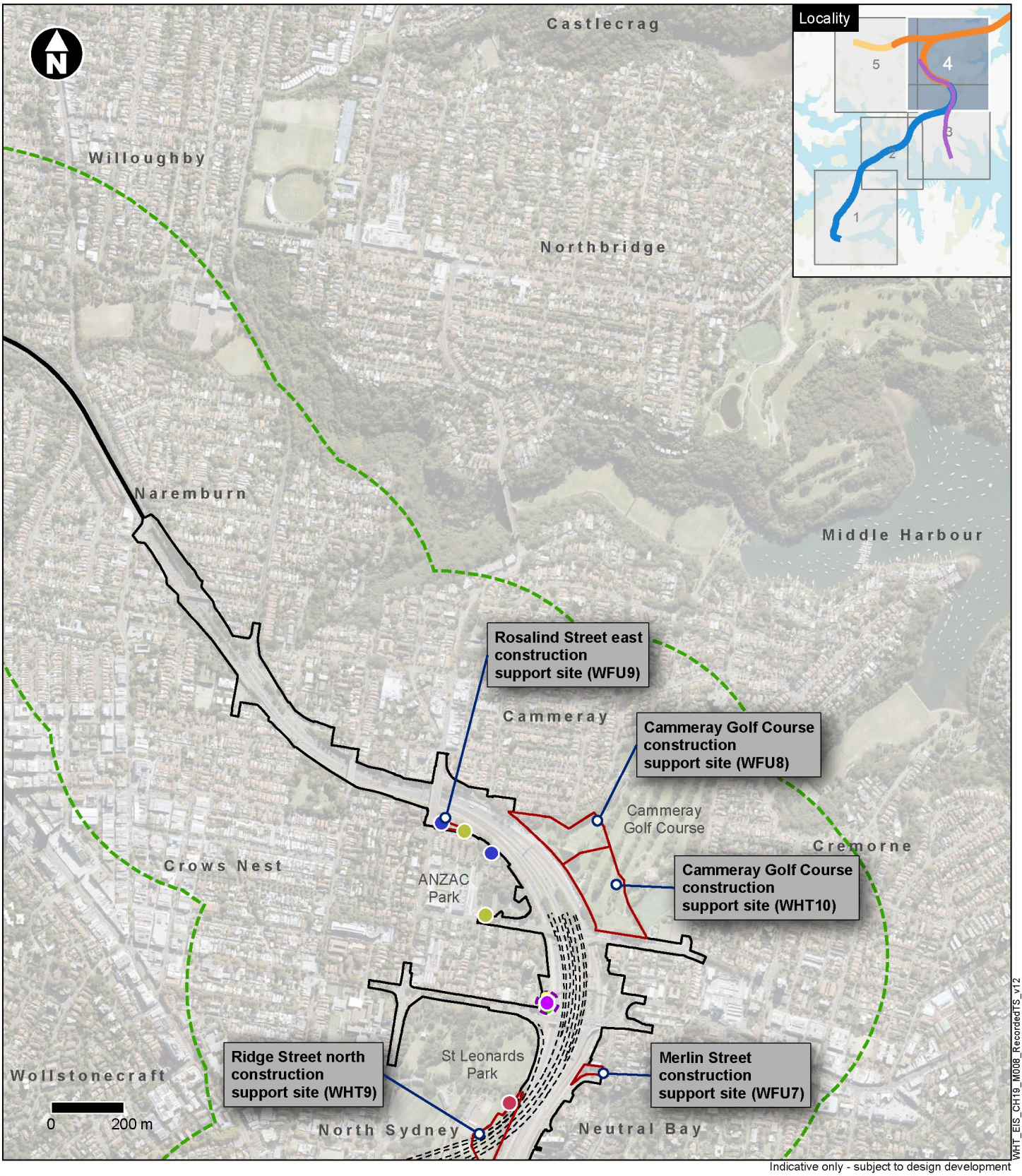
Construction features

- Construction footprint
- Construction support site
- Tunnel section

Threatened flora species

- *Eucalyptus nicholii*
- *Eucalyptus scoparia*
- *Syzygium paniculatum*
- *Acacia terminalis subsp terminalis*
- *Acacia terminalis subsp terminalis 30 m buffer*
- *Acacia terminalis subsp terminalis species polygon*
- Potential hollow-bearing tree
- Assessment area

Figure 19-8 Recorded threatened species (map 3)



Legend

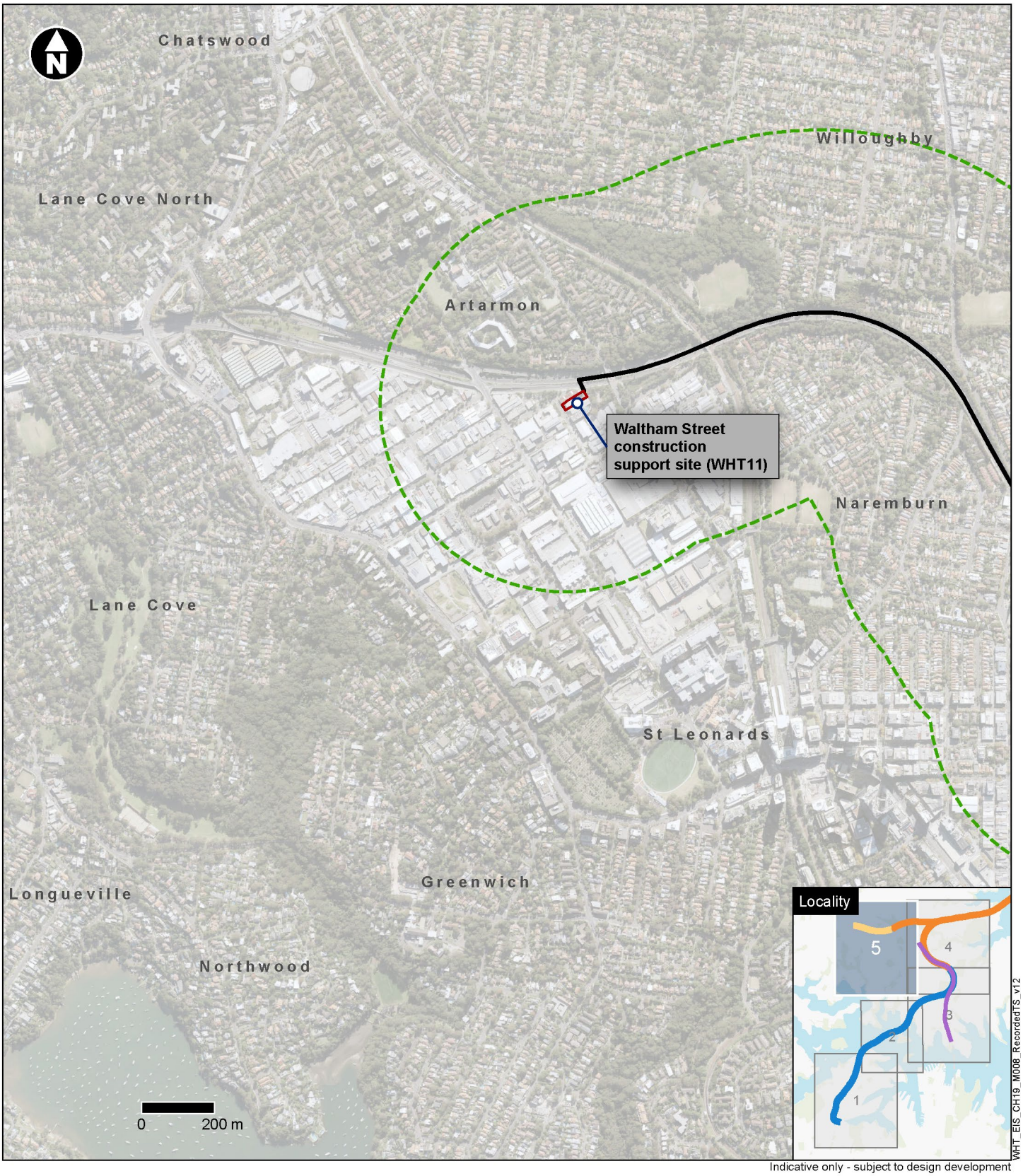
Construction features

- Construction footprint
- Construction support site
- Tunnel section

Threatened flora species

- *Eucalyptus nicholii*
- *Eucalyptus scoparia*
- *Syzygium paniculatum*
- *Acacia terminalis subsp terminalis*
- *Acacia terminalis subsp terminalis 30 m buffer*
- *Acacia terminalis subsp terminalis species polygon*
- Assessment area

Figure 19-9 Recorded threatened species (map 4)



Legend

Construction features

Construction footprint

Construction support site

Tunnel section

Assessment area

Figure 19-10 Recorded threatened species (map 5)

19.3.3 Aquatic biodiversity

Aquatic habitat

Table 19-8 provides a summary of the aquatic freshwater habitats associated with the waterways within and downstream of the construction footprint.

Quarry Creek and the natural reaches of Flat Rock Creek have been identified as Type 1 highly sensitive key fish habitat and sensitive receiving environments. The classification of waterways regarding their status as sensitive receiving environments is discussed in detail in Chapter 17 (Hydrodynamics and water quality), and summarised in Table 19-8.

The quality of these waterways was also assessed as part of the surface water assessment, the results of which are provided in Chapter 17 (Hydrodynamics and water quality). In general, the waterways potentially impacted by the project are largely influenced by surrounding urban development with occurrences of contaminants such as suspended sediments, heavy metals and persistent organic pollutants including from stormwater, wastewater overflows and leachate from contaminated lands. Some of these waterways have also undergone significant change from natural channels to artificial, concrete-lined channels to accommodate higher volume and velocity flows from an increase in urban, impervious surfaces.

Although no fish or macroinvertebrate sampling was carried out as part of the aquatic assessment, the waterways in the aquatic biodiversity study area are considered suitable for the majority of common and exotic fish species typically found in waterways in the Sydney region. The most suitable habitat are the natural reaches of these waterways (Willoughby Creek, Quarry Creek and some reaches of Flat Rock Creek).

Common native fish species typically found in waterways in the Sydney region include short-finned and long-finned eels (*Anguilla australis* and *A. reinhardtii*), common jollytails (*Galaxias brevipinnis*), Australian bass (*Macquaria novemaculeata*) and a number of gudgeon species. Exotic fish species are also widespread across the Sydney region.

The waterways are also likely to support an array of macroinvertebrates including the Sydney crayfish (*Euastacus australasiensis*) and the freshwater shrimp (*Paratya australiensis*) as well as smaller insects and freshwater mussels. These species depend on healthy waterways and access to diverse habitats including swamps, floodplains, wetland, streams and rivers of which only streams occur within the aquatic biodiversity study area.

Threatened ecological communities, species and endangered populations

No threatened freshwater fauna, flora species or ecological communities or endangered populations listed under the FM Act and/or the EPBC Act have been identified as likely to occur within the construction footprint.

Freshwater migratory species

No freshwater migratory species listed under the EPBC Act are considered likely to occur within the construction footprint.

Table 19-8 Aquatic freshwater habitats

Location	Habitat features	Key fish habitat classification	Sensitive receiving environment
Whites Creek at Rozelle, located about 40 metres south-east of the Rozelle Rail Yards construction support site (WHT1)	• The creek at the location of the inspections at Lilyfield is heavily modified, with concrete lined channel and banks • The riparian corridor is also highly modified with low condition riparian vegetation consisting of planted native trees and shrubs in landscaped areas (eg within Buruwan Park, next to The Crescent), with no remnant native vegetation present. In other areas, weeds are common • No instream fish habitat is present, due to the concrete channel structure. No logs, aquatic vegetation, emergent vegetation or rocks are present.	Not a key fish habitat	No
Willoughby Creek at Cammeray, located about 60 metres east of the Cammeray Golf Course construction support site (WHT10 and WFU8)	• The area of the creek next to Primrose Park Tennis Courts was identified as a semi-natural waterway, partially modified to accept stormwater discharge. Around 10 metres downstream of the survey location, the creek contains entrenched bedrock and a concrete-lined channel. A natural bedrock/boulder waterfall and a shallow plunge pool is located around 50 metres upstream of the survey location • Banks in the upstream section of the creek are vegetated by dense tree cover and shrubs with a groundcover consisting primarily of ferns. Walking tracks and tennis courts are present on the south-east bank and on the opposite bank the riparian vegetation corridor is around 70 metres wide and continuous. Further downstream, the riparian corridor includes Primrose Park sporting fields • Moderate condition riparian vegetation including commonly occurring native tree species are present within remnant riparian vegetation, such as Black Wattle (*Callicoma serratifolia*), Coachwood (*Ceratopetalum apetalum*), Blueberry Ash (*Elaeocarpus reticulatus*), Cheese Tree (*Glochidion ferdinandi*) • Localised infestations of Large Leaf Privet (*Ligustrum lucidum*) and Lantana (*Lantana camara*) are also known to occur	• Type 3 minimally sensitive key fish habitat • Class 3 minimal key fish habitat for fish passage.	No

Location	Habitat features	Key fish habitat classification	Sensitive receiving environment
	• This riparian vegetation provides shade and potentially, other ecological functions (eg a source of food and habitat, in the form of wood debris, for aquatic biota). No instream vegetation or woody debris were identified within the section of the creek inspected. Some rocky features are present.		
Flat Rock Creek at Naremburn, located about one kilometre north of the Cammeray Golf Course construction support site (WHT10 and WFU8)	• The creek was identified as freshwater upstream of its confluence with Quarry Creek and estuarine downstream of the confluence • Along Artarmon Reserve the channel is concrete-lined and does not support any instream aquatic vegetation and limited landscaped riparian vegetation. This section of the creek is not considered to be key fish habitat and is not considered a sensitive receiving environment • Upstream of Quarry Creek, the channel consists of a steep gorge with natural bedrock and large boulders. Dense riparian vegetation encroached on the channel is likely attributed to frequent low flow conditions in the main channel. Riparian vegetation consists of native, tall, woody trees, dense shrubs and groundcover • Downstream of Quarry Creek, the channel appeared be subjected to stormwater discharge with evidence of channel and bank erosion a likely result of high flow events. The south bank had dense native and exotic, overhanging riparian vegetation • Upstream of Quarry Creek, the channel consists of a steep gorge with natural bedrock and large boulders. Dense riparian vegetation encroached on the channel is likely attributed to frequent low flow conditions in the main channel. Riparian vegetation consists of native, tall, woody trees, dense shrubs and groundcover • Downstream of Quarry Creek, the channel is subjected to stormwater discharge with evidence of channel and bank erosion a likely result of high flow events. The south bank consists of dense native and exotic, overhanging riparian vegetation	• Type 1 highly sensitive key fish habitat • Class 2 moderate key fish habitat for fish passage (upstream of Quarry Creek) • Class 1 major key fish habitat for fish passage (downstream of Quarry Creek).	Yes

Location	Habitat features	Key fish habitat classification	Sensitive receiving environment
	• In the upper reaches, instream woody debris (less than three metres long) provides aquatic habitat along its upper reaches, albeit some were emergent at the time of survey. Downstream, fish habitat includes woody debris and some undercut banks with potential to provide refuge as well as large woody debris (greater than three metres long) and dense instream common reed (*Phragmites australis*) present in some sections.		
Quarry Creek at Cammeray, located about 800 metres north of the Cammeray Golf Course construction support site (WHT10 and WFU8)	• At the location of the inspection, the channel flowed through a steep rocky gorge. Upstream of this it appeared freshwater and ephemeral with bedrock steps, rocky riffles and runs with low to moderate flow during dry conditions. Quarry Creek becomes estuarine near the Flat Rock Creek confluence with a silt/clay substratum • Dense exotic riparian vegetation is present within the areas of the creek inspected.	• Type 1 highly sensitive key fish habitat • Class 2 moderate key fish habitat for fish passage.	Yes

19.3.4 Groundwater dependent ecosystems

No groundwater dependent ecosystems were identified within the construction footprint.

The northern extent of the construction footprint would be located upstream of mapped groundwater dependent ecosystems that rely on groundwater associated with Flat Rock Creek as outlined in Table 19-9 and shown on Figure 19-11.

Table 19-9 Groundwater dependent ecosystems in proximity to the project

Location of mapped groundwater dependent ecosystem	Distance from the project	Mapped ecosystems
Upper reaches of Flat Rock Creek at Munro Park – moderate to high potential for terrestrial groundwater dependent ecosystem	About 300 metres north-east of the construction footprint associated with the Warringah Freeway Upgrade	• Coastal Sandstone Gully Forest • Sandstone Riparian Scrub • Coastal Sand Forest.

This groundwater dependent ecosystem is located outside the range of potential impact, and therefore has not been included for further assessment.

19.3.5 Wetlands and conservation areas

Six coastal wetlands listed under the *State Environmental Planning Policy (Coastal Management) 2018* are located within the aquatic biodiversity study area. However, none of these would be located within the construction footprint. There are no wetlands of international importance within the construction footprint. Therefore, impacts to wetlands and conservation areas are not assessed further.

Legend

Operational features

- Western Harbour Tunnel
- Warringah Freeway Upgrade

Construction features

- Construction footprint

Connecting prjects

- Beaches Link
- Gore Hill Freeway Connection

Groundwater dependent ecosystems

- Ecosystem that relies on subsurface presence of groundwater

Figure 19-11 Distribution of groundwater dependent ecosystems

19.3.6 Marine biodiversity

Marine habitats

Seven marine habitat types were identified within the marine biodiversity study area and are shown in Figure 19-12. The habitats and relevant key fish habitat classifications as defined in the *Policy and Guidelines for Fish Habitat Conservation and Management* (NSW DPI, 2013) are identified in Table 19-10.

No critical habitats listed on State or Commonwealth registers of critical habitat occur within the marine biodiversity study area.

Table 19-10 Marine habitats within the marine biodiversity study area

Key fish habitat classification	Marine habitat
Highly sensitive key fish habitat (Type 1)	Seagrass
	Subtidal rocky reef
Moderately sensitive key fish habitat (Type 2)	Intertidal rocky shore
	Mangrove
	Intertidal sand and mudflat
Minimally sensitive key fish habitat (Type 3)	Deep water soft sediment
	Open water

Threatened marine ecological communities, species and endangered populations

No threatened marine ecological communities listed under the FM Act or the EPBC Act have been identified in the marine biodiversity study area. One endangered population listed under the FM Act has a high likelihood of occurrence within the marine biodiversity study area. The *Posidonia australis* seagrass population is considered to have a high likelihood of occurrence within the marine biodiversity study area due to the presence of populations in the surrounding area.

Two listed marine species were identified as having a high likelihood of occurrence within the construction footprint; the Black Rockcod (*Epinephelus daemelii*) and the New Zealand Fur-Seal (*Arctocephalus forsteri*). These species have a high likelihood of occurrence due to the presence of suitable habitat within the construction footprint. In addition, 10 species were identified as having a moderate likelihood of occurrence within the construction footprint.

In addition to these 10 species, White's Seahorse (*Hippocampus whitei*), which is currently listed as protected under the FM Act and EPBC Act, has been nominated for threat-listing under the FM Act. A preliminary assessment under the FM Act threatened species protection has been carried out for completeness. White's Seahorse was identified as having a high likelihood of occurrence within the construction footprint, based on the presence of suitable habitat within the construction footprint.

Details of the 13 listed marine species likely to occur within the construction footprint are provided in Table 19-11.

Migratory marine species

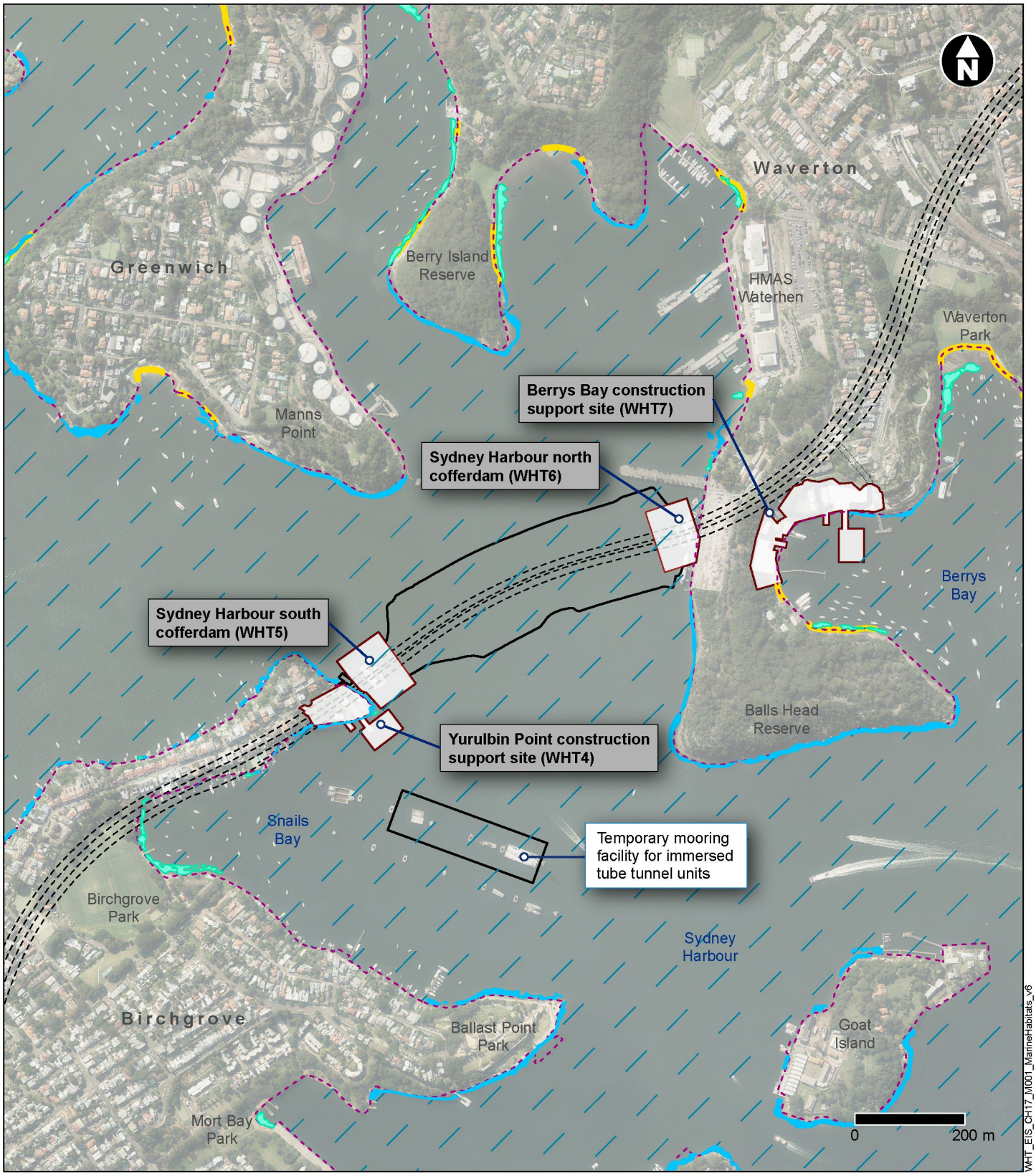
No migratory marine species listed under the EPBC Act have a high or moderate likelihood of occurrence in the construction footprint.

Table 19-11 Threatened marine species known or likely to occur in the construction footprint

Species	Conservation significance	Likelihood of occurrence in the construction footprint
Black Rockcod (*Epinephelus daemelii*)	Vulnerable (FM Act) Vulnerable (EPBC Act)	High. Suitable habitat for this species is present throughout the marine areas of the construction footprint. Suitable habitat for this species within the construction footprint includes both subtidal, and medium to high relief rocky reef areas, which are present along the shorelines of Sydney Harbour.
White's Seahorse (*Hippocampus whitei*)	Nominated for threat listing	High Suitable habitat for this species is present within the marine areas of the construction footprint, including subtidal, low, medium and high relief, rocky reef areas and in *Halophila*, *Zostera* and *Posidonia* seagrasses.
New Zealand Fur-seal (*Arctocephalus forsteri*)	Vulnerable (BC Act)	High. Foraging habitat and suitable rest areas are present throughout the marine areas of the construction footprint. One individual has returned annually to the Sydney Opera House steps since 2014 and is likely to forage in Sydney Harbour.
Australian Fur-seal (*Arctocephalus pusillus doriferus*)	Vulnerable (BC Act)	Moderate. Foraging habitat and suitable rest areas are present throughout the marine areas of the construction footprint.
Southern Right Whale (*Eubalaena australis*)	Endangered (BC Act) Endangered, migratory (EPBC Act)	Moderate. This species is one of the most commonly sighted species in Sydney Harbour. Suitable habitat for use during annual migration is present throughout the marine areas of the construction footprint.
Humpback Whale (*Megaptera novaeangliae*)	Vulnerable (BC Act) Vulnerable, migratory (EPBC Act)	Moderate. This species is one of the most commonly sighted species in Sydney Harbour. Suitable habitat for use during annual migration is present throughout the marine areas of the construction footprint.

Species	Conservation significance	Likelihood of occurrence in the construction footprint
Loggerhead Turtle (*Caretta caretta*)	Endangered (BC Act) Endangered, migratory, marine (EPBC Act)	Moderate. This species has been anecdotally recorded within the marine biodiversity study area, however high-quality preferred habitat for this species is not present within the marine areas of the construction footprint.
Green Turtle (*Chelonia mydas*)	Vulnerable (BC Act) Vulnerable, migratory, marine (EPBC Act)	Moderate. This species has been anecdotally recorded within the marine biodiversity study area, however high-quality preferred habitat for this species is not present within the marine areas of the construction footprint.
Leatherback Turtle (*Dermochelys coriacea*)	Endangered (BC Act) Endangered, migratory, marine (EPBC Act)	Moderate. This species has been anecdotally recorded within the marine biodiversity study area, however high-quality preferred habitat for this species is not present within the marine areas of the construction footprint.
Hawksbill Turtle (*Eretmochelys imbricata*)	Vulnerable, migratory, marine (EPBC Act)	Moderate. This species has been anecdotally recorded within the marine biodiversity study area, however high-quality preferred habitat for this species is not present within the marine areas of the construction footprint.
Flatback Turtle (*Natator depressus*)	Vulnerable, migratory, marine (EPBC Act)	Moderate. This species has been anecdotally recorded within the marine biodiversity study area, however high-quality preferred habitat for this species is not present within the marine areas of the construction footprint.
Grey Nurse Shark (*Carcharias taurus*)	Critically endangered (FM Act) Critically endangered (EPBC Act)	Moderate. Foraging habitat for this species is present throughout the marine areas of the construction footprint.

Species	Conservation significance	Likelihood of occurrence in the construction footprint
White Shark (*Carcharodon carcharias*)	Vulnerable (FM Act) Vulnerable, migratory (EPBC Act)	Moderate. Foraging habitat for this species is present throughout the marine areas of the construction footprint.



Legend

Construction features
- Construction footprint
- Construction support site
- Tunnel section

Highly sensitive key fish habitat (Type 1)
- Seagrass
- Subtidal rocky reef

Moderately sensitive key fish habitat (Type 2)
- Intertidal rocky shore
- Intertidal sand and mudflat

Minimally sensitive key fish habitat (Type 3)
- Shallow and deep soft sediment habitat

Figure 19-12 Marine habitats within the marine biodiversity study area

19.4 Assessment of potential impacts

This section assesses the potential impacts during construction and operation of the project on:

- Terrestrial flora, including removal of vegetation and loss of threatened flora species, edge effects, spread of weeds and pathogens (Section 19.4.1)
- Terrestrial fauna, including potential removal or degradation of fauna habitat, fauna injury and mortality, noise, vibration, dust and light spill impacts (Section 19.4.2)
- Aquatic biodiversity, including potential loss of aquatic habitat and water quality impacts (Section 19.4.3)
- Marine biodiversity, including potential loss of marine habitat, marine water quality impacts, and underwater noise impacts (Section 19.4.4).

19.4.1 Assessment of potential impacts to terrestrial flora

Removal of vegetation

Construction of the project would require removal of about 7.29 hectares of vegetation (refer to Table 19-12), which comprises native plantings, planted medians, non-native species or weeds. Most of the vegetation to be removed would be located within the Warringah Freeway road reserve and the Cammeray Golf Course construction support sites (WHT10 and WFU8). Additionally, a small area of vegetation would be removed from the Yurulbin Point construction support site (WHT4).

No native vegetation (vegetation consistent with any plant community types or threatened ecological communities) would be removed as part of the project. This includes the small area of native vegetation consistent with plant community type 1778 Smooth-barked Apple - Coast Banksia/Cheese Tree open forest on sandstone slopes on the foreshores of the drowned river valleys of Sydney that was identified within the Berrys Bay construction support site (WHT7), which would be protected and retained during construction of the project through the implementation of an exclusion zone.

No biodiversity offsets would be required for the removal of the vegetation types listed below.

The removal of a potential hollow-bearing tree would be required in Jeaffreson Jackson Reserve; potential impacts on fauna species, as a result of this removal are discussed in Section 19.4.2.

Table 19-12 Vegetation to be removed as part of the project

Vegetation type	Area removed (ha)
Native plantings	2.99
Native plantings (planted median)	2.84
Urban exotic/native	1.11
Weeds and exotics	0.35
Total area of vegetation to be removed	**7.29**

Removal of threatened flora species

Potential impacts to threatened flora species as a result of the project are summarised in Table 19-13, including impacts to planted individuals of Sunshine Wattle (*Acacia terminalis* subsp.

terminalis), Narrow-leaved Black Peppermint (*Eucalyptus nicholii*) and Wallangarra White Gum (*Eucalyptus scoparia*). These impacts are indicative based on the current level of design development and would be confirmed during further design development.

Table 19-13 Summary of threatened flora species impacts

Species	Conservation significance	Habitat or individuals to be impacted
Sunshine Wattle (*Acacia terminalis* subsp. *terminalis*)	Endangered (BC Act and EPBC Act)	One remnant individual
Narrow-leaved Black Peppermint *(Eucalyptus nicholii)*	Vulnerable (BC Act and EPBC Act)	Up to seven planted individuals
Wallangarra White Gum *(Eucalyptus scoparia)*	Endangered (BC Act) Vulnerable (EPBC Act)	Up to two planted individuals

The project would not have a significant impact on any of these threatened flora species based on the very low numbers of remnant individuals to be removed, and the fact that other individuals are planted. Biodiversity offsets would be provided for impacts to the single individual of *Acacia terminalis* subsp. *terminalis* recorded in the construction footprint, as outlined in Section 19.5. Offsets are not required for impacts to the Narrow-leaved Black Peppermint (*Eucalyptus nicholii*) and Wallangarra White Gum (*Eucalyptus scoparia*).

Edge effects on native vegetation

Native vegetation in Balls Head Reserve is next to the Berrys Bay construction support site (WHT7) at Waverton. The plant community type 1778: Smooth-barked Apple – Coast Banksia / Cheese Tree open forest on sandstone slopes on the foreshores of the drowned river valleys of Sydney is located on elevated rocky slopes, above buildings that would be used as site offices.

Native vegetation within the construction footprint would be retained and protected within an exclusion zone, to ensure no clearance of this vegetation would occur. No native vegetation would be cleared for the project, and as such no new ‘edges’ would be created. Given this, with the implementation of the exclusion zone, indirect impacts to native vegetation as a consequence of edge effects are considered unlikely to occur as a result of the project.

Invasion and spread of weeds, pathogens and disease

An increase in the movement of people, vehicles, machinery, vegetation waste and soil during and following construction activities may facilitate the introduction or spread of exotic grasses and other weeds that currently occur. Disturbed areas, such as those in which earthworks are to be carried out, would be particularly susceptible to weed establishment. The construction footprint is highly urbanised, with little to no native vegetation, reducing the threat of weeds to biodiversity. Even so, environmental management measures would be implemented to minimise the risk of introduction and spread of weeds.

In addition, the project has the potential to increase the spread of pathogens that threaten native biodiversity values, such as the soil-borne pathogen *Phytophthora cinnamomi* (Phytophthora). This pathogen is associated with damage and death to native plants. Construction of the project has the potential to increase the spread of this pathogen which could be dispersed by vehicles, animals, walkers and the movement of soil, or over large distances in flowing water, such as storm runoff. Management measures would be implemented to minimise the spread of weeds and pathogens during construction of the project (refer to Section 19.5).

19.4.2 Assessment of potential impacts to terrestrial fauna

Removal of fauna habitat

Table 19-14 provides a summary of the potential impacts to terrestrial fauna habitats and associated threatened species for the following habitat types:

- Vegetated habitats
- Man-made structures and built environments (including existing buildings, jetties and wharves)
- Marine and intertidal habitats. The assessment of potential impacts to marine species habitat is discussed in Section 19.4.4.

Construction of the project would require removal of about 7.29 hectares of vegetation (refer to Table 19-12), which comprises native plantings, non-native species or weeds. Most of the vegetation to be removed would be located within the Warringah Freeway road reserve and the Cammeray Golf Course construction support sites (WHT10 and WFU8). Additionally, a small area of vegetation would be removed from the Yurulbin Point construction support site (WHT4). The removal of flowering and fruiting trees, shrubs and ground layer vegetation would result in the loss of potential foraging and sheltering habitat to a number of threatened fauna species known or considered likely to occur in the construction footprint. However, these impacts would be negligible since the habitat to be removed does not comprise a significant proportion of habitat available to species in the surrounding terrestrial biodiversity locality or wider bioregion.

Further to this, the limited extent of vegetated fauna habitat within the construction footprint occurs as small, isolated patches that do not maintain habitat connectivity with any large areas of native vegetation in the wider locality. Much of the vegetation which would be removed is currently subject to regular and on-going disturbance and maintenance (ie pruning and mowing).

Direct impacts to man-made structures and the built environment would be limited to some structures at Yurulbin Park and Berrys Bay, which offer limited and marginal potential roosting habitat for some bat species including the Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*), Eastern Freetail-bat (*Mormopterus norfolkensis*), Little Bentwing-Bat (*Miniopterus australis*), and Southern Myotis (*Myotis macropus*). These works would be unlikely to adversely impact such species. Pre-clearing surveys for bat roosts would be carried on structures prior to them being demolished. If microbats are identified as roosting in these structures, individuals would be appropriately managed and excluded from these areas prior to works commencing (refer to Section 19.5). Therefore, the project is unlikely to adversely impact any threatened bat species.

The removal of a potential hollow-bearing tree in Jeaffreson Jackson Reserve would result in the loss of nesting, roosting and/or sheltering habitat for locally occurring hollow-dependent fauna species, such as Brushtail Possum and Sulphur-crested Cockatoo. Its removal is unlikely to impact any threatened fauna species.

No marine or intertidal habitats that provide potential habitat for terrestrial fauna would be directly impacted by the project.

Table 19-14 Potential impacts to threatened fauna habitats and associated fauna species

Habitat type	Known or likely threatened fauna species	Potential impacts
Vegetated habitats	• Grey-headed Flying-fox (*Pteropus poliocephalus*) • Eastern Bentwing-bat (Miniopterus schreibersii oceanensis) • Eastern Freetail-bat (Mormopterus norfolkensis) • Little Bentwing-Bat (*Miniopterus australis*) • Powerful Owl (*Ninox strenua*) • White-bellied Sea Eagle.	• Negligible impacts due to the loss of potential foraging and sheltering habitat associated with vegetation to be removed • The removal of a small area of vegetation would not substantially contribute to an increase in habitat fragmentation • The proposed construction site offices within the Berrys Bay construction support site (WHT7) would be established in existing buildings, minimising potential edge effects to nearby vegetated habitat and associated species during site establishment • Potential noise, vibration, dust and light spill impacts are not expected to be significant given that most construction areas would occur in already highly urbanised areas. This includes works next to Balls Head Reserve.
Man-made structures and built environments	• Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*) • Eastern Freetail-bat (*Mormopterus norfolkensis*) • Little Bentwing-Bat (*Miniopterus australis*) • Southern Myotis (*Myotis macropus*).	• Direct impacts would be limited to some structures at Yurulbin Park and at Berrys Bay which offer limited and marginal potential roosting habitat. With the implementation of appropriate management measures including pre-clearing surveys prior to demolition of these structures, the project is unlikely to adversely impact any roosting habitat for threatened bat species • Potential noise, vibration, dust and light spill impacts on other potential roosting and nesting habitat associated with wharves, jetties and buildings within and next to the construction footprint are expected to be minor, with adverse impacts on threatened bat species unlikely • Potential noise and vibration impacts to roosting Eastern Bentwing-bats (*Miniopterus schreibersii oceanensis*) within the coal loader tunnels at Waverton, particularly during autumn and winter when this roost is known to be occupied. Adaptive management strategies would be developed in consultation with the Department of Planning, Industry and Environment (Environment, Energy and Science), Department of Planning, Industry and Environment (Regions, Industry, Agriculture and Resources), North Sydney Council and/or an appropriately qualified expert in microbat biology and behaviour and implemented to minimise potential adverse impacts as required.

Fauna injury and mortality

The majority of fauna species recorded within the construction footprint are highly mobile bird and mammal species that are likely to be able to move away from these types of activities quite readily. No threatened fauna species typically at risk of fauna strike (ie slow-moving fauna species) have been recorded in the construction footprint. Therefore, impacts on locally occurring fauna species during construction are considered unlikely. However, there is potential that terrestrial fauna injury or mortality would occur as a result of construction activities such as vegetation clearing (particularly during the felling of trees), or may result from collisions with work vehicles or plant, or accidental entrapment in plant, trenches or other works.

The threatened Little Penguin (*Eudyptula minor*) could be susceptible to collisions with watercraft or barges carrying out construction within Sydney Harbour. However, this species typically forages in shallow waters at the shoreline, which the project largely avoids. Sydney Harbour is subject to high levels of water traffic and the species may be adapted to avoiding water vessels.

Impacts during operation are unlikely to occur since no threatened fauna species typically at risk of fauna strike have been recorded in the area, and most of the project would be located underground. Surface connections would be located in highly urbanised areas and within existing road corridors absent of native vegetation and intact fauna habitat.

Noise, vibration, dust and light spill impacts

Potential noise, vibration, dust and light spill impacts are not expected to be significant given that most construction areas would occur in already highly urbanised areas.

Construction activities would result in localised and temporary noise and vibration impacts; however, as construction areas occur in highly urbanised areas that are subject to high levels of ambient noise, any increase in noise and vibration is not expected to have a significant impact on terrestrial fauna.

Noise and vibration would potentially impact the Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*) known to roost within one of the coal loader tunnels at Waverton during autumn and winter. This would include potential impacts during construction of the tunnels for the project, including locations around 10 metres below the coal loader tunnels, and construction activities associated with the Sydney Harbour north cofferdam (WHT6). Adverse impacts during summer and spring are unlikely, given that the roost has not been known to be occupied during these seasons. Potential noise and vibration impacts to the Eastern Bentwing-bat would be appropriately managed through measures outlined in Section 19.5.

Construction activities in Sydney Harbour resulting in impulsive or continuous underwater noise may lead to altered behaviour of the Little Penguin (*Eudyptula minor*). The species may avoid foraging in areas subjected to continuous or high levels of sound. Sudden or high levels of sound may have the potential to result in hearing loss or damage to auditory tissues in the Little Penguin. The potential for an impact to occur and the scale or nature of impact would depend on an individual penguin's proximity to construction activities, lessening as distance from construction activities increases. Given the level of construction activity proposed in the harbour, it is expected that individuals of the species would avoid the area reducing the risk of hearing loss and/or auditory damage occurring.

Water quality impacts

Construction works within Sydney Harbour have the potential to result in water quality impacts (eg during piling and dredging activities) which could result in potential adverse impacts to foraging habitat for threatened fauna species such as the Little Penguin (*Eudyptula minor*) and White-bellied Sea Eagle (*Haliaeetus leucogaster*). However, the selected methodology for the project has considered dredging methods and controls to limit the potential for turbidity impacts and mobilisation of sediment, in order to minimise the impact on the surrounding marine environment.

This includes, but is not limited to, the installation of floating silt curtains and other management measures. Accordingly, any potential increase in turbidity and sedimentation of marine waters near construction activities would be minimal, localised and temporary.

19.4.3 Assessment of potential impacts to aquatic biodiversity

Loss of aquatic habitat and hydrological impacts

No riparian vegetation would be removed as part of the project and no instream works would be carried out in the waterways traversed by the project. Accordingly, there would be no direct impacts to these waterways.

Water quality impacts

One highly modified waterway occurs within the construction footprint: Whites Creek. The lower reach of Whites Creek is located near Rozelle Rail Yards construction support site (WHT1). No instream works are proposed in this waterway as part of this project.

The catchments of three other waterways fall within the construction footprint: Willoughby Creek, Flat Rock Creek and Quarry Creek. No instream works are proposed in these waterways.

No threatened fauna species were identified within freshwater habitat in or downstream of the construction footprint. Accordingly, there would be no removal, fragmentation or modification to freshwater ecology or associated geomorphology of these waterways as a result of the project.

Construction activities near Whites Creek at Rozelle Rail Yards construction support site (WHT1), and along the Warringah Freeway corridor at Cammeray and Naremburn, could result in soil erosion, siltation and off-site movement of eroded sediments by stormwater into downstream waterways. The highest risk construction activity would be earthworks. If unmanaged, construction activities could increase levels of turbidity and sediment deposition, decrease dissolved oxygen and change pH levels in downstream waterways. Accidental fuel and chemical spills and contaminated runoff from construction vehicles, plant, equipment or chemical storage areas have the potential to reach downstream waterways.

Potential impacts of construction activities on water quality and surface flows would be managed by the implementation standard environmental management measures as outlined in Chapter 17 (Hydrodynamics and water quality) including erosion and sediment controls for all work sites and surface work areas. With the implementation of appropriate measures during construction, impacts to water quality would be temporary and manageable. Water treatment devices, such as construction sediment basins, would be located where they collect a high proportion of sediment-laden runoff from disturbed areas of the construction.

During construction, treated wastewater would be discharged to Rozelle Bay, Iron Cove, Snails Bay, Berrys Bay and Willoughby Creek. During operations, treated wastewater would be discharged to Rozelle Bay. Discharges from the wastewater treatment plants during construction and operation would be designed to improve or maintain water quality in the receiving environment.

19.4.4 Assessment of potential impacts to marine biodiversity

Impacts to key fish habitat

A risk assessment relating to the potential hazards to Type 1, 2 and 3 key fish habitats within the marine biodiversity study area is summarised in Table 19-15, including the removal of habitat, altered hydrodynamics, elevated turbidity and sedimentation from dredging, mobilisation of contaminants, introduction of marine pests and underwater noise from dredging and piling.

Removal of medium/high relief rocky reef habitat would occur during the installation of the Sydney Harbour south (WHT5) and Sydney Harbour north (WHT6) cofferdams. This has the potential to provide habitat for the Black Rockcod species and White's Seahorse. As the removal of this habitat would be limited to less than 0.01 hectares, impacts would be small relative to the extent of the habitats in Sydney Harbour so as to not compromise the functionality, long-term connectivity or viability of habitats, or ecological processes beyond the affected areas. No offsets would be required as this area of rocky reef would be reinstated after construction and there would therefore be no net loss of habitat.

Dredging for the installation of the immersed tube tunnels would also result in the removal of about 10.51 hectares of deepwater soft sediment habitat. These areas are expected to recover quickly through natural processes of recruitment, immigration of marine flora and fauna species and reinstatement of habitat after construction is completed.

There is also potential for scour from vessel movement and changes in water quality from wastewater discharge during construction of the project to result in removal of a small patch of seagrass habitat between Yurulbin Park and the Sydney Harbour south cofferdam (WHT5). With appropriate management of vessel activities and wastewater discharge, impacts to this habitat would be minimal.

Alteration of hydrodynamics associated with the construction of the Sydney Harbour south (WHT5) and Sydney Harbour north (WHT6) cofferdams would impact currents around Type 1 key fish habitats, mostly reductions. During the high and low tides, differences would be more noticeable in the surface layer when compared to bottom layers. Modelling of temporary changes to current speeds carried out for the project construction phase indicated that while the temporary changes would be relatively large in some locations at some parts of the tidal cycle, substantial impacts are not expected for the key fish habitats within the marine biodiversity study area. The alteration to hydrodynamics would be temporary and not outside of the range of current speeds found where Type 1 key fish habitat, including seagrass and rocky reef exist in other parts of the marine biodiversity study area. As the seabed at the immersed tube tunnel crossing would be restored to the existing profile after construction, there would be no permanent alterations to hydrodynamics in the operation phase of the project.

Turbidity and sedimentation caused by dredging during the construction of the project has the potential to impact on about 0.01 hectares of rocky reef habitat. It also has the potential to impact on two small patches of seagrass, totalling about 0.03 hectares. The modelled predicted sedimentation load carried out for the project indicated that the project is unlikely to substantially impact these habitats. Impacts associated with turbidity and sedimentation would be temporary and limited to the construction phase of the project, and would not adversely impact the broader ecological functioning of marine communities.

Underwater noise would be caused by dredging and piling during the construction of the project in Sydney Harbour. Construction related underwater noise may be impulsive or continuous and has the potential to impact on fish and shark species within the marine biodiversity study area, including in seagrass, rocky reef, deepwater and open water habitats. Potential impacts may include physical impacts to marine species, such as impacts to foraging behaviours and potential impacts to hearing loss or organ impacts, and changes to the behaviour of marine species to avoid underwater noise generated by the project. Modelling carried out for the project indicated that impacts would be largely limited to the immediate location of piling and dredging activities but may extend to about 0.43 kilometres of the noise source, with the potential to impact up to 0.02

hectares of seagrass habitat, 0.79 hectares of rocky reef habitat, and 121.25 hectares of deepwater and open water habitat. As different species have different tolerance thresholds to underwater noise, there would be a range of potential responses to these impacts. It is expected that any impacts to marine species would not affect the broader ecological functioning or viability of local populations due to the temporary nature of underwater noise impacts, with any changes in species assemblages recovered through natural processes of recruitment and immigration.

Overall, the impacts on key fish habitats during construction and operation of the project are not considered to be significant and would be adequately managed by the measures identified in Section 19.5.

Table 19-15 Risk assessment for key fish habitats

Hazard	Highly sensitive key fish habitat (Type 1)		Moderately sensitive key fish habitat (Type 2)			Minimally sensitive key fish habitat (Type 3)	
	Seagrass	Subtidal rocky reef	Intertidal rocky shore	Mangrove	Intertidal sand and mudflat	Deep water soft sediment	Open water
Removal of habitat	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Moderate
Turbidity	Moderate	Moderate	Moderate	Low	Moderate	Moderate	Moderate
Sedimentation	Moderate	Moderate	Moderate	Low	Moderate	Moderate	N/A
Mobilisation of contaminants	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Moderate
Introduction/spread of marine pests	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Moderate
Altered hydrodynamics	Moderate	Moderate	Moderate	Low	Moderate	Moderate	Moderate
Underwater noise	Moderate	Moderate	N/A	Low	Low	Moderate	Moderate
Boat strike to marine mammals and reptiles	Moderate	Moderate	N/A	N/A	N/A	Moderate	Moderate
Spill of contaminants	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate

Impacts to marine threatened species and ecological communities

A risk assessment relating to potential hazards to threatened species and ecological communities within the marine biodiversity study area is summarised in Table 19-16.

Threatened or protected species, populations or endangered ecological communities listed under the FM Act, BC Act or EPBC Act that are most likely to be affected by the project are those that would reside, forage or transit through habitat that would be affected during construction activities. This includes the Black Rockcod and White's Seahorse because of their potential to reside in moderate or high relief rocky reef, although only a very few individuals of this species would occur in the small areas of this habitat where individuals would potentially be harmed.

Some marine mammals, marine turtles and elasmobranchs could also occur because of their potential to either forage on or transit through seagrass, rocky reef or deepwater soft sediment habitats but their potential for occurrence in the small parts of these habitats where species could be harmed from the project would be low given the habitat is suboptimal. As marine mammals and marine turtles can be observed above the water, impacts to marine mammals would be manageable.

As the potential for impact during the construction phase of the project would be largely limited to the temporary disturbance of individual marine species, the potential for significant impacts to any threatened species would be minor and would not affect the viability of local populations of listed species.

In summary, the project is not expected to have a significant impact on any marine threatened species, populations or endangered ecological communities (including those which are matters of national environmental significance).

Table 19-16 Risk assessment for threatened marine species and ecological communities

Hazard	Threatened marine species (grouped)			
	Fish (specifically Black Rockcod and White's Seahorse)	Mammals	Reptiles	Sharks
Removal of habitat	Moderate	Moderate	Moderate	Moderate
Turbidity	Moderate	Moderate	Moderate	Moderate
Sedimentation	Moderate	N/A	Moderate	Moderate
Mobilisation of contaminants	Moderate	Low	Low	Low
Introduction/spread of marine pests	Moderate	N/A	Low	Low
Altered hydrodynamics	Moderate	Moderate	Moderate	Moderate
Underwater noise	Moderate	Moderate	Moderate	Moderate
Boat strike to marine mammals and reptiles	N/A	Moderate	Moderate	N/A
Spill of contaminants	Moderate	Low	Low	Low

19.5 Environmental management measures

Environmental management measures relating to biodiversity impacts are outlined in Table 19-17. The required biodiversity offsets for the project are outlined in Section 19.5.1.

Table 19-17 Environmental management measures for biodiversity impacts

Ref	Phase	Impact	Environmental management measure	Location
B1	Construction	Removal of native vegetation and threatened species habitat	Vegetation removal will be further minimised, where feasible and reasonable.	WHT/WFU
B2	Construction	Removal of native vegetation and threatened species habitat	Vegetation removal will be carried out in accordance with *Guide 4: Clearing of vegetation and removal of bushrock* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011a).	WHT/WFU
B3	Construction	Removal of native vegetation and threatened species habitat	The unexpected species find procedure included in *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011b) will be followed if threatened ecological communities, flora or fauna species, not assessed in the biodiversity assessment, are identified in the construction footprint.	WHT/WFU
B4	Construction	Removal of native vegetation and threatened species habitat	Vegetation will be re-established, where feasible and reasonable, in accordance with *Guide 3: Re-establishment of native vegetation* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011c).	WHT/WFU
B5	Construction	Removal of threatened flora species	Pre-clearing surveys for threatened flora species will be carried out in accordance with *Guide 1: Pre-clearing process* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011d).	WHT/WFU
B6	Construction	Noise, vibration and light impacts	Carry out inspections of Eastern Bentwing-bat roosting sites in the surrounding locality (eg concrete box culverts, jetties) prior to construction, to determine the roosting capacity of each site at times roosting numbers are expected to be high.	WHT
B7	Construction	Noise, vibration and light impacts	Monthly monitoring of Eastern Bentwing-bats in the Coal Loader tunnel will be carried out prior to construction (in the months of March to September), preferably by utilising thermal camera imaging at tunnel entrances (a less invasive method than carrying out counts within the tunnel itself).	WHT

Ref	Phase	Impact	Environmental management measure	Location
B8	Construction	Noise, vibration and light impacts	Monthly monitoring of Eastern Bentwing-bats in the Coal Loader tunnel during construction (in the months of March to September) will be carried out, preferably by utilising thermal camera imaging at tunnel entrances (a less invasive method than carrying out counts within the tunnel itself).	WHT
B9	Construction	Noise, vibration and light impacts	Adaptive management measures (supplemented by additional monitoring if required) to minimise impacts on the Eastern Bentwing-bat will be developed in consultation with Department of Planning, Industry and Environment (Environment, Energy and Science, and the Regions, Industry, Agriculture and Resources divisions), North Sydney Council and an appropriately qualified expert in microbat biology and behaviour, if monthly monitoring during construction suggests Eastern Bentwing-bat behaviour is affected by construction noise.	WHT
B10	Construction	Injury and mortality of fauna	Fauna will be managed in accordance with *Guide 9: Fauna handling of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011e).	WHT/WFU
B11	Construction	Injury and mortality of fauna	Pre-clearing surveys will be carried out in accordance with *Guide 1: Pre-clearing process* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011d).	WHT/WFU
B12	Construction	Injury and mortality of fauna	Pre-clearing surveys for microbat roosts will be carried out on the wharf structures to be demolished at Yurulbin Point (WHT4) and Berrys Bay (WHT7) construction support sites. If microbats are identified roosting in these structures, individuals will be excluded from this roosting habitat.	WHT
B13	Construction	Injury and mortality of fauna	An observer qualified to spot Little Penguins will be used during marine construction activities. A stop-work procedure would be implemented upon sighting of the species in the proximity of the works area.	WHT
B14	Construction	Invasion and spread of weeds, pests, pathogens and disease	Weed species will be managed in accordance with *Guide 6: Weed management* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011f).	WHT/WFU

Ref	Phase	Impact	Environmental management measure	Location
B15	Construction	Invasion and spread of weeds, pests, pathogens and disease	Pathogens will be managed in accordance with *Guide 2: Exclusion zones* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011g).	WHT/WFU
B16	Construction	Impacts to marine vegetation and sensitive habitat	Transit routes for vessels entering and departing from construction support sites will be marked out with consideration for propeller wash and distances to sensitive marine habitats.	WHT
B17	Construction	Impacts to marine vegetation and sensitive habitat	Exclusion zones will be implemented to avoid disturbance to sensitive marine habitats not proposed to be directly impacted by the project. These include any intertidal sand and mudflats, intertidal rocky shore, subtidal rocky reef and seagrass habitats with potential to occur within or next to transit routes and vessel movements. Routine inspections and maintenance of exclusion fencing would be carried out.	WHT
B18	Construction	Impacts to marine vegetation and sensitive habitat	The velocity of wastewater treatment plant discharge will be minimised to avoid scour impacts on the marine environment.	WHT/WFU
B19	Construction	Impacts to marine vegetation and sensitive habitat	To minimise the potential impact of turbidity (suspended sediment) on sensitive marine vegetation and habitats silt curtains will be installed around seagrass patches and subtidal rocky reef contained within the Zone of Influence.	WHT
B20	Construction	Impacts to marine vegetation and sensitive habitat	Silt curtains will be monitored for effectiveness particularly following inclement weather and maintenance carried out when required, Records of monitoring and maintenance will be kept.	WHT
B21	Construction	Impacts to marine vegetation and sensitive habitat	Subtidal rocky reef and intertidal rocky shore habitat removed along the shoreline at the Sydney Harbour south cofferdam (WHT5) and Sydney Harbour north cofferdam (WHT6) will be rehabilitated and restored as close as possible to pre-construction conditions where feasible and reasonable.	WHT

Ref	Phase	Impact	Environmental management measure	Location
B22	Construction	Invasion and spread of marine pests, pathogens and disease	Locally sourced vessels and equipment will be used where feasible and reasonable. Any vessels sourced internationally will be inspected for potential marine pests prior to departing from their previous port. Construction contractors will need to demonstrate that due diligence has been taken to avoid introducing marine pests, pathogens or disease from internationally sourced vessels and/or construction equipment prior to departure.	WHT
B23	Construction	Invasion and spread of marine pests, pathogens and disease	A targeted survey will be conducted of the dredge footprint to locate any areas of the marine algal pest *Caulerpa taxifolia*. If *Caulerpa taxifolia* is identified within the dredging footprint, surface sediments from these areas will be disposed of onshore rather than in the marine environment.	WHT
B24	Construction	Impacts to marine species	A stop work procedure will be developed to address marine mammal or reptile activity.	WHT
B25	Construction	Impacts to marine species	Salvage of live fish and other native marine organisms (eg large, mobile macroinvertebrates) will occur during cofferdam dewatering. All salvaged organisms will be immediately relocated to similar habitat nearby.	WHT
B26	Construction	Underwater noise impacts to marine species	Visual monitoring from the harbour surface will be carried out to identify any underwater noise related impacts on fish. If required, additional at source protection measures will be considered.	WHT

19.5.1 Biodiversity offsets

Species credits would be required as part of the biodiversity offsets for the project, as outlined below. A species credit is a class of biodiversity credit 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 Biodiversity Data Collection (OEH, 2017 and OEH, 2019). Offsets are identified and a preliminary strategy is provided in Appendix S (Technical working paper: Biodiversity development assessment report).

Offsets required for the potential threatened species impacted by the project that require species credits are summarised in Table 19-18.

Table 19-18 Threatened species offsets – species credits

Species	Individuals	Species credits
Sunshine Wattle (*Acacia terminalis subsp. terminalis*)	1	2

The impacts of a development and gains in biodiversity values at biodiversity stewardship sites are measured in biodiversity credits.

Chapter 20

Land use and property

January 2020

20 Land use and property

This chapter considers the potential impacts of the project on land use and property from the construction and operation of the project.

The Secretary's environmental assessment requirements as they relate to land use and property, and where in the environmental impact statement these have been addressed, are detailed in Table 20-1.

The proposed environmental management measures relevant to land use and property are included in Section 20.5.

Table 20-1 Secretary's environmental assessment requirements – Land use and property

Secretary's requirement	Where addressed in EIS
Environmental Impact Statement	
1. The EIS must include, but not necessarily be limited to, the following: b. a description of the project and all components and activities (including ancillary components and activities) required to construct and operate it, including: - land use changes as a result of the proposal and the acquisition of privately owned, Council and Crown lands, and impacts to Council and Crown lands.	Impacts to properties, including property acquisitions and future land uses during construction and operation is discussed in **Section 20.4.**
Socio-economic, Land Use and Property	
1. The Proponent must assess social and economic impacts (of all phases of the project) in accordance with the current guidelines (including cumulative construction and operational impacts of the proposal and major projects in the vicinity of the project) and in consultation with relevant landowners (such as the Ports Authority of NSW and those landowners whose property is being acquired).	Socio economic impacts as a result of the project are presented in **Section 21.4** and **Section 21.5** of Chapter 21 (Socio-economics). **Chapter 27** (Cumulative impacts) assesses the cumulative construction and operational impacts of the proposal and major projects in the vicinity of the project.
2. The Proponent must assess impacts from construction and operation on potentially affected properties, businesses, recreational users and land and water users (including potential cumulative impacts associated with use of Glebe Island and White Bay in consideration of other major developments in the precinct), including amenity impacts (including from cumulative and extended construction time frames and construction fatigue), property acquisitions/adjustments, future land uses, access, relevant statutory rights, and community severance and barrier impacts resulting from the project.	Impacts to properties, including property acquisitions and future land uses during construction and operation is discussed in **Section 20.4**. **Sections 21.4** and **Section 21.5** present the socio-economic impacts as a result of the project. **Chapter 27** (Cumulative impacts) assesses the cumulative construction and operational impacts of the proposal and major projects in the vicinity of the project.

Secretary's requirement	Where addressed in EIS
3. Where an immersed tube method (IMT) of construction is proposed for use in Sydney Harbour, the Proponent must: a. provide details of how reductions to current Harbour depths will be avoided;	The immersed tube tunnel construction methodology is presented in **Chapter 6** (Construction works). Details of the alternatives considered for the immersed tube tunnel are detailed in **Chapter 4** (Project development alternations).
b. provide details confirming the level of protection for the IMTs will be similar to or better than that of the existing Sydney Harbour Tunnel;	**Chapter 6** (Construction work) provides details confirming the level of detail of protection for the immersed tube tunnels.
c. identify impacts to ship scheduling in consultation with the Harbour Master;	**Chapter 8** (Construction traffic and transport) and **Chapter 9** (Construction traffic and transport) describes the impacts related to the construction and operation of the immersed tube tunnel. **Chapter 8** also specifies the consultation requirements with the Harbour Master to minimise impacts during construction. **Section 21.4, Section 21.5** and **Appendix U** (Technical working paper: Socio-economic Assessment) discuss impacts to ship scheduling.
d. assess the impact to the Viva supply chain for fuel oils at Gore Cove; and	**Chapter 8** (Construction traffic and transport) assesses the impacts related to construction activities in Sydney Harbour.
e. provide details of full mission simulation which takes in account, but is not necessarily limited to: - movement and placement of the IMTs; and - identification of weather restrictions and towage requirements for the safe movement of seagoing ships to and from berths in Glebe Island, White Bay, Gore Cove and past proposed Project work areas in Glebe Island and White Bay, and Birchgrove to Waverton.	**Chapter 8** (Construction traffic and transport) presents the outcomes of the simulation report which shows that movements would be feasible and would be able to be carried out safely.
4. The Proponent must assess potential impacts on utilities (including communications, electricity, gas, fuel and water and sewerage) and the relocation of these utilities.	**Chapter 6** (Construction work), details utilities impacted during construction. **Chapter 5** (Project description) outlines utilities and services management for the project and **Appendix D** (Utilities management strategy) provides a detailed description of utilities likely to be impacted and a framework for utility installations, relocations, adjustments and protection.

Secretary's requirement	Where addressed in EIS
5. Where the project is predicted to impact on utilities the Proponent must undertake a utilities management strategy, identifying management options, including relocation or adjustment of the utilities.	**Appendix D** (Utilities management strategy) provides a detailed description of utilities likely to be impacted and a framework for utility.
6. A draft Community Consultation Framework must be prepared identifying relevant stakeholders, procedures for distributing information and receiving/responding to feedback and procedures for resolving stakeholder and community complaints during construction and operation. Key issues that must be addressed in the draft Framework include, but are not limited to: a. traffic management (including property access, pedestrian access); b. landscaping/urban design matters; c. construction activities including out of hours work; and d. noise and vibration mitigation and management.	**Chapter 7** (Stakeholder and community engagement) provides the content for the framework and a draft Community consultation framework is provided in **Appendix E.**

20.1 Legislative and policy framework

The assessment of land use and property impacts has been carried out taking into account the following legislation, policies and strategic planning documents:

- *The Native Title Act 1993* (Commonwealth) and *Aboriginal Land Rights Act 1983* (NSW) provide a framework for the protection of native title rights on certain Crown lands. There are no Crown lands subject to a native title claim within the project footprint
- *Greater Sydney Region Plan: A Metropolis of Three Cities – Connecting People* (Greater Sydney Commission, 2018a)
- *Our Greater Sydney 2056: North District Plan – Connecting Communities* (Greater Sydney Commission, 2018b)
- *Our Greater Sydney 2056: Eastern City District Plan – Connecting Communities* (Greater Sydney Commission, 2018c).

These policies and strategic planning documents are further described in Chapter 3 (Strategic justification and project need).

The following plans are also relevant to current and future land use in the project footprint:

- *Informing the Bays Precinct, Sydney Transformation Plan* (UrbanGrowth, 2015a)
- *North Sydney Centre Review* (North Sydney Council, 2015)
- *Waverton Peninsula Strategic Masterplan* (North Sydney Council, 1999)
- *Ward Street Precinct Masterplan* (North Sydney Council, 2018a)
- *St Leonards Park Landscape Masterplan* (North Sydney Council, 2018b).

The *Informing the Bays Precinct, Sydney Transformation Plan* identifies key objectives that apply to the transformation of the Bays Precinct and actions to shape the development program for the

precinct. The plan has been informed by community engagement processes carried out by the NSW Government. These include the release of the Discussion Paper: *Transforming City Living: The Bays Precinct* (UrbanGrowth, 2015b) and launch of a *Call for Great Ideas*. The Plan is further discussed in Section 20.4.2.

The *Waverton Peninsula Strategic Masterplan s*ets out strategies for the development of key sites on the Waverton Peninsula for the development of public open space and for working waterfront land uses. These sites include the former Coal Loader and Caltex site and former industrial sites associated with BP (now known as Carradah Park). This Masterplan is further discussed in Section 20.4.2.

The *North Sydney Centre Review* was carried out by North Sydney Council and aims to identify and implement policies and strategies to ensure North Sydney strengthens its role as a key component of Sydney's global economic arc. The review included studies covering traffic and pedestrian management, public domain, late night trading, capacity and land use, and marketing and promotion for the North Sydney centre. The Review is further discussed in Section 20.4.2.

The *Ward Street Precinct Masterplan* sets out a strategy for redevelopment of the area located within the block bounded by Miller Street, McLaren Street, Walker Street and Berry Street in North Sydney, including Ward Street. The Masterplan focuses on balancing the delivery of commercial space with public space and community facilities, with pedestrian connections to the new Victoria Cross Metro station. The Masterplan is further discussed in Section 20.4.2.

The *St Leonards Park Landscape Masterplan* is designed to guide future upgrade works in recognition of the park's recreational and heritage values. The Masterplan includes restoration works for key heritage items within the park and the provision of new and improved recreational facilities, including active transport pathways, playground and sporting equipment. The Masterplan is further discussed in Section 20.4.2.

20.2 Assessment methodology

The assessment methodology for impacts on land use and property included the following key tasks:

- Review of key strategic planning polices and documents relevant to in and around the project footprint to identify future land uses, planning controls and developments
- Review of the local environment and identifying existing land uses and properties in and around the project footprint
- Assessing the potential impacts on properties including those that would need to be acquired to construct and operate the project
- Assessing the potential impacts on existing and likely future land uses during construction and operation of the project
- Identifying measures to avoid, minimise and manage impacts on land use and property
- Identifying potential future uses of land required for construction but not required for operation.

20.3 Existing environment

20.3.1 Overview

The project would traverse the Inner West and Lower North Shore region of metropolitan Sydney within the Inner West, North Sydney and Willoughby local government areas. A diverse range of development types and land use zones are currently located within and around the project footprint including residential, commercial, mixed uses, industrial and maritime, infrastructure and recreational open space.

The land use zones within the project footprint are defined under the following environmental planning instruments and are shown in Figure 20-1 to Figure 20-5:

- Leichhardt Local Environmental Plan 2013 (Leichhardt LEP 2013) (now part of the Inner West local government area)
- North Sydney Local Environmental Plan 2013 (North Sydney LEP 2013)
- Willoughby Local Environmental Plan 2012 (Willoughby LEP 2012)
- Sydney Regional Environmental Plan No 26 – City West (SREP 26)
- Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005 (Sydney Harbour SREP).

Low density residential land uses are prominent in the suburbs of Rozelle, Balmain, Birchgrove and Waverton. Medium and high density residential land uses are generally located along the Warringah Freeway corridor in the suburbs of North Sydney, Neutral Bay, Crows Nest and Cammeray.

Commercial and other mixed land uses are located in North Sydney, particularly on the western side of the Warringah Freeway corridor, and in parts of Rozelle, including Victoria Road and Darling Street.

Industrial and maritime land uses characterise the foreshore areas of White Bay and Glebe Island in Rozelle and at Berrys Bay in Waverton. Commercial and recreational maritime activities are carried out on Sydney Harbour.

There are a number of private and public recreation areas located within the project footprint. The largest of these are located in Birchgrove (Yurulbin Park), Waverton (Balls Head), North Sydney (St Leonards Park), and Cammeray (ANZAC Park, Cammeray Park and Cammeray Golf Course). Parts of Sydney Harbour within and around the project footprint are used for recreational activities and commercial and government operations. There are several existing moorings within Snails Bay and Berrys Bay.

Social infrastructure in the vicinity of the project is discussed in more detail in Chapter 21 (Socio-economics).

20.3.2 Rozelle Interchange and surrounds

Existing land use

The approved Rozelle Interchange, forming part of the M4-M5 Link project, is to be located within parts of Rozelle, Annandale and Lilyfield on land within and adjacent to Rozelle Rail Yards. The Rozelle Rail Yards were previously used for industrial, rail and ports related activities. Site management works carried out by Transport for NSW (formerly Roads and Maritime Services) (under a separate environmental assessment and approval) has facilitated the future use of the Rozelle Rail Yards for construction and infrastructure purposes. The M4-M5 Link project will include areas of new open space within the Rozelle Rail Yards site at the completion of

construction. Redevelopment of The Rozelle Rail Yards is identified in the *Informing the Bays Precinct, Sydney Transformation Plan* as a long-term priority.

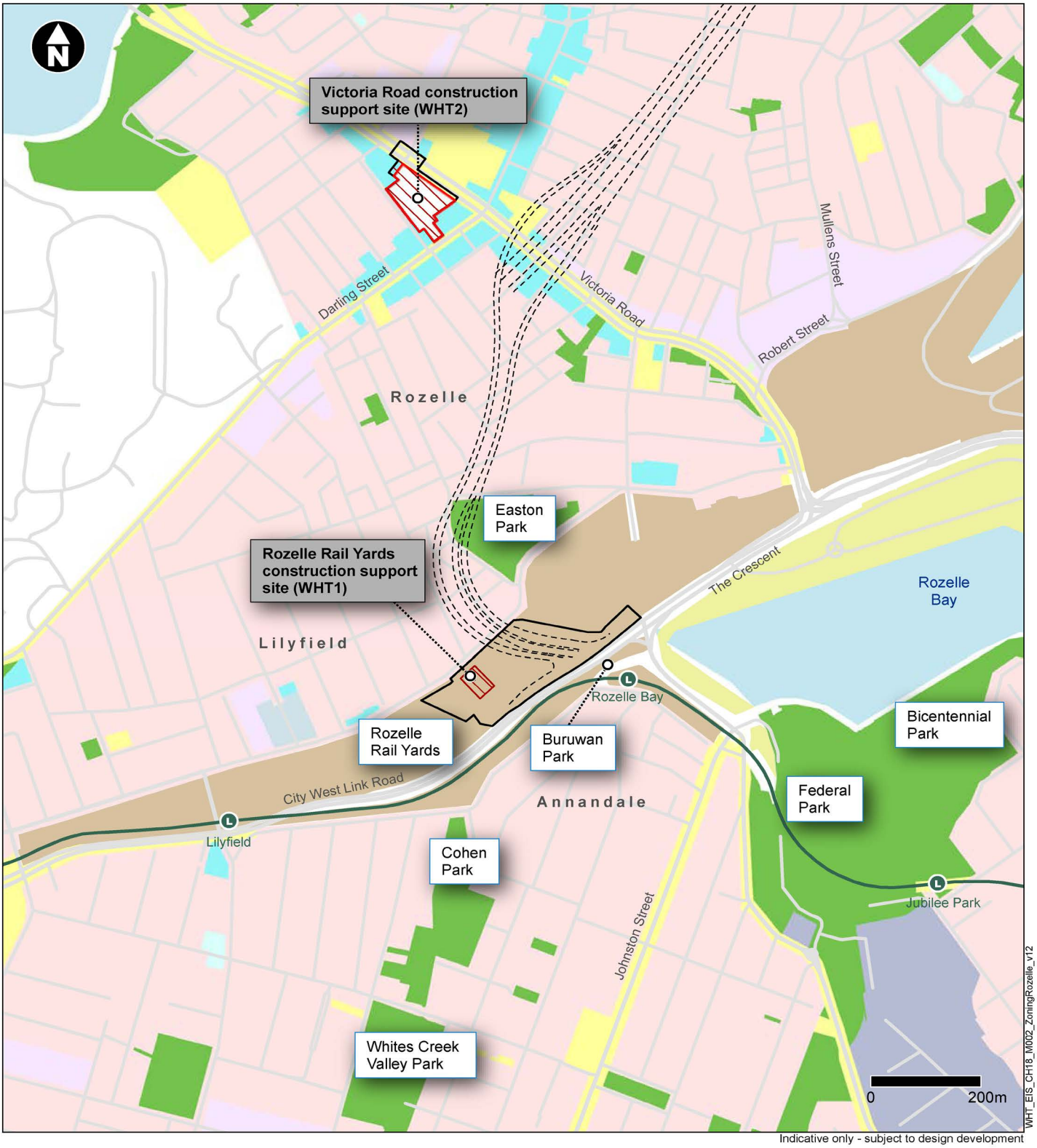
Existing land use around the Rozelle Interchange is characterised by low density residential development, generally comprising detached dwellings and townhouses. There are several small neighbourhood centres comprising of local businesses to the north of the Rozelle Rail Yards. Some businesses are also located along the foreshore to the north of The Crescent such as boat hire and hardware stores.

Public recreation areas near the construction footprint at the Rozelle Interchange include Easton Park in Rozelle, Buruwan Park (being replaced by operational road infrastructure as part of the approved M4-M5 Link (refer to Figure 20-1)), Cohen Park and Whites Creek Valley Park in Annandale, and Bicentennial Park in Glebe.

Major road and rail infrastructure in the area includes the City West Link, The Crescent, Victoria Road, Johnston Street, and the Sydney light rail with stops at Lilyfield and Rozelle Bay.

Land use zoning

Land use zones in and around the Rozelle Interchange are defined under the SREP 26 and Leichhardt LEP 2013 and are shown in Figure 20-1.



Legend

Operational features

Western Harbour Tunnel (tunnel section)

Construction features

Construction footprint

Construction support site

Sydney Light Rail

SREP 26

Port and employment

Waterfront use

Land use zoning

B1 Neighbourhood Centre

B2 Local Centre

B4 Mixed Use

B7 Business Park

IN2 Light Industrial

R1 General Residential

RE1 Public Recreation

RE2 Private Recreation

SP2 Infrastructure

DM Deferred Matter

Figure 20-1 Land use and zoning – Rozelle Interchange and surrounds

20.3.3 Rozelle to Birchgrove

Existing land use

Existing land use in the area from Rozelle to Birchgrove is characterised by low density residential development in the suburbs of Rozelle, Balmain and Birchgrove. This area also includes the White Bay and Glebe Island foreshore, which is characterised by industrial and maritime land uses.

Key existing arterial and local road infrastructure in the area includes the City West Link and Victoria Road with Robert Street, Terry Street, Evans Street and Darling Street providing access into Balmain and Rozelle from Victoria Road.

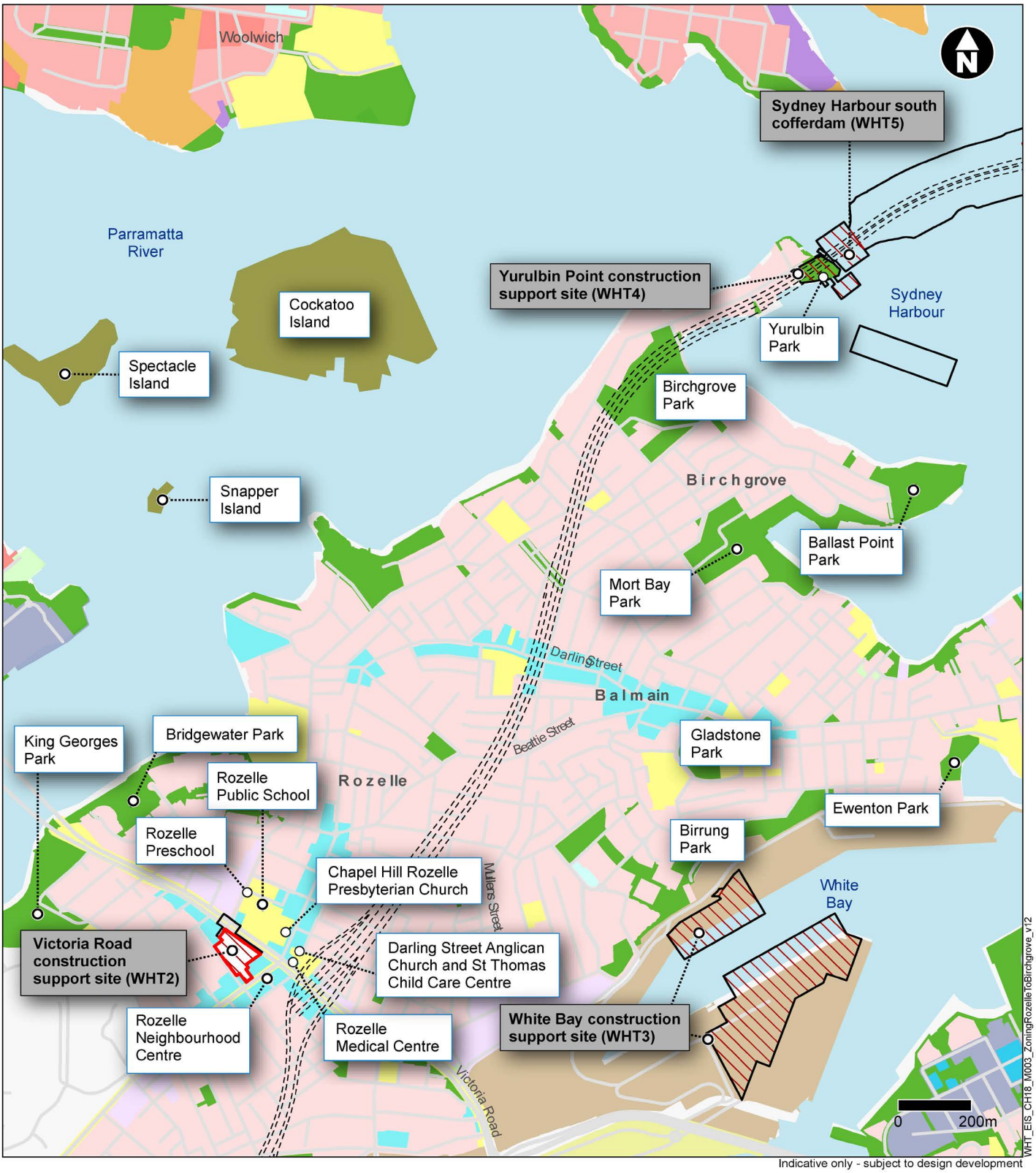
Victoria Road and Darling Street in Rozelle include a variety of local businesses and community uses such as the Rozelle Neighbourhood Centre, Rozelle Preschool, Rozelle Public School, Chapel Hill Rozelle Presbyterian Church, Darling Street Anglican Church, St Thomas Child Care Centre and Rozelle Medical Centre (refer to Figure 20-2). Proposed amendments to the Development Control Plan applicable to the site at 138 – 172 Victoria Road (the site of the former Balmain Leagues Club) were approved by the Inner West Council on 25 June 2019. Following this approval, an amended development application for the site has been submitted.

Of the public recreation areas between Rozelle and Birchgrove, Yurulbin Park in Birchgrove is the only public recreation area within the construction footprint (refer to Figure 20-2). Other public recreation areas near the construction footprint include:

- Bridgewater Park and King Georges Park in Rozelle
- Birrung Park, Gladstone Park and Ewenton Park in Balmain
- Birchgrove Park, Mort Bay Park, and Ballast Point Park in Birchgrove.

Land use zoning

Land use zones in the area from Rozelle to Birchgrove are defined under the SREP 26 and the Leichhardt LEP 2013, and are shown in Figure 20-2.



Legend

Operational features

- Western Harbour Tunnel (tunnel section)

Construction features

- Construction footprint
- Construction support site

SREP 26

- Port and employment
- Public recreation
- Waterfront use

Land use zoning

- B1 Neighbourhood Centre
- B2 Local Centre
- B3 Commercial Core
- B4 Mixed Use
- E2 Environmental Conservation
- IN2 Light Industrial
- IN4 Working Waterfront
- R1 General Residential
- R2 Low Density Residential
- R3 Medium Density Residential
- RE1 Public Recreation
- RE2 Private Recreation
- SP2 Infrastructure
- DM Deferred Matter

Figure 20-2 Land use and zoning – Rozelle to Birchgrove

20.3.4 Birchgrove to Berrys Bay

Existing land use

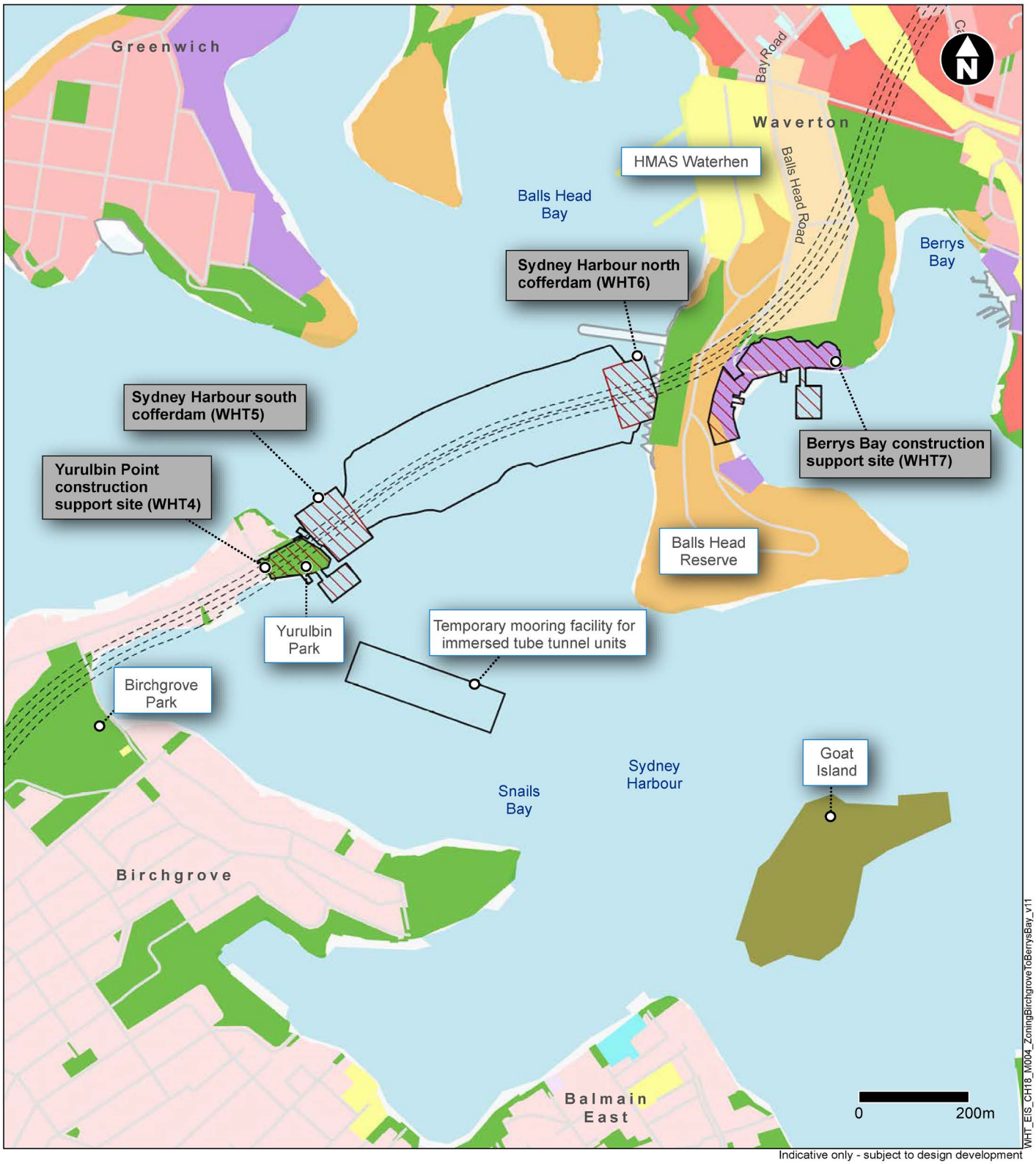
Existing land use in the area from Birchgrove to Berrys Bay within the construction footprint includes Sydney Harbour and associated foreshore land (refer to Figure 20-3).

Land uses along the foreshore at Birchgrove mostly comprise public recreation, public transport and open space, while the Berrys Bay foreshore is characterised by public recreation and industrial maritime uses. The Waverton Peninsula includes Balls Head Reserve which is an environmental conservation area. Commercial and industrial buildings and infrastructure owned by the NSW Government are located on the eastern side of Waverton Peninsula, including an existing Sydney Water asset and a number of disused buildings. The Royal Australian Naval base, HMAS Waterhen, is on the western side of Waverton Peninsula. The *Waverton Peninsula Strategic Masterplan* sets out strategies for development within this area.

Sydney Harbour is used for a range of marine activities including commercial operations, the movement of cargo, public transport and recreational fishing and boating. Snails Bay at Birchgrove has a public jetty for recreational use as well as several private jetties. There are several existing Transport for NSW moorings and dolphin berths next to and within the construction footprint in the Birchgrove to Berrys Bay area.

Land use zoning

Land use zones in the area from Birchgrove to Berrys Bay are defined under the Leichhardt LEP 2013, the North Sydney LEP 2013 and the Sydney Harbour SREP, and are shown in Figure 20-3.



Legend

Operational features

- Western Harbour Tunnel (tunnel section)

Construction features

- Construction footprint
- Construction support site

SREP2005

- National Parks

Land use zoning

- B1 Neighbourhood Centre
- B2 Local Centre
- E2 Environmental Conservation
- E4 Environmental Living
- IN2 Light Industrial
- IN4 Working Waterfront
- R1 General Residential
- R2 Low Density Residential
- R3 Medium Density Residential
- R4 High Density Residential
- RE1 Public Recreation
- RE2 Private Recreation
- SP2 Infrastructure
- UL Unzoned Land

Figure 20-3 Land use and zoning – Birchgrove to Berrys Bay

20.3.5 Berrys Bay to the Warringah Freeway

Existing land use

Existing land use in the area from Berrys Bay to the Warringah Freeway at North Sydney includes the Waverton Peninsula on the northern side of Sydney Harbour, and the suburbs of North Sydney, Waverton and McMahons Point (refer to Figure 20-4). Low and medium density residential land uses are located in the suburbs of Waverton and McMahons Point.

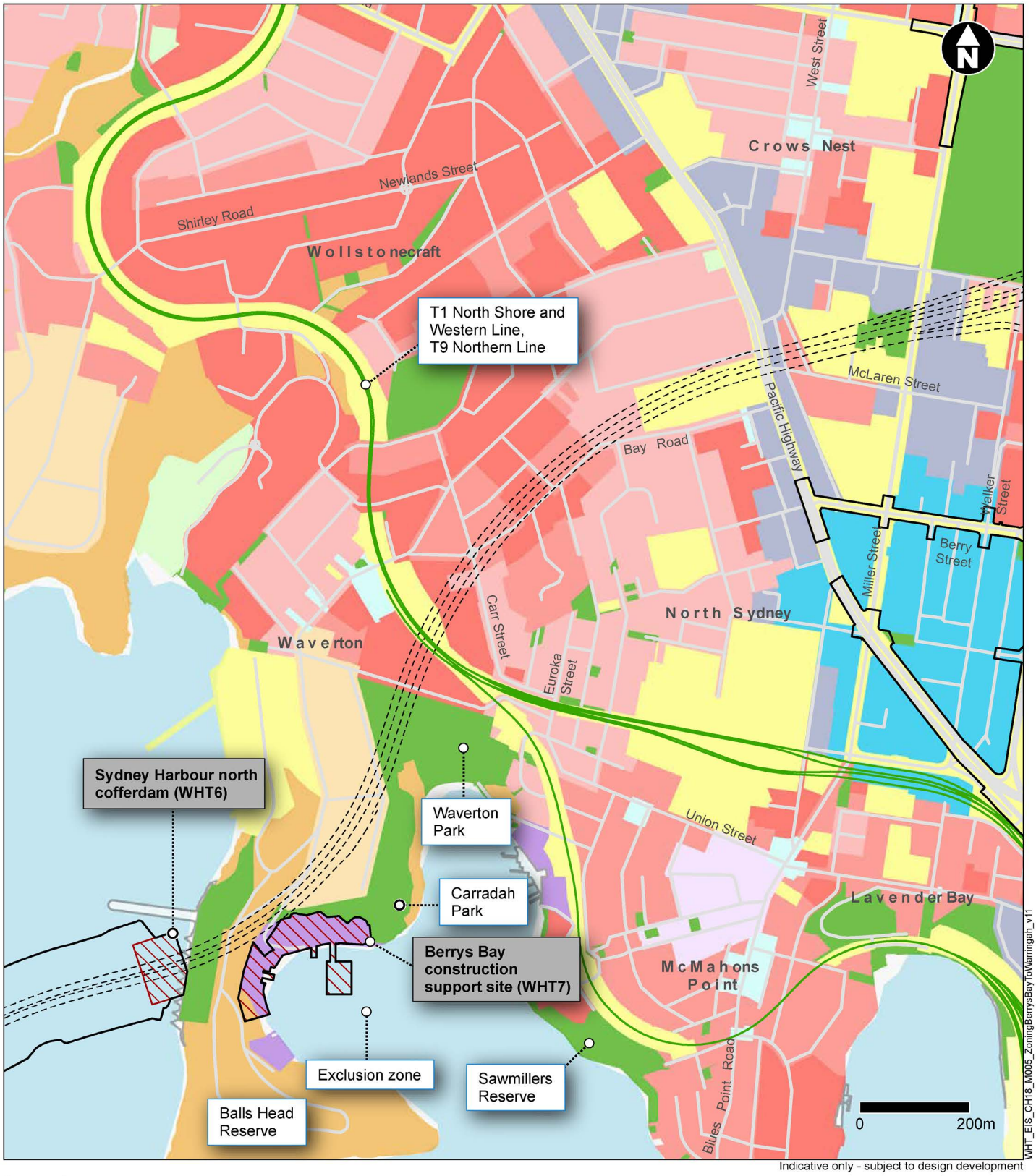
The northern portion of this area comprises the North Sydney commercial precinct which includes a range of business, retail and office uses. North Sydney also includes areas of medium and high density residential land use. The *Ward Street Precinct Masterplan* aims to balance the delivery of commercial space with public space and community facilities within the northern portion of the North Sydney commercial precinct.

Balls Head Reserve is a prominent environmental conservation and public parkland area partly located within the construction footprint. Waverton Park and Carradah Park in Waverton and Sawmillers Reserve in McMahons Point are located in the vicinity of the construction footprint. Most recently, the development of Berrys Bay was proposed by Meridien Marinas (DA 260/15) in an area leased to them by Transport for NSW to develop the Berrys Bay Maritime Precinct. The development application was rejected by the Joint Regional Planning Panel in May 2016. There are currently no development proposals for the site.

Major road and rail infrastructure located in this area includes the Pacific Highway, the Warringah Freeway and the T1 North Shore and Western and T9 Northern rail lines.

Land use zoning

Land use zones in the area between Berrys Bay and the Warringah Freeway at North Sydney are defined under the North Sydney LEP 2013 and are shown in Figure 20-4.



Legend

Operational features

----- Western Harbour Tunnel (tunnel section)

Construction features

Construction footprint

Construction support site

Land use zoning

B1 Neighbourhood Centre

B3 Commercial Core

B4 Mixed Use

E2 Environmental Conservation

E4 Environmental Living

IN2 Light Industrial

IN4 Working Waterfront

R2 Low Density Residential

R3 Medium Density Residential

R4 High Density Residential

RE1 Public Recreation

RE2 Private Recreation

SP1 Special Activities

SP2 Infrastructure

UL Unzoned Land

Figure 20-4 Land use and zoning – Berrys Bay to the Warringah Freeway

20.3.6 Warringah Freeway and surrounds

Existing land use

Existing land use in the area around the Warringah Freeway corridor between Milsons Point and Naremburn is characterised by a mix of low, medium and high density residential development, business and retail uses, neighbourhood centres and commercial uses.

The commercial centre of North Sydney is located to the west of the Warringah Freeway, and is surrounded by a range of mixed use and infrastructure land uses, including education facilities along Miller Street and Ridge Street (refer to Figure 20-5).

Public recreation areas within the construction footprint include St Leonards Park in North Sydney, ANZAC Park, Cammeray Golf Course and Cammeray Park in Cammeray (refer to Figure 20-5). Within St Leonards Park, future management and works are guided by the *St Leonards Park Landscape Masterplan.*

Major road infrastructure located in this area includes the Warringah Freeway between Milsons Point and Naremburn. There are several existing major road network connections to and from the Warringah Freeway, including:

- Pacific Highway and High Street, which provide connections to North Sydney and Kirribilli
- Mount Street, which provides connectivity for North Sydney
- Berry Street, which provides connectivity for North Sydney and Crows Nest
- Falcon Street, which provides connections to North Sydney, Crows Nest, Cammeray and Neutral Bay
- Ernest Street and Miller Street, which provide connections to Cammeray
- Brook Street, which provides connections to Willoughby and Crows Nest
- Willoughby Road, which provides connections to Naremburn.

Land use zoning

Land use zones in the area around the Warringah Freeway are defined under the North Sydney LEP 2013 and the Willoughby LEP 2012, and are shown in Figure 20-5.

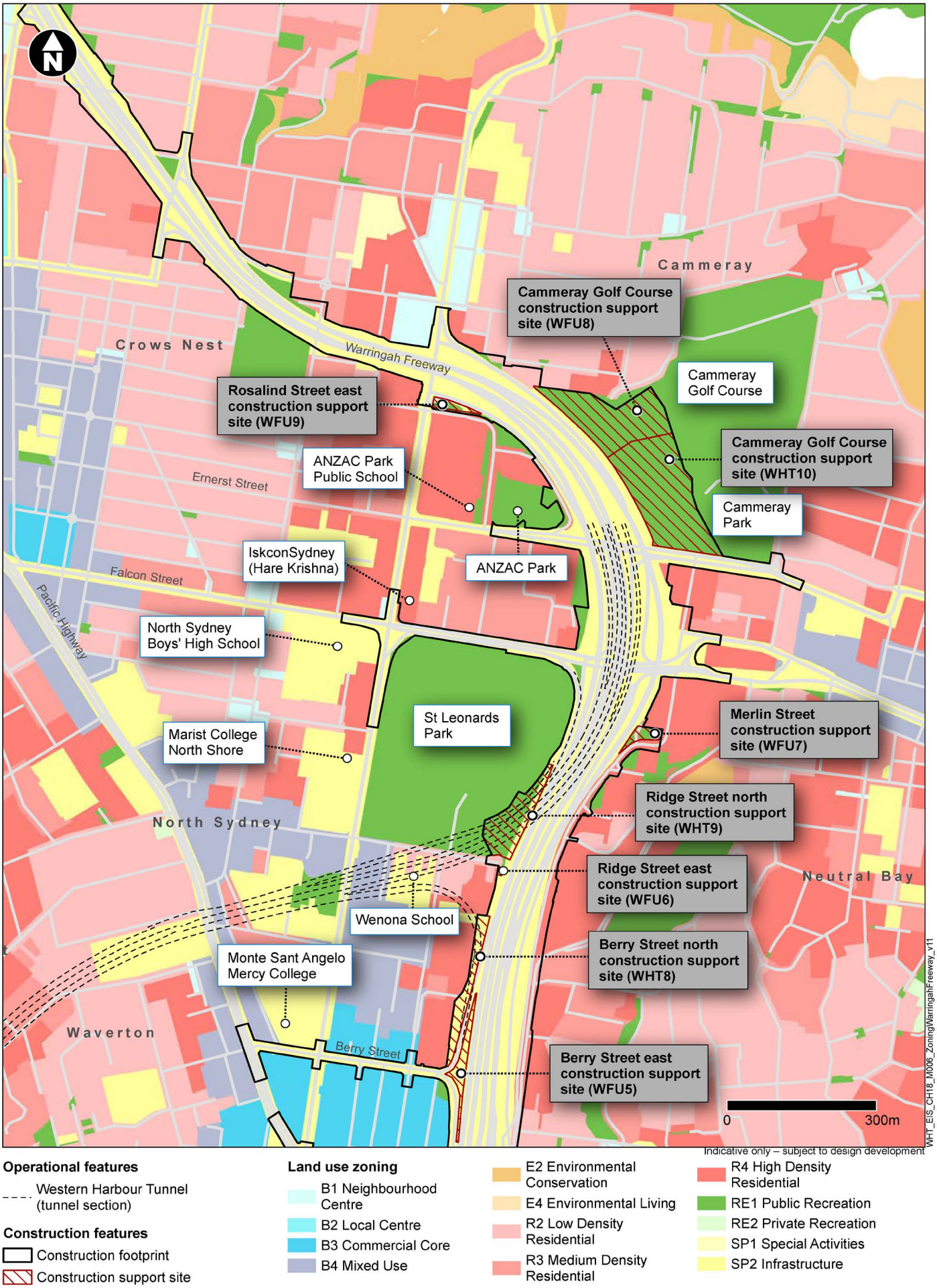


Figure 20-5 Land use and zoning – Warringah Freeway and surrounds

20.4 Assessment of potential impacts

The project has the potential to impact on property and land use in the following ways:

- Occupation of surface properties, including temporary use during construction and permanent acquisition for operational infrastructure
- Acquisition of substratum (below ground) land for the project tunnels
- Return of residual land (full or partial lots) required for construction but not for operation of the project
- Impacts to land use and development potential during construction and operation of the project
- Changes in public open space availability
- Ground movement impacts to properties during construction and operation of the project
- Creation of residual land (partial lots) that is not fully acquired or occupied on a permanent basis.

Further assessment of impacts to boat moorings are discussed in Chapter 8 (Construction traffic and transport) and Chapter 21 (Socio-economics).

20.4.1 Property

Acquisition and temporary use of surface properties

The project has been designed and developed to minimise property acquisitions and has prioritised the use of Transport for NSW land. Notwithstanding this, some temporary use and permanent acquisition of properties would be required. All property acquisitions required for the project would be carried out in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991* (NSW), and in accordance with the land acquisition reforms announced by the NSW Government in 2016. Temporary use of properties would be managed through leasing arrangements or property acquisition should lease arrangements not be practical. Where required discussions would be held with affected property owners concerning the purchase, lease or licence of land. Landowners and tenants of landowners affected by acquisition will be supported by access to counselling services throughout the process and a community relations support toll-free telephone line will be established to respond to any community concerns.

The project would require the acquisition or temporary use of 28 properties including:

- Seventeen private residential properties
- Four private commercial properties
- Seven government-owned properties (excluding Transport for NSW land).

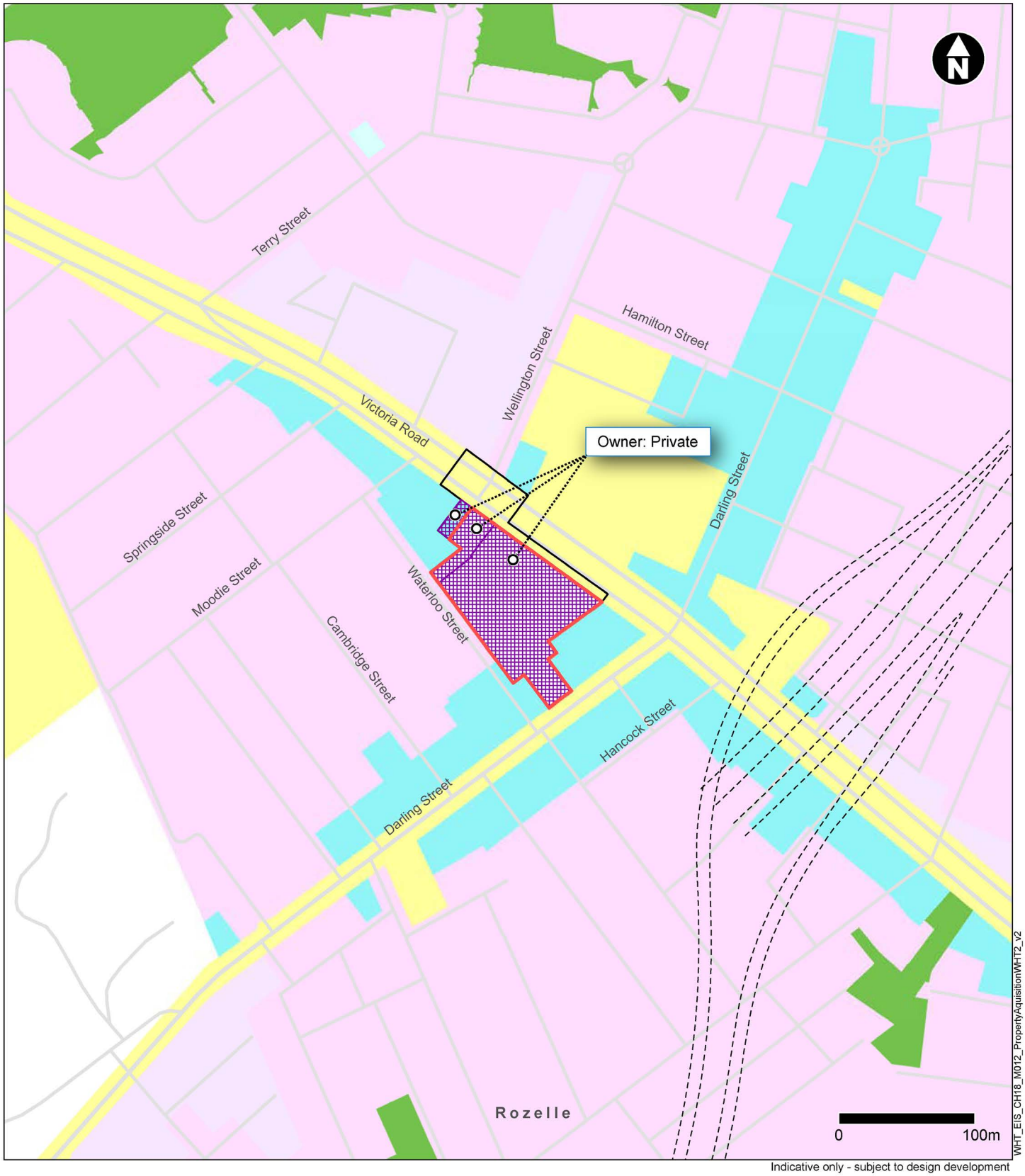
Anticipated properties required for acquisition or temporary use are summarised in Table 20-2. Properties anticipated to be permanently acquired by the project are shown in Figure 20-6 to Figure 20-9. Impacts of property acquisition are further discussed in Chapter 21 (Socio-economics).

The acquisition of land for construction activities may result in residual land that would not be required for operational infrastructure or activities. The future use of this land is discussed in the section below.

Table 20-2 Anticipated property acquisition and temporary leases required for the project

Location	Ownership	Number of property acquisitions[1]		Number of properties for temporary use[1]	
		Full property acquisition	Partial property acquisition	Full property lease	Partial property lease
Western Harbour Tunnel component					
Rozelle[2]	Private – commercial	2	0	0	0
	Private – residential	1	0	0	0
	Government	0	0	0	1
Birchgrove	Government	0	0	1	0
Waverton	Government	0	0	0	1
Artarmon	Private – commercial	1	0	0	0
Total for Western Harbour Tunnel component		**4**	**0**	**1**	**2**
Warringah Freeway Upgrade component					
North Sydney	Private – commercial	0	1	0	0
	Government	0	1[3]	0	1
Neutral Bay	Private – residential	0	1	0	0
	Government	1	0	0	0
Cammeray	Private – residential	15	0	0	0
	Government	0	1[3]	0	0
Total for Warringah Freeway Upgrade component		**16**	**4**	**0**	**1**

Note 1: Multiple parent lots and strata titles may exist within each property.
Note 2: May be leased rather than acquired, subject to negotiations with landowner.
Note 3: Along with acquisition additional land at these properties would be leased for construction.



Legend

Operational features

- Operational footprint
- Western Harbour Tunnel (tunnel section)

Construction features

- Construction footprint

- Property to be acquired

Land use zoning

- B1 Neighbourhood Centre
- B2 Local Centre
- IN2 Light Industrial
- R1 General Residential
- RE1 Public Recreation
- SP2 Infrastructure
- DM Deferred Matter

Figure 20-6 Property acquisitions for the Western Harbour Tunnel (around Rozelle)

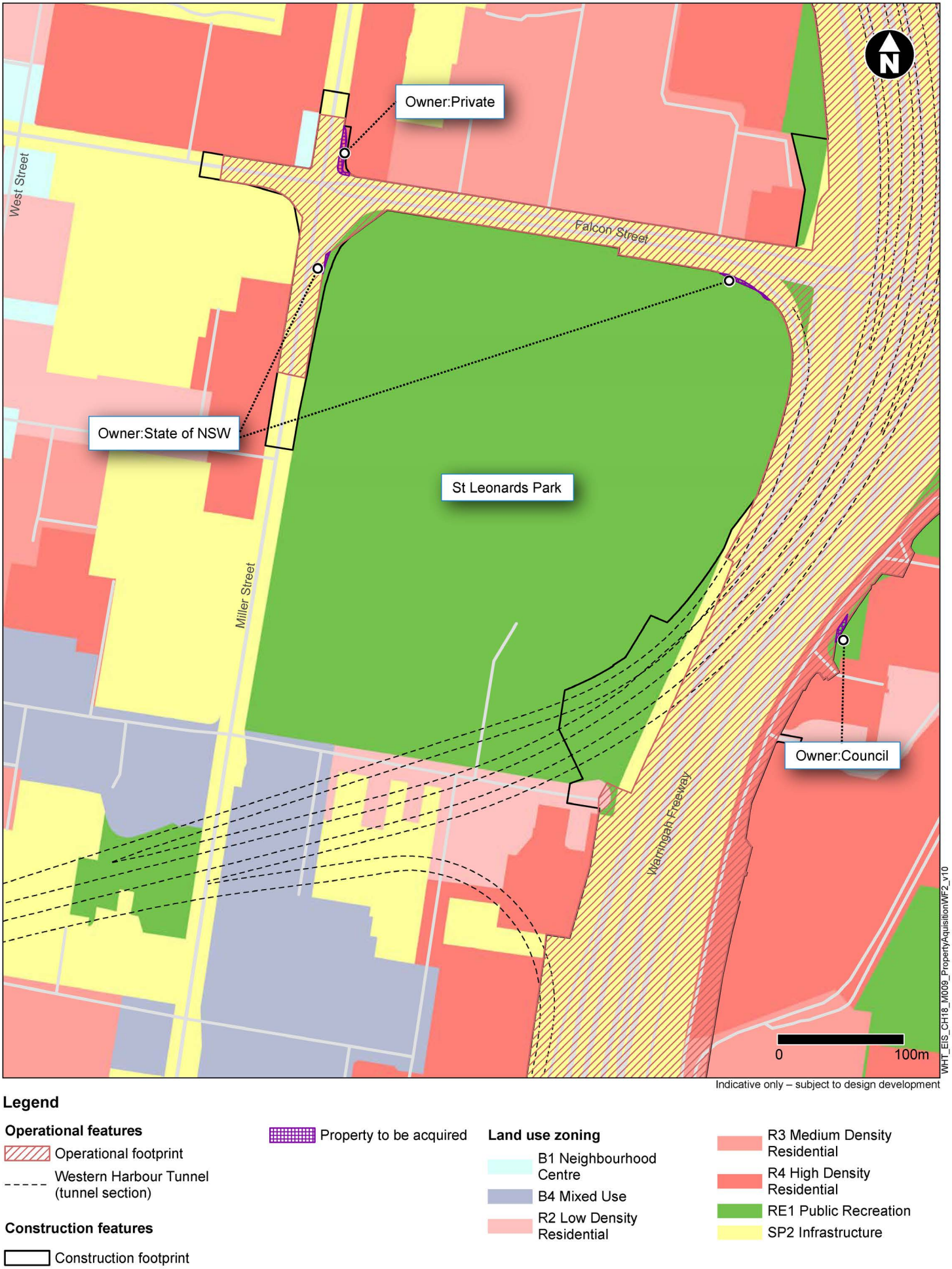


Figure 20-7 Property acquisitions for the Warringah Freeway Upgrade (around North Sydney)

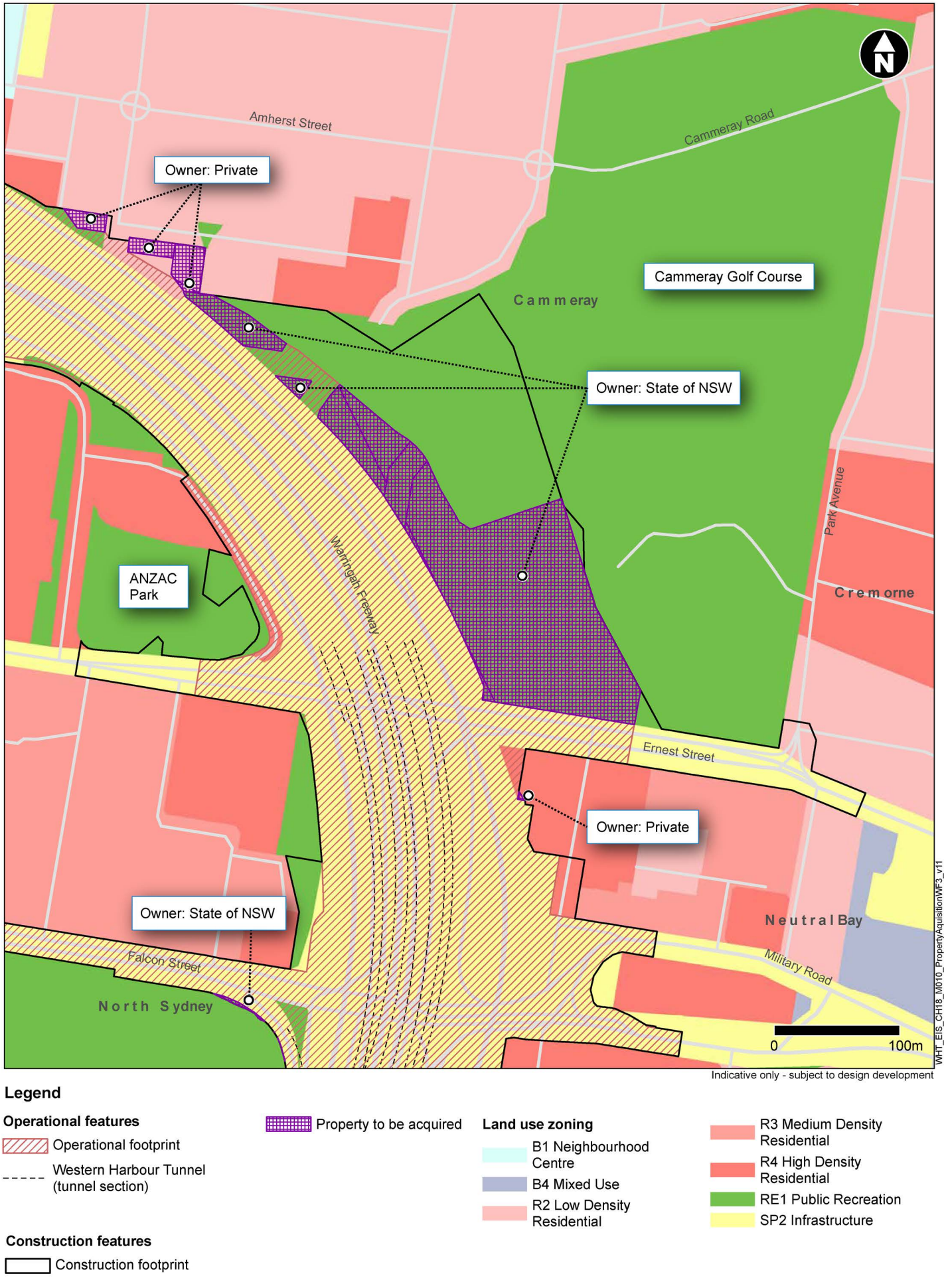


Figure 20-8 Property acquisitions for the Warringah Freeway Upgrade (around Cammeray)

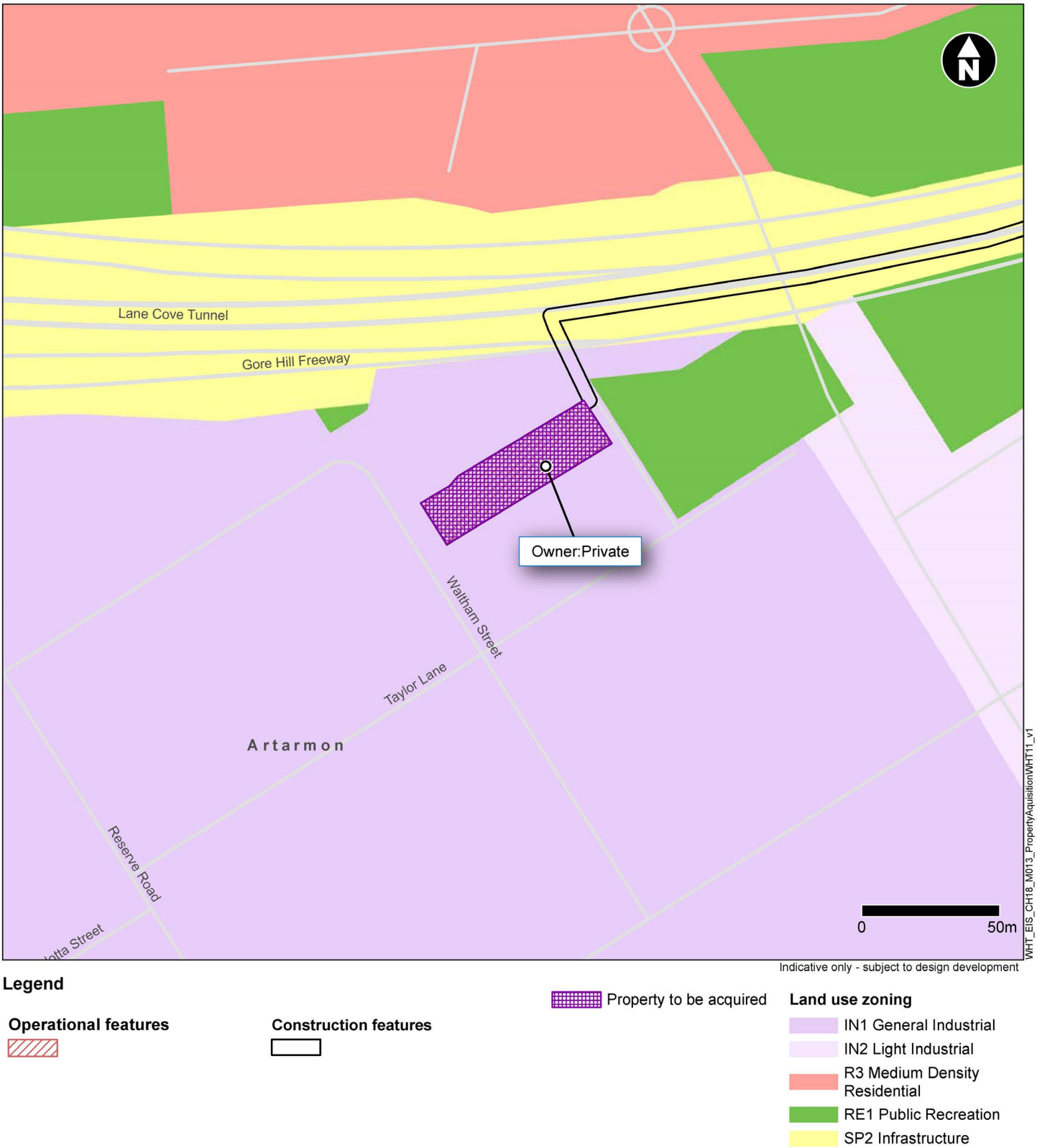


Figure 20-9 Property acquisitions for the Western Harbour Tunnel (around Artarmon)

Residual land

Residual land comprises lots that are created when a site is only partially acquired on a permanent basis to operate the project. Residual land can be created by initially acquiring a full or partial lot and leaving or returning part of the lot for future use (the residual lot).

Because most local environmental plans place minimum lot size requirements and other restrictions on parcels of land to be used for specified types of development, the creation of a residual lot has the potential to affect the development potential of the land. Minimum lot sizes most often apply to land zoned for residential purposes but can also apply to other land use zonings. Residual lands that would be created as a result of the project are summarised in Table 20-3.

The residual land created as a result of the project would largely continue to remain suitable for future development in accordance with the relevant land use zonings and applicable development standards (for example, the minimum lot size if applicable). Following construction, residual land would be rehabilitated to the existing ground level or as otherwise agreed with the landowner. Additionally, some lots would be wholly or partially occupied during construction of the project but would not be required for permanent operational infrastructure or other operational activities. Where feasible and reasonable, this land would be reinstated, rehabilitated and returned to an equivalent state and the same use as existing on the land prior to construction of the project. Where land is leased for construction of the project, reinstatement and rehabilitation of the site would be carried out in consultation with the relevant landowner.

Any future development of lands would be subject to separate assessment and approval in accordance with the *Environmental Planning and Assessment Act 1979* and is beyond the scope of this project.

Table 20-3 Residual land created by the project

Location	Pre-construction land use	Current land use zoning	Ownership	Project use and anticipated future treatment
Western Harbour Tunnel component				
Rozelle	Private – commercial	DM Deferred Matter	Private	138-172 Victoria Road in Rozelle would be temporarily required for use as a construction support site (WHT2) and would not be required on a permanent basis to operate the project. The site may be acquired by Transport for NSW or leased depending on ongoing property negotiations. If the property is leased, the site would be rehabilitated and returned to the landowner at the completion of construction. Any proposed redevelopment of the remaining land would be subject to development assessment and approval from the relevant planning authority.
	Private – residential	B2 Local Centre	Private	A private residential property on Victoria Road would be permanently acquired for use as a construction support site (WHT2). The land acquired for the project would not impact on the long term viability of the site to continue to be used for private residential purposes.
	Glebe Island	SREP 26 Port and employment	Government	White Bay construction support site would be temporarily leased for use as a construction support site (WHT3) and would not be required on a permanent basis to operate the project. The site would be rehabilitated and returned to the landowner at the completion of construction.
Birchgrove	Yurulbin Park	RE1 Public Recreation	Government	Yurulbin Park in Birchgrove would be temporarily leased for use as a construction support site (WHT4). This site would not be required on a permanent basis to operate the project and would be rehabilitated in line with the design vision provided by the original landscape architect (Bruce Mackenzie) as part of this project as soon as practicable at the completion of construction. The project would not impact on the long term viability of the site to continue to be used for public recreation and open space purposes.

Location	Pre-construction land use	Current land use zoning	Ownership	Project use and anticipated future treatment
Waverton	Working waterfront at Balls Head	IN4 Working Waterfront E2 Environmental Conservation	Government	Government-owned waterfront land at Berrys Bay in Waverton would be temporarily required for use as a construction support site (WHT7). This site would not be required on a permanent basis to operate the project and would be rehabilitated as soon as practicable at the completion of the project. Once complete the project would not impact on existing or potential future land uses. Transport for NSW acknowledge the importance of the Berrys Bay area and is committed to working with the community and key stakeholders to understand their views on the future use of the Berrys Bay. Once the project is completed, Transport for NSW would return the Berrys Bay area as public open space. As part of this process, Transport for NSW would establish a reference group, to include representation of key stakeholders, the community and independent experts, to support the development of the final layout. It is expected this process would be carried out prior to the start of construction works.
Warringah Freeway Upgrade component				
North Sydney	St Leonards Park	RE1 Public Recreation	Government	The south-eastern portion of St Leonards Park would be temporarily required for use as the Ridge Street north construction support site (WHT9). This site would not be required on a permanent basis to operate the project and would be rehabilitated and returned as soon as practicable at the completion of construction. Kerb and footpath adjustment works would occur on Miller Street southbound around the intersection with Falcon Street. These works would provide a new dedicated lane for left turning traffic from Falcon Street westbound to Miller Street southbound. Further review of the impacts in this area is currently being carried out and permanent impacts to St Leonards Park would be minimised or, where possible eliminated.
	ANZAC Park	RE1 Public	Government	A section of the park would be temporarily leased for use during

Location	Pre-construction land use	Current land use zoning	Ownership	Project use and anticipated future treatment
		Recreation		construction. The section of land comprises less than 10 per cent of the total area of ANZAC Park. The temporary lease during construction would not impact on the long term viability of the site, which would continue to be used for public recreation and open space.
	Private – commercial	R4 High Density Residential	Private	Two sections of private commercial property on Falcon Street would be permanently acquired for permanent road corridor works on the Warringah Freeway. The sections of land acquired for the project would not impact on the long term viability of the site to continue to be used its current function as both Hare Krishna Catering and the Hare Krishna Movement, place of worship.
Neutral Bay	Rose Avenue Reserve	RE1 Public Recreation	North Sydney Council	A section of Rose Avenue Reserve would be permanently acquired for permanent road corridor works on the Warringah Freeway. The section of land acquired for the project comprises about 25 per cent of the total area of Rose Avenue Reserve and would not impact on the long term viability of the site to continue to be used for public recreation and open space purposes.
	Private – residential	R4 High Density Residential	Private	A section of private residential property adjacent to Ernest Street would be permanently acquired for permanent road corridor works on the Warringah Freeway. The section of land acquired for the project comprises less than five per cent of the total property and would not impact on the long term viability of the site to continue to be used for private residential purposes.
Cammeray	Cammeray Golf Course	RE1 Public Recreation	Government	Part of Cammeray Golf Course would be permanently acquired for permanent operational facilities for both the Western Harbour Tunnel and Warringah Freeway Upgrade project and the Beaches Link and Gore Hill Freeway Connection project. Land required for the project would be acquired and/or leased as part of the Warringah Freeway Upgrade component of the project. The sections of land acquired for both projects would comprise about 25,000 m^2. Alterations to the configuration of the golf course would be required, however the project would not impact on the long

Location	Pre-construction land use	Current land use zoning	Ownership	Project use and anticipated future treatment
				term feasibility of the site to continue to be used as a nine hole golf course and for public recreation and open space purposes. Parts of the golf course would also be temporarily required for use as a construction support site (WHT10 and WFU8). The sections of land required temporarily would comprise about 48,300 m^2. These sections would not be required on a permanent basis to operate the project, however a portion of the site would be retained to support the construction of the Beaches Link and Gore Hill Freeway Connection project. Land that would not be required to support the Beaches Link and Gore Hill Freeway Connection project would be rehabilitated and returned as soon as practicable at the completion of construction. Land that would be retained to support the Beaches Link and Gore Hill Freeway Connection project would be rehabilitated and returned as soon as practicable at the completion of construction of that project. Both projects have been designed and developed to minimise impacts to Cammeray Golf Course. The configuration of the construction support sites and the permanent operational infrastructure for both projects, whether implemented at the same time or at different times, would allow for the site to remain operational as a nine hole golf course for the duration of the construction and operation of both projects. Amendments to the configuration of holes and their associated pars would be required during construction and operation of the project to achieve this outcome. Transport for NSW have engaged and consulted with the golf course operator and land holder and this would continue during further design development and implementation of the project to ensure that the operation of the golf course site during construction and operation of the project is possible.

Location	Pre-construction land use	Current land use zoning	Ownership	Project use and anticipated future treatment
	Private – residential	R2 Low Density Residential	Private	The site of a residential building comprising 12 units on Morden Street and common property at Cammeray would be fully acquired and demolished for use during construction. A large section comprising about 95 per cent of the site would not be required on a permanent basis to operate the project. Following construction, the site would be rehabilitated as soon as practicable at the completion of the project. The project would not impact on the long term viability of the site for development consistent with permissible land uses.
Cammeray	Residential dwelling	R2 Low Density Residential	Private	Two residential dwellings on Bellevue Street at Cammeray would be fully acquired and demolished for use during construction. The sites would not be required to operate the project and would be rehabilitated as soon as practicable at the completion of the project. The project would not impact on the long term viability of the sites or change the permissible uses.
Artarmon	Private – commercial	IN1 General Industrial	Private	The property would be acquired for construction support site (WHT11). The site would be required for the operation of Western Harbour Tunnel and would be used to construct the motorway control centre for the Western Harbour Tunnel. The site would be adjacent to operational infrastructure for the future Beaches Link and Gore Hill Freeway Connection project.

Acquisition of substratum

The construction and operation of the project would require the acquisition of land below the surface of the ground to accommodate the mainline and ramp tunnels. This is called substratum acquisition and is shown in Figure 20-10.

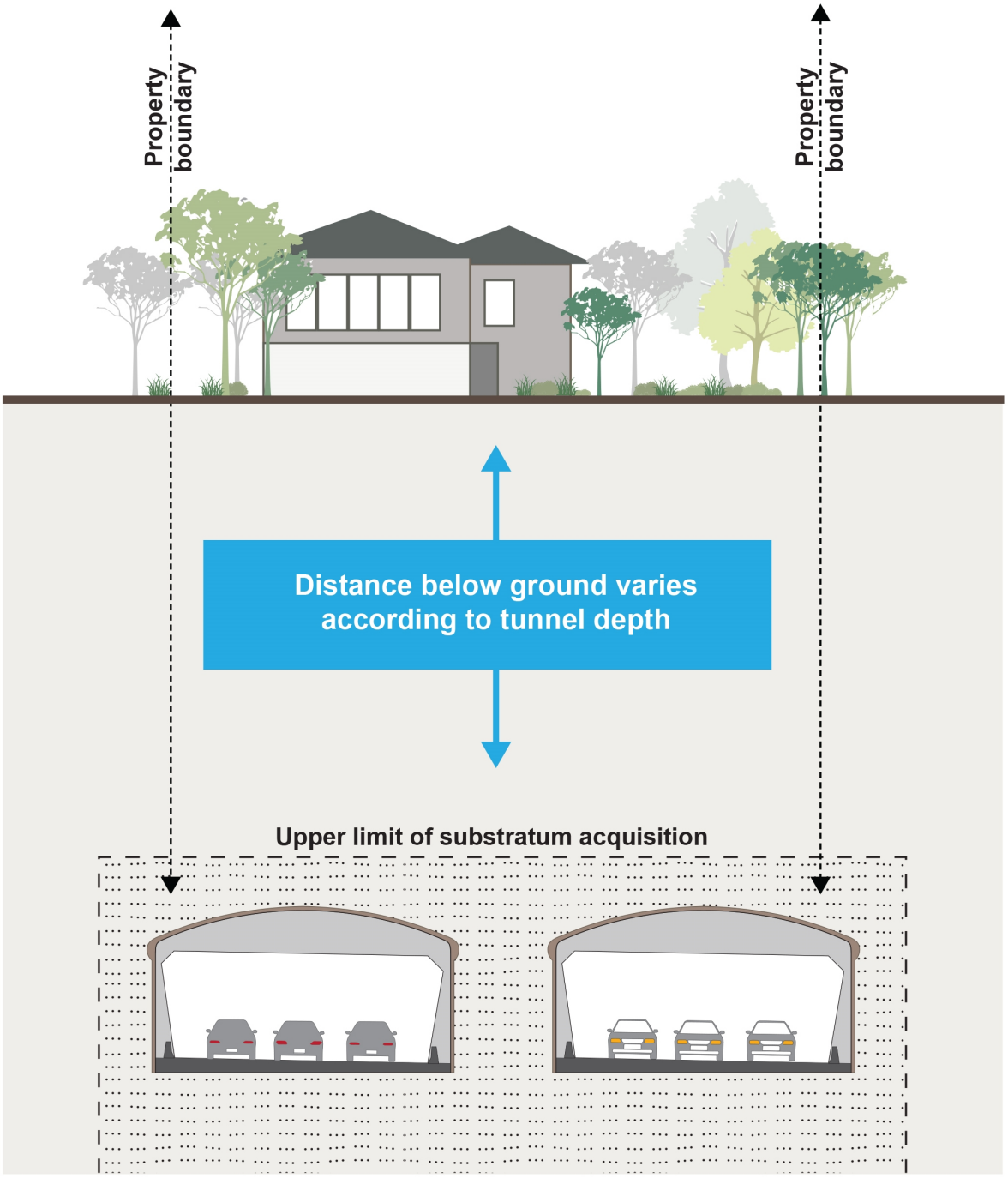


Figure 20-10 Example of substratum acquisition

This substratum acquisition would consist of a stratum acquisition envelope around the tunnels, including any associated ground support area that may be required. In some circumstances, the introduction of the tunnels has the potential to limit development above the tunnels. For example, depending on the depth of the tunnels from the surface, the ability to construct basement levels in buildings above the tunnels may be restricted. However, this is generally only the case where the

tunnel depth is shallow, near tunnel portals. Tunnel portal locations are described in Chapter 5 (Project description). Otherwise, substratum acquisition should not affect the future use of property at the surface. Subject to council regulations and approvals, landowners would generally be able to:

- Carry out improvements, such as installing a swimming pool
- Dig deeper foundations for a new building or second storey additions.

Where substratum acquisition is required, Transport for NSW would contact owners of affected properties. Transport for NSW has the authority to acquire the subsurface land, under the *Roads Act 1993* (NSW). The *Land Acquisition (Just Terms Compensation) Act 1991* (NSW) provides that compensation is not payable for substratum acquisition of land or easements, unless specific circumstances as detailed in that Act apply. Appendix C of the *Roads and Maritime Land Acquisition Information Guide* (Roads and Maritime, 2014a) sets out in detail the compensation provisions of the Act relating to substratum acquisition.

Ground movement impacts

Ground movement (or settlement) due to excavation or disturbance below ground may present a risk to the stability of nearby buildings and other structures during construction and operation of the project.

An assessment of potential ground movement impacts associated with the project is provided in Chapter 16 (Geology, soils and groundwater). The assessment identified risks of 'very slight' settlement impacts to buildings, primarily near the connection to the Rozelle Interchange and at the North Sydney cavern location. Changes in land use as the result of ground movement impacts is therefore considered unlikely during both construction and operation of the project. Management measures are included in Chapter 16.

20.4.2 Land use

Potential land use impacts during construction

The project has the potential to impact land use and development potential of land occupied by construction works and construction support sites. These impacts would be temporary in nature, except for sites that are subsequently used for operational infrastructure (refer to Table 20-5). Table 20-4 outlines the potential land use impacts at each construction site and construction support site required for the project.

Potential indirect impacts as a result of changes to land use would also relate to traffic and transport, noise and vibration, air quality and social and economic values. Consideration of these impacts is provided in Chapter 8 (Construction traffic and transport), Chapter 10 (Construction noise and vibration), Chapter 12 (Air quality) and Chapter 21 (Socio-economics). Utility relocations, adjustments and protection are discussed in Chapter 5 (Project description) and Appendix D (Utilities management strategy).

Table 20-4 Potential land use impacts during construction

Construction location	Potential impacts on land use during construction
Rozelle Interchange and surrounds	
Rozelle Rail Yards construction support site (WHT1)	The Rozelle Rail Yards construction support site (WHT1) would temporarily change the existing land use at the Rozelle Rail Yards from redundant industrial and transport infrastructure to a construction support site. Prior to the start of construction, the site would operate as a construction site for the M4-M5 Link project. Subsequently, WHT1 has been additionally assessed as part of the approved M4-M5 Link project EIS. The establishment of the construction support site would have no impact on the existing land use and development potential of the Rozelle Rail Yards as the site is currently inaccessible and generally unsuitable for development in its current state. A new area of open space would be provided at the site at the completion of construction as part of the approved M4-M5 Link project. Use of the site for construction of the Western Harbour Tunnel would be coordinated with the requirements of the approved M4-M5 Link project. The *Informing the Bays Precinct, Sydney Transformation Plan* (UrbanGrowth, 2015a) identifies the Rozelle Rail Yards as a longer-term priority destination that would form part of The Bays Precinct urban renewal project. The establishment of the construction support site would occupy part of the Rozelle Rail Yards on a temporary basis and would not preclude the planned future construction of Rozelle Park as part of the Bays Precinct Urban Transformation Program.
Rozelle to Birchgrove	
Victoria Road construction support site (WHT2)	The Victoria Road construction support site (WHT2) would be located adjacent to Victoria Road in Rozelle, at the former Balmain Leagues Club site. The site is currently occupied by a vacant two-storey building, car parking areas and vacant and occupied residential and commercial properties. The site would be temporarily used as a construction support site for the duration of construction (either acquired or leased). The temporary occupation of this land would not affect the existing land use zoning or development controls that are applicable to the site. The temporary occupation of the site would however prevent any development from occurring for the duration of construction. If the site is leased, it would be returned to the landowners upon completion of construction, for development in accordance with land use zoning and planning controls. The Victoria Road construction support site (WHT2) would also include a privately owned residential property on Victoria Road to the north of the former Balmain Leagues Club site. The site would be acquired or leased and temporarily converted to a construction support site for the duration of construction. The temporary occupation of this land would not affect the existing land use zoning or development controls that are applicable to the site.

Construction location	Potential impacts on land use during construction
White Bay construction support site (WHT3)	Land use impacts at the White Bay construction support site (WHT3) would be negligible as the surrounding precinct currently provides for a range of maritime and industrial activities. The temporary occupation of this land would not affect the existing land use zoning arrangement or development controls that are applicable to the site. The temporary establishment of a construction support site at White Bay during construction of the project would not introduce long term land use impacts that would preclude its future development as part of the Bays Precinct Urban Transformation Program.
Yurulbin Point construction support site (WHT4)	Construction of the project would impact on the existing public use of Yurulbin Park which would be temporarily occupied and used for the Yurulbin Point construction support site (WHT4). The nearest available area of recreational open space is Birchgrove Park located about 500 metres from Yurulbin Park. The Birchgrove Ferry Wharf would also be temporarily impacted for the duration of construction, which would affect existing ferry services and recreational use of the wharf. Ferry customers would be notified of alternative travel arrangements in advance of the wharf closure (refer to Chapter 8 (Construction traffic and transport for additional information). Upon completion of construction, the site would be reinstated in line with the vision provided by the original landscape architect (Bruce Mackenzie) and made available again for public use. The current land use zoning for Yurulbin Park being for public recreational use restricts the future development of the site for other uses. The temporary use of Yurulbin Park during construction is therefore not expected to impact on the site's future use.
Birchgrove to Berrys Bay	
Sydney Harbour south cofferdam (WHT5)	The Sydney Harbour south cofferdam construction support site (WHT5) would be temporarily located in Sydney Harbour off the Yurulbin Park shoreline. An exclusion zone would be set up around WHT5 to facilitate the safe passage of all vessels and recreational users travelling in the vicinity of the cofferdam. Construction activities associated with this site would require the establishment of maritime speed restrictions around construction equipment. This would result in minor increases to transit times for recreational, commercial and government vessels. Recreational users, community groups and sailing clubs that make use of Sydney Harbour may also be temporarily impacted by these restrictions. Potential impacts on vessel movements and marine activities within Sydney Harbour are further considered in Chapter 8 (Construction traffic and transport). The establishment of WHT5 would not require the relocation of any existing moorings within Snails Bay or impact on access to private jetties for residential properties along Louisa Road in Birchgrove. Access to the existing moorings at Snails Bay would be restricted during construction to allow for the mooring of immersed tube tunnel

Construction location	Potential impacts on land use during construction
	units at this location.
Sydney Harbour north cofferdam (WHT6)	The Sydney Harbour north cofferdam construction support site (WHT6) would be temporarily located to the west of the Waverton Peninsula off Balls Head. An exclusion zone would be set up around WHT6 to facilitate the safe passage of all vessels and recreational users travelling in the vicinity of the cofferdam. Construction activities associated with this site would require the establishment of maritime speed restrictions around construction equipment. This would result in minor increases to transit times for recreational, commercial and government vessels. Potential impacts on vessel movements and marine activities within Sydney Harbour are further considered in Chapter 8 (Traffic and transport). The establishment of WHT6 would require the temporary relocation of the historic *Baragoola* and *M.V. Cape Don* vessels which are currently moored in the vicinity of the site. Transport for NSW would give reasonable time and notice for the vessel owners to find a suitable alternate birthing within Sydney Harbour before construction commences.
Berrys Bay to the Warringah Freeway	
Berrys Bay construction support site (WHT7)	The Berrys Bay construction support site (WHT7) would be a temporary land and water-based construction support site located on the northern foreshore of Berrys Bay in Waverton. The construction support site would be located on government-owned land that is zoned for working waterfront uses. Activities carried out at the site, including the transportation of spoil (via barge to the White Bay construction support site (WHT3)), would be consistent with the current land use zoning. Land use impacts may include temporary impediments for vessels based at the Sydney Harbour Yacht Charter located at Berrys Bay. Impediments may be experienced due to the movement of barges to and from the construction support site. Coordination would be required during the arrival and departure of construction barges in Berrys Bay to avoid manoeuvring, access and egress restrictions for the Sydney Harbour Yacht Charter vessels. Impacts to marine traffic and access are further considered in Chapter 8 (Construction traffic and transport). Moorings in the vicinity of the construction support site at Berrys Bay (WHT7) and on approach to the site would need to be relocated. Relocations would be managed by Transport for NSW in accordance with the measures outlined in Chapter 8 (Construction traffic and transport). The establishment of the construction support site would occupy land covered by the *Waverton Peninsula Strategic Masterplan*. This area would be impacted on a temporary basis and would not preclude the long term use of the area for public open space and working waterfront land uses.

Construction location	Potential impacts on land use during construction
Berry Street north construction support site (WHT8)	The Berry Street north construction support site (WHT8) would temporarily occupy land located between the Berry Street on ramp and the Warringah Freeway in North Sydney. The site is owned by Transport for NSW and is currently vacant and zoned SP2 Infrastructure. The location of this construction support site would not impact on the existing land use zone as it is currently vacant and zoned for infrastructure related uses. The site would be rehabilitated and returned to an equivalent state at the completion of construction. The construction support site would be located in the vicinity of land covered by the *Ward Street Precinct Masterplan* but is not expected to impact the implementation of this plan on a temporary or permanent basis.
Ridge Street north construction support site (WHT9)	The Ridge Street north construction support site (WHT9) would temporarily occupy the south-eastern portion of St Leonards Park between the North Sydney Bowling Club and the Warringah Freeway corridor. The construction support site would be located on land largely owned by the State of NSW (Crown land) that is zoned for public recreation. The adjoining netball courts, North Sydney Bowling Club, North Sydney Oval, Bon Andrews Oval and St Leonards Park Music Shell would remain operational during construction and would not be directly impacted during construction. About 12 on-street car parking spaces along Ridge Street would be temporarily removed to create access to the site. St Leonards Park comprises one of the largest areas of public open space in North Sydney. The Ridge Street north construction support site would temporarily occupy only a small area of land in the context of the whole of St Leonards Park. Alternative sections of the park would be available for public recreation during the construction period which could include the expansive open space area located to the north of North Sydney Oval and adjacent Bon Andrews Oval. The directly impacted part of St Leonards Park would be rehabilitated in consultation with North Sydney Council and with consideration of the *St Leonards Park Landscape Masterplan*. The areas would be returned to an equivalent state at the completion of construction for continued public recreational use.
Cammeray Golf Course construction support site (WHT10)	The Cammeray Golf Course construction support site (WHT10) would temporarily occupy the south-western portion of the existing golf course, adjacent to the Warringah Freeway, Ernest Street and Cammeray Park in Cammeray. The site would be located on government-owned land zoned for public recreational use associated with the Cammeray Golf Club. The site would be a tunnelling site and would be located adjacent to a separate construction support site for the Warringah Freeway Upgrade works (WFU8). The construction support site would occupy part of Cammeray Golf Course for the duration of construction works.

Construction location	Potential impacts on land use during construction
	The location and layout of WHT10 and adjoining WFU8 within Cammeray Golf Course have been designed to minimise disruption to users of the golf course. It is anticipated that Cammeray Golf Club would continue to operate as a nine hole golf course during construction, with a revised configuration and reductions in length of some fairways. The adjoining Cammeray Park sports ground, tennis club, croquet club and skate park would remain operational during construction and would not be directly impacted during construction. At the completion of construction, a portion of the site would be used on an ongoing basis to support permanent project infrastructure. Land use impacts during operation of the project are considered in the below section.
Waltham Street construction support site (WHT11)	The Waltham Street construction support site (WHT11) would temporarily occupy an entire lot within the Artarmon Industrial area, between Waltham Street to the west, Gore Hill Freeway to the north, Hampden Road to the east and industrial buildings to the south. The site would be located on private, commercial land zoned for industrial use. The site would be used to construct the motorway control centre for the Western Harbour Tunnel. The site would also be used for equipment laydown, car parking for construction workers and temporary site office buildings. At the completion of construction, the entire site would be used to support permanent project infrastructure. Land use impacts during operation of the project are considered in the below section.
Warringah Freeway and surrounds	
Warringah Freeway Upgrade	Surface works required as part of the Warringah Freeway Upgrade would be carried out from a point immediately north of the Sydney Harbour Bridge at Milsons Point to the intersection with Willoughby Road at Naremburn. A detailed description of these works is provided in Chapter 5 (Project description). Construction activities carried out within the Warringah Freeway corridor and along the surrounding road network would generally be carried out on land owned by Transport for NSW and zoned for infrastructure related uses. Consequently, the majority of construction works associated with the Warringah Freeway Upgrade would not directly impact existing land use zones or the development potential of land in the area between Milsons Point and Naremburn. There is the potential for construction of the Warringah Freeway Upgrade to impact a number of private driveways in areas located adjacent to where construction works would be carried out. Impacts would include temporary access impediments for residents or removal of driveways to facilitate construction activities. Access to residences would be maintained at all times, and any impacted driveways would be reinstated by Transport for NSW as soon

Construction location	Potential impacts on land use during construction
	as practicable once the relevant construction works are completed. Construction works would also temporarily impact pedestrians and cyclists who would need to be detoured around areas of construction works at certain locations along the Warringah Freeway corridor and the surrounding road network. Impacts of the project on pedestrian and cyclists are further considered in Chapter 8 (Construction traffic and transport) and Chapter 21 (Socio-economics). The Warringah Freeway Upgrade would require the establishment of nine construction support sites to enable construction of the project (refer to Chapter 6 (Construction work)). Land use impacts associated with these sites are discussed below.
Blue Street construction support site (WFU1)	The Blue Street construction support site (WFU1) would temporarily occupy land located between the Pacific Highway and T1 North Shore and Western rail line in North Sydney and would support construction activities at the southern end of the Warringah Freeway Upgrade. WFU1 would be located on land owned by Transport for NSW and is zoned SP2 Infrastructure. The use of this site to support construction activities would not impact on the existing land use as it is currently zoned for infrastructure related uses. The site would be rehabilitated and returned to an equivalent state at the completion of construction.
High Street south construction support site (WFU2)	The High Street south construction support site (WFU2) would temporarily occupy land that is bound by Cahill Expressway, High Street and the High Street off ramp in North Sydney. The land is owned by Transport for NSW and is zoned SP2 Infrastructure. The use of this site to support construction activities would not impact on the existing land use as it is currently vacant and zoned for infrastructure related uses. The site would be rehabilitated and returned to an equivalent state at the completion of construction.
High Street north construction support site (WFU3)	The High Street north construction support site (WFU3) would temporarily occupy land that is bound by Cahill Expressway and Alfred Street in North Sydney. The land is owned by Transport for NSW and is zoned SP2 Infrastructure. The use of this site to support construction activities would not impact on the existing land use as it is currently vacant and zoned for infrastructure related uses. The site would be rehabilitated and returned to an equivalent state at the completion of construction.
Arthur Street east construction support site (WFU4)	The Arthur Street east construction support site (WFU4) would temporarily occupy land bound by the Warringah Freeway, Arthur Street, Mount Street and High Street in North Sydney. The land is owned by Transport for NSW and is zoned SP2 Infrastructure. The use of this site to support construction activities would not impact on the existing land use as it is currently vacant and zoned for infrastructure related uses. The site would be rehabilitated and returned to an equivalent state at the completion of construction.

Construction location	Potential impacts on land use during construction
Berry Street east construction support site (WFU5)	The Berry Street east construction support site (WFU5) would temporarily occupy land bound by the Warringah Freeway, Arthur Street and Berry Street/Warringah Freeway on ramp in North Sydney. The land is owned by Transport for NSW and is zoned SP2 Infrastructure. The use of this site to support construction activities would not impact on the existing land use as it is currently vacant and zoned for infrastructure related uses. The site would be rehabilitated and returned to an equivalent state at the completion of construction.
Ridge Street east construction support site (WFU6)	The Ridge Street east construction support site (WFU6) would temporarily occupy land between the Warringah Freeway and residential properties on Ridge Street in North Sydney. WFU6 would support construction of the Ridge Street pedestrian bridge eastern abutment. The construction support site would be on land owned by Transport for NSW and is zoned SP2 Infrastructure. The use of this site to support construction activities would not impact on the existing land use as it is currently vacant and is zoned for infrastructure related uses. The site would be rehabilitated and returned to an equivalent state at the completion of construction.
Merlin Street construction support site (WFU7)	The Merlin Street construction support site (WFU7) would temporarily occupy Merlin Street Reserve in Neutral Bay. WFU7 would be the main construction support site for the Alfred Street North realignment and new southbound bus lane bridge off Falcon Street. The construction support site would be on land owned by Transport for NSW and is zoned for public recreation and high density residential. Part of the Merlin Street Reserve would be permanently impacted during operation of the project due to the creation of a new southbound bus lane bridge off Falcon Street. Land use impacts during operation of the project are further considered in the below section.
Cammeray Golf Course construction support site (WFU8)	The Cammeray Golf Course construction support site (WFU8) would temporarily occupy the north-western portion of the existing golf course, located adjacent to the Warringah Freeway. WFU8 would be located on government-owned land zoned for public recreational use associated with the Cammeray Golf Club. WFU8 would be the main site supporting construction works for the Warringah Freeway Upgrade and would be located adjacent to a separate construction support site for the Western Harbour Tunnel works (WHT10). The location and layout of WFU8 and the adjoining WHT10 within Cammeray Golf Course have been designed to minimise disruption to users of the golf course. It is expected that the Cammeray Golf Club would continue to operate as a nine hole golf course during construction, with a revised configuration and reductions to the length of some of the fairways. The Cammeray Park sports ground, tennis club, croquet club and skate park located to the south-east of WFU8

Construction location	Potential impacts on land use during construction
	would not be directly impacted by the construction support site. At the completion of construction, a portion of the site would be used on an ongoing basis to support permanent project infrastructure and the future Beaches Link and Gore Hill Freeway Connection project construction support site (subject to a separate approval). Land use impacts during operation are considered in the below section.
Rosalind Street east construction support site (WFU9)	The Rosalind Street east construction support site (WFU9) would temporarily occupy land bound by the Warringah Freeway northbound off ramp to Miller Street in the north and east, Rosalind Street to the south and Miller Street in Cammeray to the west. WFU9 would be located on land owned by Transport for NSW and zoned for public recreation. Despite the land use zoning the site is unsuitable for public recreational use as it is a relatively small parcel of land, is severed from any expansive open space area and is bordered by existing road infrastructure. Land use impacts at this location during construction would be negligible. The site would be rehabilitated and returned to an equivalent state at the completion of construction.

Potential land use impacts during operation

The project has the potential to impact land use and development potential of surrounding areas during operation. Land use changes as a result of the project would occur largely in response to the physical introduction of permanent project infrastructure at Rozelle, North Sydney and Cammeray. The location of operational infrastructure has been developed in consideration of existing land uses and future development to minimise permanent impacts and is discussed further in Table 20-5.

Surrounding land would also be affected by the operation of the project. The operation of ventilation outlets at Rozelle Rail Yards and at the Warringah Freeway in Cammeray has the potential to influence development patterns for existing and future elevated receptor locations (for example, those receptors within multi-storey residential buildings) and is discussed further in Table 20-6.

Potential indirect impacts as a result of changes to land use would also relate to traffic and transport, noise and vibration, air quality and social and economic values. Consideration of these impacts is provided in Chapter 9 (Operational traffic and transport), Chapter 11 (Operational noise and vibration), Chapter 12 (Air quality) and Chapter 21 (Socio-economics).

Table 20-5 Potential land use impacts during operation

Operational infrastructure	Potential impacts on land use during operation
Rozelle Interchange and surrounds	
• Connection to the Rozelle Interchange (part of the M4-M5 Link) • Western Harbour Tunnel operational facilities that form part of the M4-M5 Link Rozelle East Motorway Operations Complex • Wastewater treatment plant.	The Rozelle Interchange would be located on land zoned Port and Employment under the SREP 26. The objectives of this zone are to facilitate the continuation of commercial port uses, encourage a mix of land uses that generate employment opportunities, particularly in relation to port and maritime uses, and to provide road and rail access to port activities. The establishment of permanent project infrastructure at this location is consistent with the existing land use zone objectives as it would provide improved road access to the surrounding port and maritime precinct of Rozelle Bay and White Bay. Further, the siting of operational project infrastructure at the Rozelle Rail Yards has been developed in consideration of maximising areas of land that would be available for landscaping and urban design treatments and/or community and social infrastructure. *Informing the Bays Precinct, Sydney Transformation Plan* (UrbanGrowth, 2015a) identifies the area around the Rozelle Interchange, including land at the Rozelle Rail Yards, as a longer-term priority destination that would form part of The Bays Precinct urban renewal project. The NSW Government has identified this precinct as a potential location to reconnect areas to the north and south of the Rozelle Rail Yards and to improve connections between Lilyfield and the Sydney Harbour foreshore. Future uses may include a mix of housing choices, including affordable housing, as well as active and passive recreational public spaces and employment uses. Operation of the project would not preclude the future construction of Rozelle Park as part of the Bays Precinct Urban Transformation Program. The project may pose restrictions on the potential establishment of future elevated receivers (including multi-storey residential buildings) located close to the ventilation outlet and motorway facilities at the Rozelle Interchange. This issue is discussed further in the following section.
Rozelle to Birchgrove	
There would be no permanent operational infrastructure established at surface level in the area between Rozelle and Birchgrove. Works would comprise subsurface tunnelling that would not introduce any permanent impacts to existing land uses, current land use zones or the strategic land use direction of the area.	
Birchgrove to Berrys Bay	
Immersed tube tunnels	Operational infrastructure in the area between Birchgrove and Berrys Bay would include immersed tube tunnels for the crossing of Sydney Harbour. The immersed tube tunnels would sit in an excavated rock trench and would be located below the bed of the harbour. The immersed tube tunnels would not introduce navigational impacts for

Operational infrastructure	Potential impacts on land use during operation
	water-based activities and operations carried out in Sydney Harbour. Further, there would be no land use impacts during operation to foreshore land along Sydney Harbour between Birchgrove and Berrys Bay. No other permanent operational infrastructure would be established at surface level in the area between Birchgrove and Berrys Bay. Works would otherwise comprise subsurface tunnelling that would not introduce any permanent impacts to existing land uses, current land use zones or the strategic land use direction of the area.
Berrys Bay to the Warringah Freeway	
• Surface connection to Berry Street • Surface connection to Falcon Street.	Kerb and footpath adjustment works would occur on Miller Street southbound around the intersection with Falcon Street. These works would provide a new dedicated lane for left turning traffic from Falcon Street westbound to Miller Street southbound. Further review of the impacts in this area is currently being carried out and permanent impacts to St Leonards Park would be minimised or, where possible eliminated. The connections between the motorway tunnels and existing surface road network in North Sydney would be established on land owned by Transport for NSW and zoned for infrastructure related uses.
Warringah Freeway and surrounds	
• Warringah Freeway Upgrade works • Surface connections from the Warringah Freeway to the motorway tunnel on and off ramps and surrounding surface roads • New, upgraded and widened road bridges • New, upgraded and relocated shared user bridges • Interchange upgrades at High Street and Falcon Street	Surface connections as part of the Warringah Freeway Upgrade would mostly be carried out on land owned by Transport for NSW and zoned for infrastructure related uses. The project would be compatible with the existing land use zone where carried out on land zoned SP2 Infrastructure. The establishment of permanent infrastructure at Cammeray Golf Course would change the existing land use in the footprint of the permanent infrastructure from public recreation to permanent project infrastructure. Further, the project would reduce the amount of land available for public recreational use in this area. It is expected that the Cammeray Golf Course would be retained in a modified form (such as changes to the length of some fairways). The project is consistent with the broader NSW Government strategic planning direction for North Sydney and surrounding locality. As part of the North Sydney Centre Review the traffic and pedestrian management study recommends a range of initiatives focused on prioritising pedestrians in the North Sydney CBD through improvements to connectivity, amenity and mobility. The existing scale of the Warringah Freeway creates a barrier between the eastern and western sides of North Sydney. While the project would not remove this barrier, the Warringah Freeway Upgrade would provide a positive contribution to the local area by providing new and upgraded active transport infrastructure that would improve connectivity across the Warringah Freeway including connections to and from the North Sydney commercial centre. This would include the replacement of the Ridge Street shared user bridge, a new shared user path along the southern side of the High Street bridge at North Sydney, an active

Operational infrastructure	Potential impacts on land use during operation
• Upgrades to the surrounding road network and bus infrastructure • Ventilation outlet and motorway facilities at the Warringah Freeway • Motorway control centre at Waltham Street.	transport link north of Ernest Street, and an improved dedicated cycleway between Ernest Street and Miller Street. The NSW Government is currently undertaking a strategic planning investigation of the St Leonards and Crows Nest Planned Precinct. The new Sydney Metro station located at Crows Nest will provide opportunities for rejuvenation of the local area. This strategic planning investigation is being carried out in consultation with the relevant councils to ensure a coordinated planning approach. The northern extent of the Warringah Freeway Upgrade would be located within this planned precinct. It is anticipated that the project would not significantly impact on road access to and from the precinct as a result of the changes to connectivity for the Brook Street interchange. Operational infrastructure at Waltham Street would be established within the Artarmon industrial area on land zoned for light industrial uses. While the project would reduce the amount of land that would otherwise be used for light industrial activities, the project is not expected to impact on the continued viability of the Artarmon industrial area more broadly. Further, the project would not preclude the continued operation of light industrial and/or commercial uses on land that adjoins or is located in proximity to the project infrastructure within the Artarmon industrial area.

The project would involve the operation of ventilation outlets and motorway facilities at the Rozelle Interchange and at the Warringah Freeway (refer to Chapter 5 (Project description)).

Table 20-6 identifies land use zones and applicable height restrictions, if any, in an area of around 300 metres from each of the project ventilation outlets. It also outlines potential implications for existing and future land use planning and particularly that:

- There are currently no adverse impacts at any existing buildings for elevated receptors or for any future buildings up to a height of 20 metres. However, there would be potential impacts for future buildings above 20 metres in height within 300 metres of the outlets; but this would not necessarily preclude such development. Further consideration at rezoning or development application stage would be required (refer to Chapter 12 (Air quality))
- Any future changes to zoning and/or development controls would need to manage any interaction between the project and future development for buildings above 20 metres and within 300 metres of the ventilation outlet.

Potential indirect impacts as a result of changes to land use would also relate to traffic and transport, noise and vibration, air quality and social and economic values. Consideration of these impacts is provided in Chapter 9 (Operational traffic and transport), Chapter 11 (Operational noise and vibration), Chapter 12 (Air quality) and Chapter 21 (Socio-economics). The air quality impact assessment (refer to Chapter 12) and the human health impact assessment (refer to Chapter 13) carried out for the project demonstrate that operation of the motorway facilities and ventilation outlets would not result in unacceptable air quality impacts or an unacceptable impact to human health for existing receivers. The air quality impact assessment and human health assessment have assessed potential impacts at ground level, as well as at existing elevated receivers (such as those in multi-storey dwellings close to the project).

Table 20-6 Existing building height restrictions around project ventilation outlets

Ventilation outlet	Relevant land use zones within 300 metres of the ventilation outlet	Existing height restrictions within 300 metres of the ventilation outlet	Potential implications for existing and future planning controls
Ventilation outlet at the Rozelle Interchange	Land use zones for the area around the ventilation outlet at the Rozelle Interchange are shown in Figure 20-1 and include the following within 300 metres of the ventilation outlet: • Predominantly R1 General Residential and Port and Employment • Some small areas of B2 Local Centre, RE1 Public Recreation (Easton Park) and SP2 Infrastructure.	There are currently no building height restrictions applicable to land around the ventilation outlet at the Rozelle Interchange under the Leichhardt LEP 2013 or SREP 26.	There are currently no height limits imposed on development in land use zones within 300 metres of the ventilation outlet at the Rozelle Interchange. Areas in and around Rozelle Bay are included in the *Informing the Bays Precinct, Sydney Transformation Plan*. Land use considerations would be required to manage any interaction between the project and future development for buildings above 20 metres and within 300 metres of the ventilation outlet.
Ventilation outlet at the Warringah Freeway	Land use zones for the area around the proposed Warringah Freeway ventilation outlet are shown in Figure 20-5 and include the following within 300 metres of the ventilation outlet: • Predominantly R4 High Density Residential and R3 Medium Density Residential, with some pockets of R2 Low Density Residential • A small area of B4 Mixed Use zone at the western end of Military Road	Building height restrictions applicable to land around the Warringah Freeway ventilation outlet under the North Sydney LEP 2013 include: • A maximum of 12 metres for most land zoned R4 High Density Residential, with some pockets up to 16 metres around Military Road on the eastern side of the Warringah Freeway • A maximum of 8.5 metres for most land zoned R3 Medium Density Residential, with a single site on Lytton Street permitted up to 11	All land use zones within 300 metres of the ventilation outlet currently have building height restrictions of less than 20 metres. Where height restrictions do not exist, particularly in RE1 Public Recreation and SP2 Infrastructure (road infrastructure) zones, development of elevated habitable structures would either be prohibited or inconsistent with the aims of the zone. No additional development controls would be required to manage the interaction between the operation of the ventilation outlet and currently permissible habitable structures in the area. However, if zoning and/or development controls were to be

Ventilation outlet	Relevant land use zones within 300 metres of the ventilation outlet	Existing height restrictions within 300 metres of the ventilation outlet	Potential implications for existing and future planning controls
	• Several areas of SP2 Infrastructure, including education facilities, places of worship and road infrastructure • Areas of RE1 Public Recreation (including ANZAC Park, St Leonards Park and the Cammeray Golf Course).	metres • A maximum of 8.5 metres for land zoned R2 Low Density Residential • A maximum of 16 metres for land zoned B4 Mixed Use • Maximum heights for land zoned SP2 Infrastructure (education establishments and places of worship) consistent with surrounding residential zones, being either 8.5 metres or 12 metres. There are no height limits imposed on SP2 Infrastructure (road infrastructure) zones.	reviewed in the future, land use considerations would need to manage any interaction between the project and future development for buildings above 20 metres and within 300 metres of the ventilation outlet at the Warringah Freeway.

Changes in public open space

The following public open space areas would be temporarily impacted during construction:

- Yurulbin Park, Birchgrove
- Rose Avenue Reserve, Neutral Bay
- St Leonards Park, North Sydney
- ANZAC Park, North Sydney
- Cammeray Golf Course
- Merlin Street Reserve.

The majority of open space used for construction of the project would not be required to operate the project and would be rehabilitated and returned to an equivalent state as soon as practicable at the completion of construction. The project would not impact on the long term viability of these areas as public open space.

The more substantial changes in public open space as a result of the operation of the project would be at Cammeray Golf Course, where about 25,000 m^2 adjacent to the Warringah Freeway would be required for shared permanent operational facilities for both the Western Harbour Tunnel and Warringah Freeway project and the Beaches Link and Gore Hill Freeway Connection project. Change at this site would be managed to enable its ongoing operation as a nine-hole golf course, with minor amendments to the configuration of holes and their associated pars.

20.5 Environmental management measures

The project has been designed to minimise the requirement for property acquisition as far as practical and optimise the use of land already owned by Transport for NSW. Measures to avoid, minimise or manage land use and property impacts as a result of the project are detailed in Table 20-7.

Additional measures relevant to the management of land use impacts are also outlined in other chapters of the environmental impact statement, including:

- Chapter 8 (Construction traffic and transport)
- Chapter 9 (Operational traffic and transport)
- Chapter 10 (Construction noise and vibration)
- Chapter 11 (Operational noise and vibration)
- Chapter 12 (Air quality)
- Chapter 13 (Human health)
- Chapter 21 (Socio-economics)
- Chapter 22 (Urban design and visual amenity).

Table 20-7 Environmental management measures for land use and property impacts

Ref	Phase	Impact	Environmental management measure	Location
LP1	Pre-construction and construction	Property acquisition	Land acquisition for the project will be carried out in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991* (NSW), the *Roads and Maritime Services Land Acquisition Information Guide* (Roads and Maritime, 2014a) and *Fact sheet: Property acquisition of subsurface lands* (Roads and Maritime, 2015) and in accordance with the land acquisition reforms announced by the NSW Government in 2016.	WHT/WFU
LP2	Construction	Temporary use of land	Land subject to temporary use, including areas of public open space, will be rehabilitated as soon as practicable to an appropriate land use, taking into consideration the location, land use characteristics, area and adjacent land uses. This will be carried out in consultation with the relevant council and/or the landowner.	WHT/WFU
LP3	Construction	Access impediments to private property	Where impacts to private property access is unavoidable during construction, property owners will be consulted in advance to develop appropriate alternative access arrangements.	WHT/WFU
LP4	Pre-construction and construction	Temporary relocation of moorings	Transport for NSW will consult with the owners and/or leaseholders and/or licence holders of moorings that require temporary relocation to determine alternative arrangements. All efforts will be made to relocate facilities as close to their original locations as possible.	WHT
LP5	All phases	Changes to lease arrangements	Transport for NSW will consult with existing lease holders regarding any changes to lease arrangements.	WHT/WFU

Ref	Phase	Impact	Environmental management measure	Location
LP6	Operation	Residual land	Residual land remaining following construction of the project will be confirmed to identify appropriate land use, taking into consideration the location, land use characteristics, area and adjacent land uses.	WHT/WFU
LP7	Operation	Residual land at Cammeray Golf Course	Transport for NSW will continue to work with Cammeray Golf Club with a view to maintaining the long term viability of Cammeray Golf Course.	WHT/WFU
LP8	Operation	Air quality impacts for elevated receivers located around ventilation outlets and motorway facilities	Transport for NSW will assist Inner West Council, North Sydney Council and the Department of Planning, Industry and Environment (as appropriate) in determining relevant land use considerations applicable to future development in the immediate vicinity of ventilation outlets for inclusion in local environmental plans or development control plans, where required, to manage interactions between the project and future development. This may include procedures for identifying the requirement for consultation with Transport for NSW.	WHT/WFU

Western Harbour Tunnel = WHT, Warringah Freeway Upgrade = WFU.

Chapter 21

Socio-economics

January 2020

21 Socio-economics

This chapter considers the potential impacts of the project on socio-economic issues from the construction and operation of the project.

The Secretary's environmental assessment requirements as they relate to socio-economic issues and where in the environmental impact statement these have been addressed, are in Table 21-1.

The proposed environmental management measures relevant to socio-economics are included in Section 21.6.

Table 21-1 Secretary's environmental assessment requirements – Socio-economics

Secretary's requirement	Where addressed in EIS
Socio-economic, Land Use and Property	
1. The Proponent must assess social and economic impacts (of all phases of the project) in accordance with the current guidelines (including cumulative construction and operational impacts of the proposal and major projects in the vicinity of the project) and in consultation with relevant land owners (such as the Ports Authority of NSW and those land owners whose property is being acquired).	Socio economic impacts as a result of the project are presented in **Section 21.4**, **Section 21.5** and **Chapter 27** (Cumulative impacts). Engagement and consultation activities carried out to date and planned future consultation is outlined in **Chapter 7** (Stakeholder and community engagement) and **Section 21.2.3**.
2. The Proponent must assess impacts from construction and operation on potentially affected properties, businesses, recreational users and land and water users, including amenity impacts (including from cumulative and extended construction time frames and construction fatigue), property acquisitions/adjustments, future land uses, access, relevant statutory rights, and community severance and barrier impacts resulting from the project.	Socio economic impacts as a result of the project are present in **Section 21.4** and **21.5**. Impacts to properties, including property acquisitions and future land uses during construction and operation is discussed in **Chapter 20** (Land use and property) and **Chapter 27** (Cumulative impacts). Engagement and consultation activities carried out to date and planned future consultation is outlined in **Chapter 7** (Stakeholder and community engagement) and **Section 21.2.3**.
3. Where an immersed tube method (IMT) of construction is proposed for use in Sydney Harbour, the Proponent must:	See below.
a. provide details of how reductions to current Harbour depths will be avoided;	The immersed tube tunnel construction methodology is presented in **Chapter 6** (Construction works). Details of the alternatives considered for the immersed tube tunnel are detailed in **Chapter 4** (Project development alternations). An assessment on navigable water depths is provided in Appendix A of **Appendix F** (Technical working paper: Traffic and transport).

Secretary's requirement	Where addressed in EIS
b. provide details confirming the level of protection for the IMTs will be similar to or better than that of the existing Sydney Harbour Tunnel;	**Chapter 6** (Construction work) provides details confirming the level of detail of protection for the immersed tube tunnels.
c. identify impacts to ship scheduling in consultation and agreement with the Harbour Master;	**Chapter 8** (Construction traffic and transport) and **Chapter 9** (Construction traffic and transport) outline impacts related to the construction and operation of the immersed tube tunnel respectively. **Chapter 8** (Construction traffic and transport) specifies the consultation requirements with the Harbour Master to minimise impacts during construction. **Section 21.4, Section 21.5** and **Appendix U** (Technical working paper: Socio-economic Assessment) discuss impacts to ship scheduling.
d. assess the impact to the Viva supply chain for fuel oils at Gore Cove; and	**Chapter 8** (Construction traffic and transport), assesses the impacts related to construction activities in Sydney Harbour.
e. provide details of full mission simulation which takes in account, but is not necessarily limited to: i. movement and placement of the IMTs; and ii. identification of weather restrictions and towage requirements for the safe movement of seagoing ships to and from berths in Glebe Island, White Bay, Gore Cove and past proposed Project work areas in Glebe Island and White Bay, and Birchgrove to Waverton.	**Chapter 8** (Traffic and transport) presents the outcomes of the simulation report which shows that movements would be feasible and would be able to be carried out safely.
4. The Proponent must assess potential impacts on utilities (including communications, electricity, gas, fuel and water and sewerage) and the relocation of these utilities.	**Chapter 6** (Construction works) and **Appendix D** (Utilities management strategy).
5. Where the project is predicted to impact on utilities the Proponent must undertake a utilities management strategy, identifying management options, including relocation or adjustment of the utilities.	**Appendix D** (Utilities management strategy).

Secretary's requirement	Where addressed in EIS
6. A draft Community Consultation Framework must be prepared identifying relevant stakeholders, procedures for distributing information and receiving/responding to feedback and procedures for resolving stakeholder and community complaints during construction and operation. Key issues that must be addressed in the draft Framework include, but are not limited to: a. traffic management (including property access, pedestrian access); b. landscaping/urban design matters; c. construction activities including out of hours work; and d. noise and vibration mitigation and management.	The content of the Framework is summarised in **Chapter 7** (Stakeholder and community engagement). A draft Community consultation framework is provided in **Appendix E** (Community consultation framework).

21.1 Legislative and policy framework

The socio-economic assessment has been prepared to assess the impacts of the project in accordance with the *Environmental Impact Assessment Practice Note – Social and economic assessment* (EIA-N05) (Practice Note) (Roads and Maritime, 2013b). The Practice Note guides the assessment level and process for socio-economic impact assessments and outlines the requirements for establishing the socio-economic baseline.

Chapter 3 (Strategic justification and project need) provides a description of national and state strategic planning and transport policies which are relevant to the project. Local council policies relevant to socio-economic impacts of the project include:

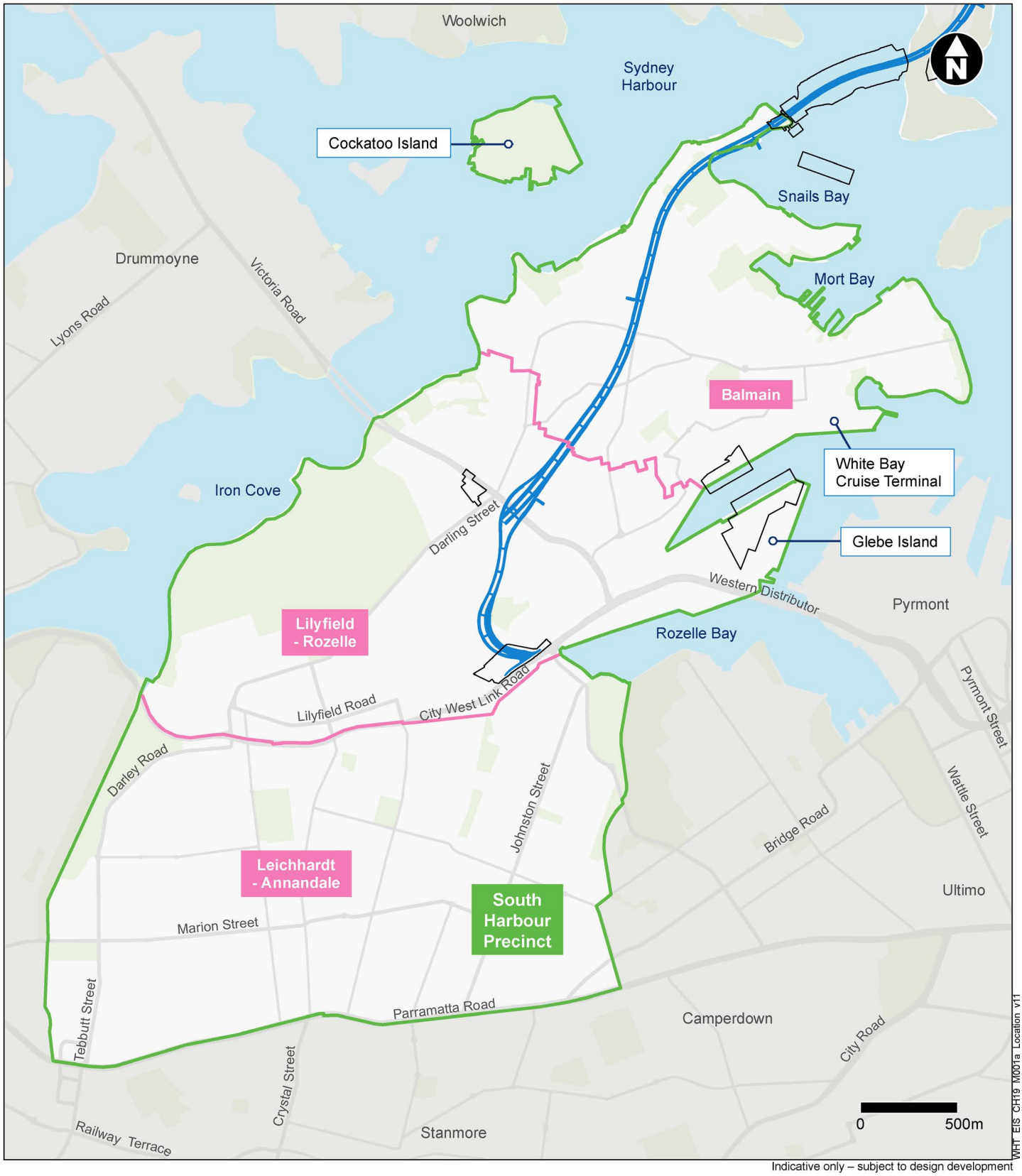
- *Statement of Vision and Priorities* (Inner West Council, 2016)
- *North Sydney Community Strategic Plan 2013-2023* (North Sydney Council, 2013)
- *Willoughby City Strategy* (Willoughby City, 2013)
- *Mosman Council Community Strategic Plan 2013-2023* (Mosman Council, 2013).

The project would generally support the actions of these plans by reducing congestion, improving travel times and enhancing the reliability of the road network across Sydney and improving access to the north and north-east of Sydney.

21.2 Assessment methodology

21.2.1 Precinct areas

The socio-economic assessment considers precincts, including adjacent waterways and comprises the Australian Bureau of Statistics (ABS) geographic boundaries (referred to as Statistical Area Level 2s) (SA2s). For the purposes of this assessment, two precincts have been identified located to the north and south of Sydney Harbour, referred to as the South Harbour Precinct and North Harbour Precinct. These areas are shown in Figure 21-1 and Figure 21-2. Broader regional impacts were also considered, where relevant.



Legend

Operational features

- Western Harbour Tunnel
- Construction footprint

South Harbour precinct

- Precinct boundary
- Statistical area boundary

Figure 21-1 South Harbour Precinct

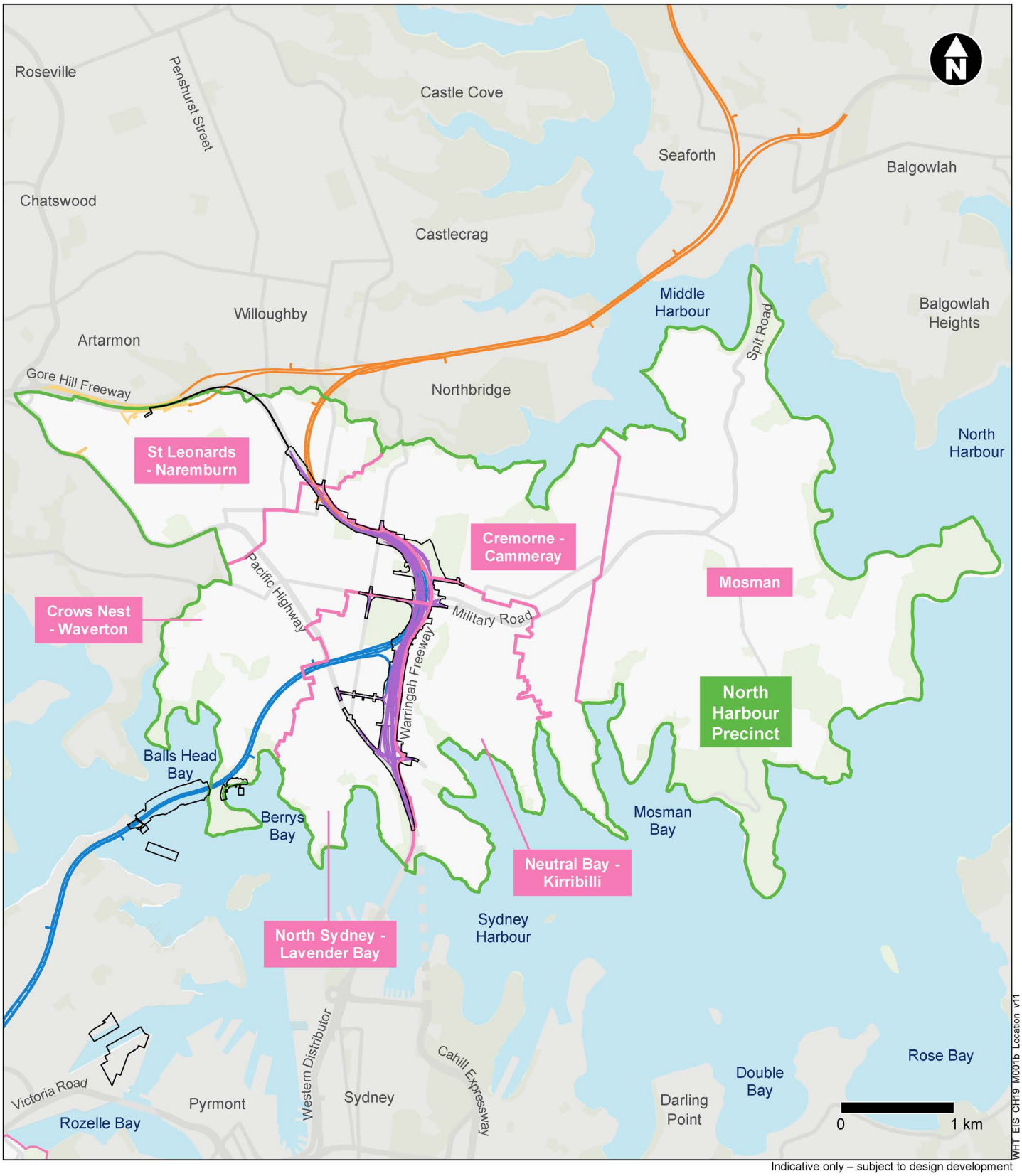


Figure 21-2 North Harbour Precinct

21.2.2 Business surveys

A business impact survey was used to inform the business impact assessment to gain a better understanding of the main issues, perceptions and concerns of businesses in regard to the project during construction and operation. The business surveys were conducted in business centres that may be more susceptible to direct or indirect effects of construction and/or operation. All information gathered as part of the business surveys was collated into a database, analysed and summarised in a survey report. Further details are provided in the business impact assessment in Appendix U (Technical working paper: Socio-economic assessment). Further engagement with business stakeholders will be carried out during the environmental impact assessment exhibition period.

21.2.3 Stakeholder consultation

Community and stakeholder engagement, including consultation with relevant landowners (such as the Ports Authority of NSW and those landowners whose property is being acquired), local communities, businesses and government agencies, has informed the project's development. The socio-economic assessment has been informed by the outcomes of this engagement, including the identification of existing features and values important to the communities considered, and assessment of potential benefits and impacts of the project.

Further details regarding consultation carried out for the project (up to exhibition of the environmental impact statement) are provided in Chapter 7 (Stakeholder and community engagement).

21.2.4 Assessment approach

The socio-economic impact assessment involved identifying, assessing and evaluating changes to or impacts on communities, businesses and industry that are likely to occur as a result of the project. The assessment involved:

- Scoping the likely range of potential socio-economic impacts and identifying businesses and communities likely to be affected by the project
- Describing existing socio-economic and business characteristics, values and conditions in the study area. The description of existing socio-economic conditions principally draws on information from the ABS Census of Population and Housing 2016, supplemented with information and data from other publicly available sources and project specialist investigations
- Identifying and evaluating changes to existing socio-economic and business conditions and values in the study area due to the project's construction and operation. Positive and negative social and economic impacts are discussed, however the methodology used requires that only negative impacts are assigned a level of significance. The level of significance of potential negative impacts was assessed by considering the sensitivity of the receiver and the magnitude of the proposed works. An evaluation matrix was used to identify the level of significance of the negative impact. Further information on the evaluation matrix is provided in Section 21.2.5. Positive impacts are qualitatively discussed but have not been assigned a level of significance using the evaluation matrix. The assessment considered potential project benefits and impacts relating to:
  - Property impacts, including impacts of property acquisition and temporary lease of property for construction
  - Equity, including the distribution of project benefits and impacts
  - Potential changes to population and demography
  - Employment, including direct and indirect employment impacts

- Business and industry, including from direct property impacts and changes in the local business environment
- Social infrastructure, including from property acquisition, temporary lease of land, and changes in local access and connectivity and amenity
- Community values, including changes to local amenity, community cohesion, local character and identity, health and safety, and environmental and natural features
- Changes to access and connectivity, including for pedestrians, cyclists, public transport users, maritime transport users, and motorists

- Identifying measures to avoid, minimise or mitigate impacts on communities and community infrastructure and business and industry arising from the project.

21.2.5 Evaluation of significance

Potential negative impacts during project construction and operation have been considered (see Table 21-2). The level of significance was determined with consideration of the sensitivity of the existing environment and magnitude of impact compared to the baseline condition. For the methodology adopted, a level of significance has only been assigned to potential negative impacts. Appendix U (Technical working paper: Socio-economic assessment) outlines what qualities contribute to the level of sensitivity for a receiver. The magnitude of an impact is dependent on its scale, intensity, spatial extent, duration and scope of works. When assessing the level of significance of negative impacts, consideration was given to:

- The range of potential direct and indirect impacts during construction and operation
- Cumulative impacts with other projects.

Table 21-2 Assessing the level of significance

		Magnitude			
		High	**Moderate**	**Low**	**Negligible**
Sensitivity	**High**	High impact	High-moderate impact	Moderate impact	Negligible
	Moderate	High-moderate impact	Moderate impact	Moderate-low impact	Negligible
	Low	Moderate impact	Moderate-low impact	Low impact	Negligible
	Negligible	Negligible impact	Negligible impact	Negligible impact	Negligible

21.3 Existing environment

This section provides an overview of the socio-economic characteristics of the two precinct areas assessed with regards to demographic profiles and housing, social infrastructure, community values, employment centres, and access and connectivity.

The existing environment with regard to traffic and transport, noise and vibration, air quality, human health, land use and property, and urban design and visual amenity are outlined in Chapter 8 (Construction traffic and transport), Chapter 9 (Operational traffic and transport), Chapter 10 (Construction noise and vibration), Chapter 11 (Operational noise and vibration), Chapter 12 (Air quality), Chapter 13 (Human health), Chapter 20 (Land use and property) and Chapter 22 (Urban design and visual amenity).

21.3.1 Demographic profile

Table 21-3 provides a summary of the demographic profile of the precinct areas. This information has been sourced from the ABS Census 2016.

Table 21-3 Demographic information for precincts

Characteristics	South Harbour Precinct	North Harbour Precinct
Population by age	• Population of about 59,540 in 2016 • Annual average growth of 1.4 per cent (2011-2016) • Lower proportion of residents 65 years and older (about 12 per cent) when compared to Greater Sydney (about 14 per cent) • A higher proportion of residents within the young working family of 15-64 years (about 70 per cent) when compared to Greater Sydney (about 67 per cent) • Equal proportion of residents under the age of 14 years when compared to Greater Sydney – both about 18 per cent.	• Population of about 111,217 in 2016 • Annual average growth of 1.3 per cent (2011-2016) • Higher proportion of residents 65 years and older (about 15 per cent) when compared to Greater Sydney (about 14 per cent) • A higher proportion of residents within the young working family of 15-64 years (about 70 per cent) when compared to Greater Sydney (about 67 per cent) • A lower proportion of residents under the age of 14 years (about 14 per cent) when compared to Greater Sydney (about 18 per cent).
Cultural diversity	• About 28 per cent of precinct residents were born overseas and 15.3 per cent of people spoke a language other than English • Greater Sydney recorded a higher proportion of people born overseas (about 36.8 per cent) and a higher proportion of people who spoke a language other than English (about 35.8 per cent).	• About 37.1 per cent of precinct residents were born overseas and 21.1 per cent of people spoke a language other than English • Greater Sydney recorded a lower proportion of people born overseas (about 36.8 per cent) and a higher proportion of people who spoke a language other than English (about 35.8 per cent).
Vulnerability/need for assistance	In 2016, 3.4 per cent of residents needed assistance, compared to about 5 per cent for Greater Sydney.	In 2016, 2.4 per cent of residents needed assistance, compared to about 5 per cent for Greater Sydney.
Dwellings	• In 2016, there were about 23,630 private dwellings, 25.5 per cent of which were apartment-style dwellings, which was similar to the Greater Sydney average (25.9 per cent) • Semi-detached houses were the primary form of housing, contributing 48.8 per cent compared to Greater Sydney's 12.9 per cent.	• In 2016, there were about 50,178 private dwellings, 60.2 per cent of which were apartment-style dwellings, which was higher than the Greater Sydney average (25.9 per cent) • Apartment style dwellings were the primary form of housing.

Characteristics	South Harbour Precinct	North Harbour Precinct
Vehicle ownership	Of occupied private dwellings: • About 13.2 per cent did not own a vehicle • About 49.5 per cent owned one vehicle • About 34.5 per cent owned two or more vehicles.	Of occupied private dwellings: • About 15.6 per cent did not own a vehicle • About 51.9 per cent owned one vehicle • About 30.3 per cent owned two or more vehicles.
Income	Higher personal ($1278 per week) and household median ($2525 per week) incomes compared to Greater Sydney ($719 per week and $1750 per week respectively).	Higher personal ($1368 per week) and household median ($2400 per week) incomes compared to Greater Sydney ($719 per week and $1750 per week respectively).
Employment	• Lower rate of unemployment (3.9 per cent) compared to Greater Sydney (6.0 per cent) • In 2016, the top four employment industries were: - Professional, scientific and technical services - Health care and social assistance - Financial and insurance services - Information media and telecommunications.	• Lower rate of unemployment (3.7 per cent) compared to Greater Sydney (6.0 per cent) • In 2016, the top four employment industries were: - Professional, scientific and technical services - Health care and social assistance - Financial and insurance services - Information media and telecommunications.
Travel to work	For employed residents within the precinct: • About 41.4 per cent drove to work in a car as either driver or passenger • About 20.5 per cent used public transport to get to work (via rail or bus) • About 8.4 per cent used active transport (walked and/or cycled).	For employed residents within the precinct: • About 35.1 per cent drove to work in a car as either driver or passenger • About 30 per cent used public transport to get to work (via rail or bus) • About 10.4 per cent used active transport (walked and/or cycled).

21.3.2 Social infrastructure

Social infrastructure in the precinct areas

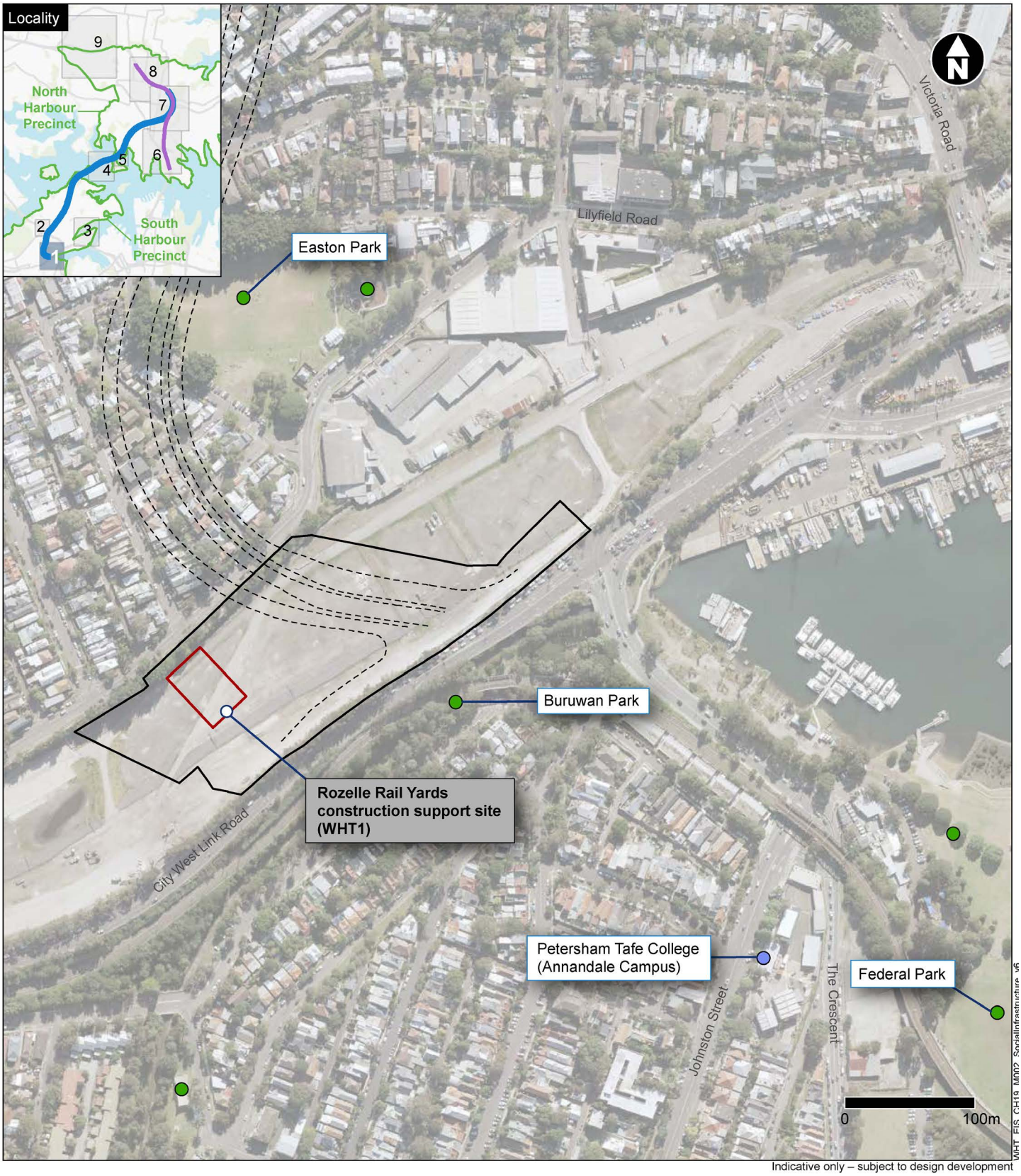
The precinct areas accommodate a wide range of community services and facilities of local and regional importance including education facilities; health, medical and emergency services; sport, recreation and leisure facilities; and community and cultural facilities. Consideration has also been made to social infrastructure within local government areas where required. These include, but are not limited to:

- Major hospitals such as the Balmain Hospital, Mater Hospital at North Sydney, and Royal North Shore and North Shore Private hospitals at St Leonards

- Tertiary education facilities, including the University of Tasmania Sydney Campus at Rozelle, University of Sydney – Sydney College of the Arts, multiple TAFE NSW campuses and the Australian Catholic University North Sydney Campus
- Local and regional sport and recreation facilities, such as Callan Park, St Leonards Park, Balls Head Reserve, Birchgrove Park, Yurulbin Park and Waverton Park
- Major retail, commercial uses, cultural and community support facilities located within the Inner West, North Sydney, Mosman and Willoughby local government areas.

Social infrastructure near the project

Social infrastructure located near surface works and construction activities is shown in Figure 21-3 to Figure 21-11.



Legend

Construction features

- Tunnel section
- Construction footprint
- Construction support site

Social infrastructure

- Education and child care
- Sport, recreation and leisure facilities

Figure 21-3 Social infrastructure near the project (map 1)

Legend

Construction features

- Tunnel section
- Construction footprint
- Construction support site

Social infrastructure

- Community centre
- Education and child care
- Health, medical and emergency services
- Places of worship

Figure 21-4 Social infrastructure near the project (map 2)

Legend

Construction features

- Tunnel section
- Construction footprint
- Construction support site

Social infrastructure

- Sport, recreation and leisure facilities
- Wharf

Figure 21-5 Social infrastructure near the project (map 3)

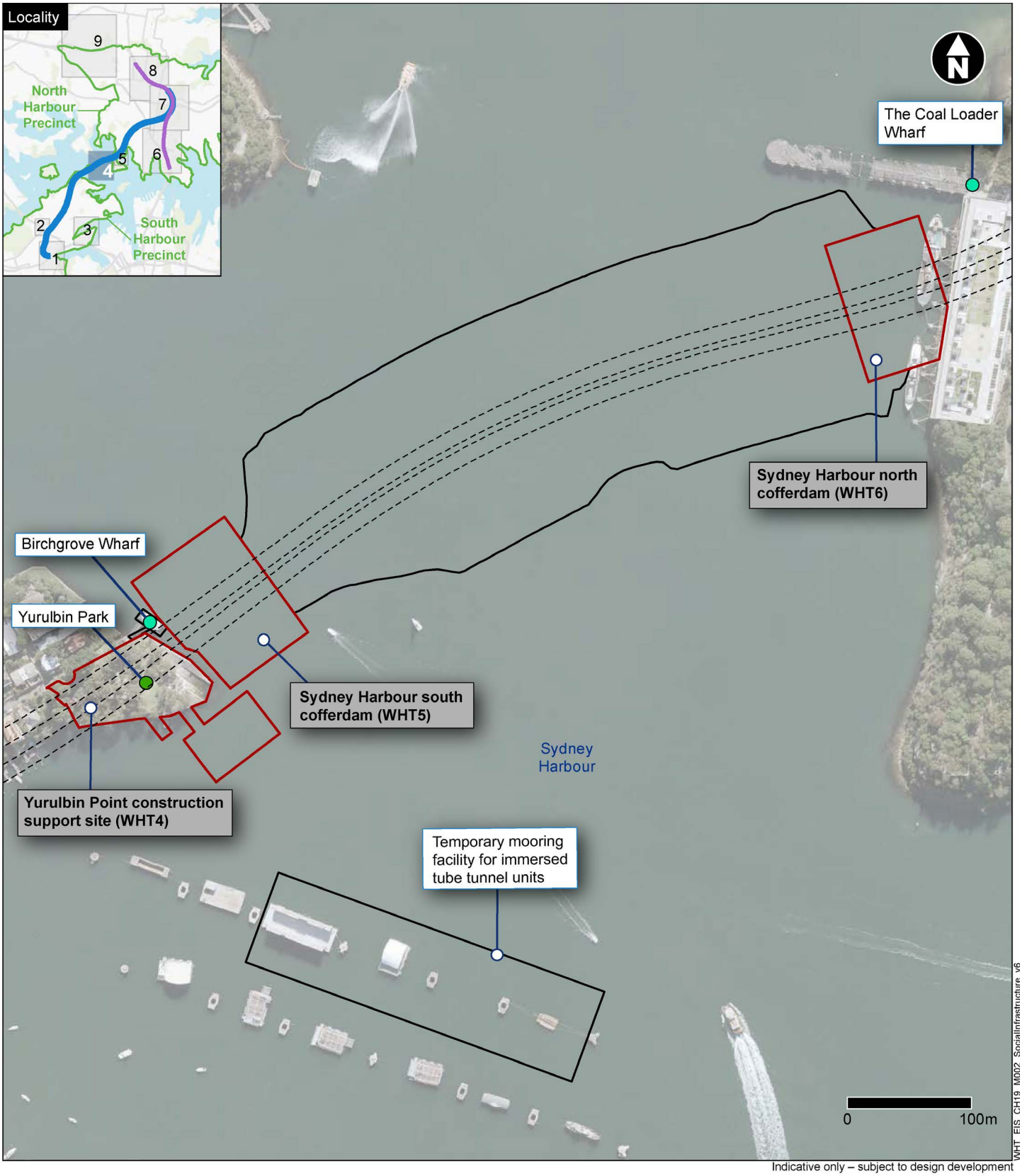
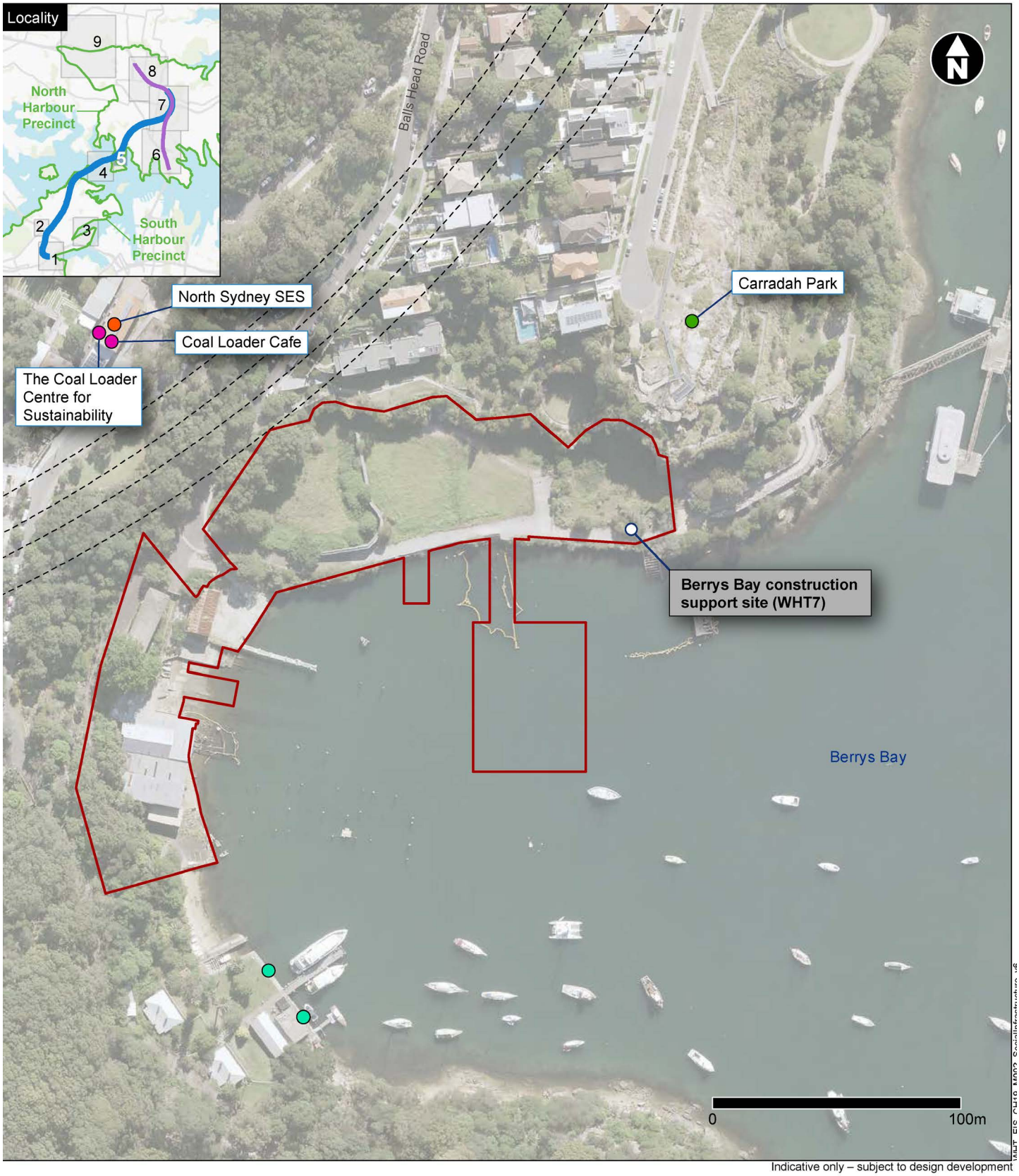


Figure 21-6 Social infrastructure near the project (map 4)



Legend

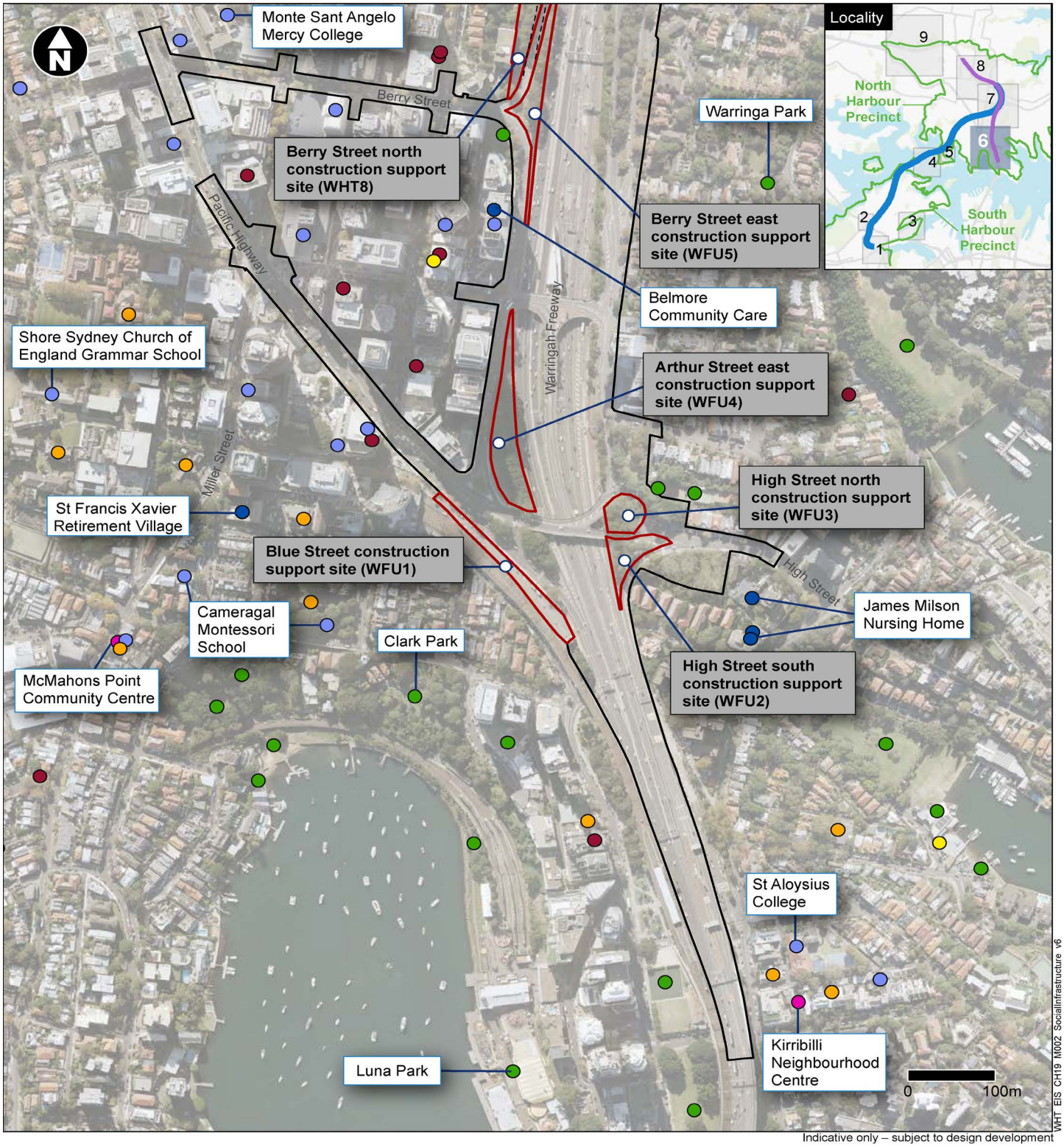
Construction features

- Tunnel section
- Construction footprint
- Construction support site

Social infrastructure

- Community centre
- Sport, recreation and leisure facilities
- SES Facility
- Wharf

Figure 21-7 Social infrastructure near the project (map 5)



Legend

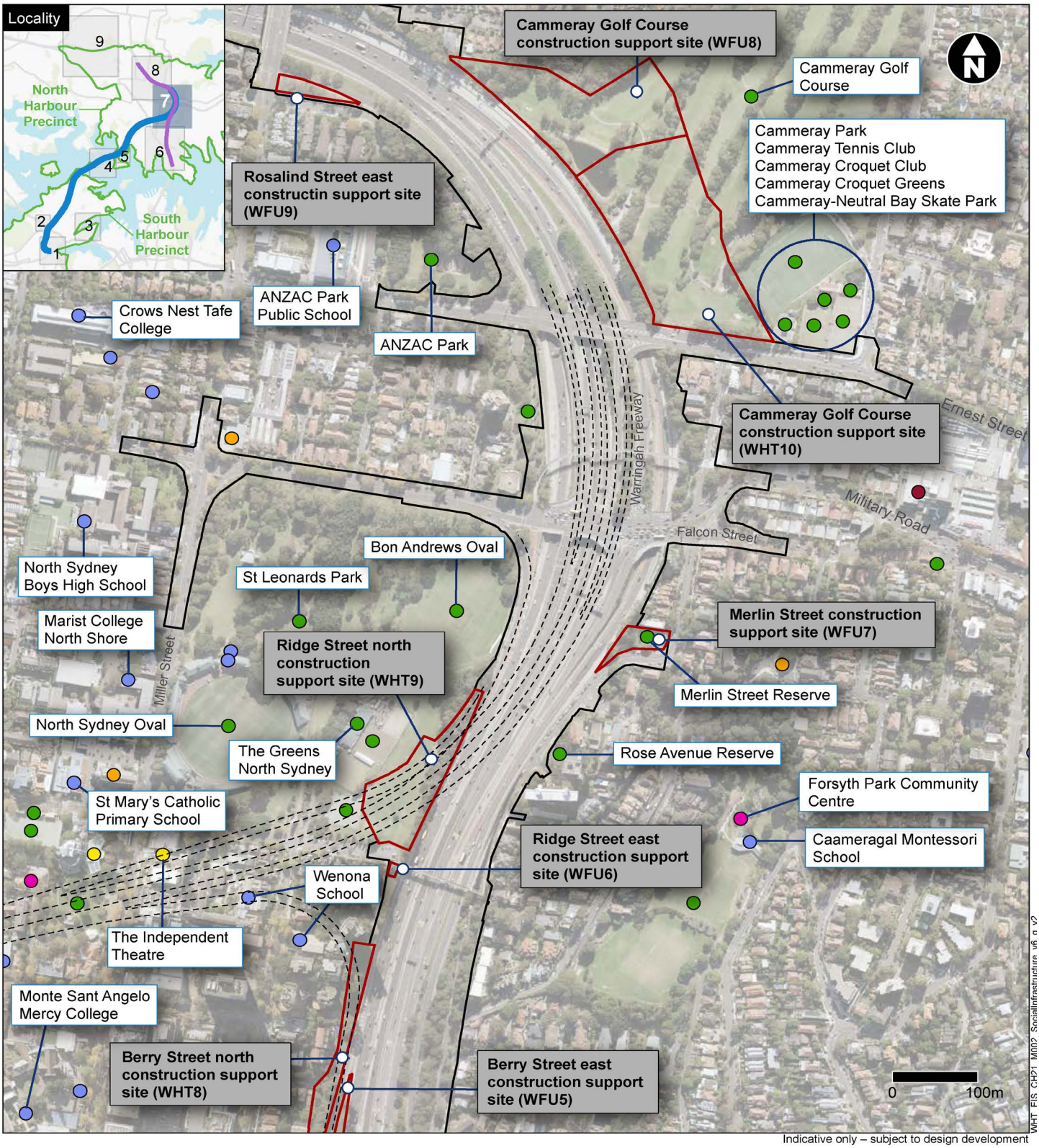
Construction features

- Construction footprint
- Construction support site

Social infrastructure

- Aged care
- Community centre
- Library and performing arts
- Education and child care
- Health, medical and emergency services
- Places of worship
- Sport, recreation and leisure facilities

Figure 21-8 Social infrastructure near the project (map 6)



Legend

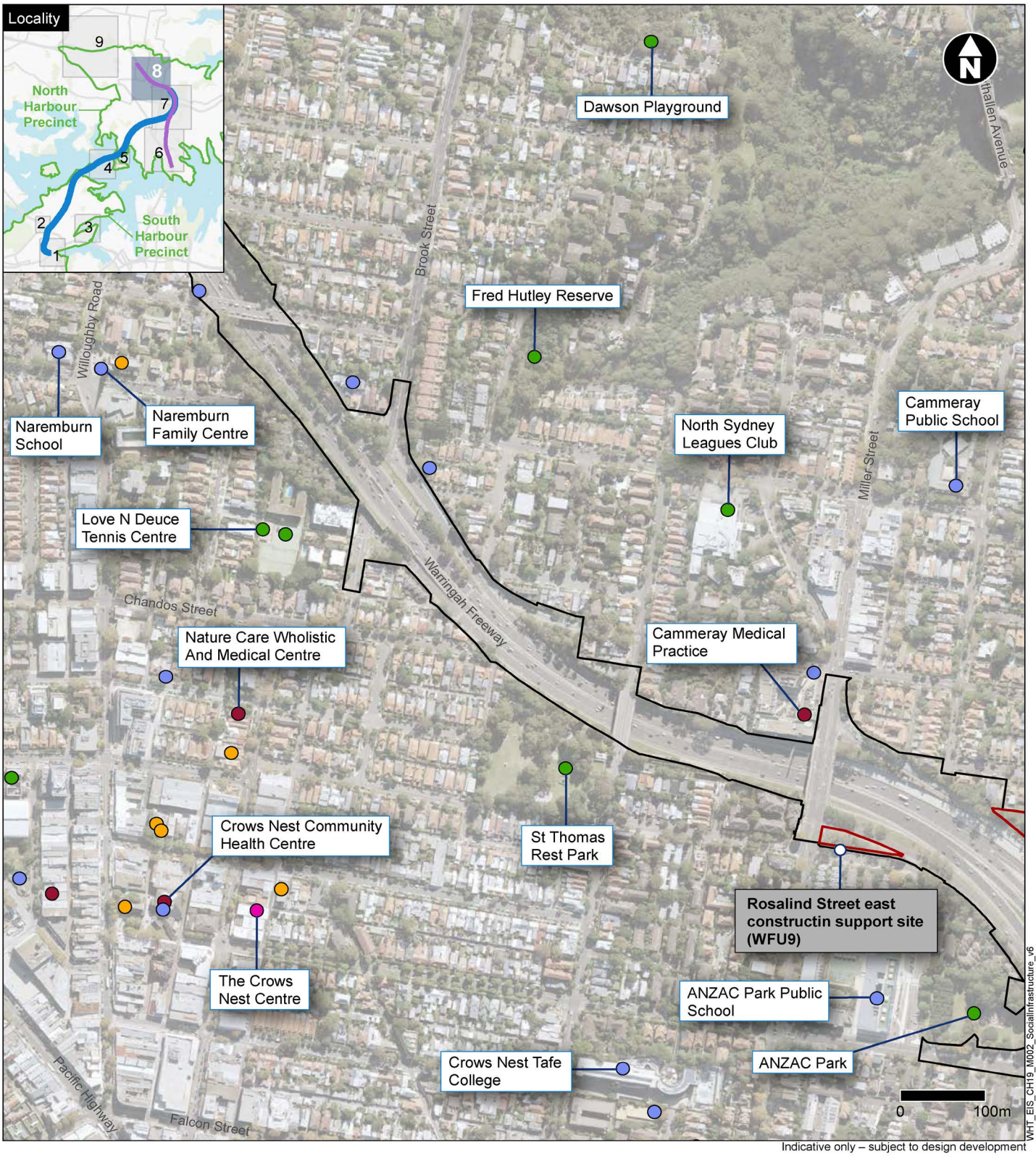
Construction features

- Tunnel section
- Construction footprint
- Construction support site

Social infrastructure

- Community centre
- Library and performing arts
- Education and child care
- Health, medical and emergency services
- Places of worship
- Sport, recreation and leisure facilities

Figure 21-9 Social infrastructure near the project (map 7)



Legend

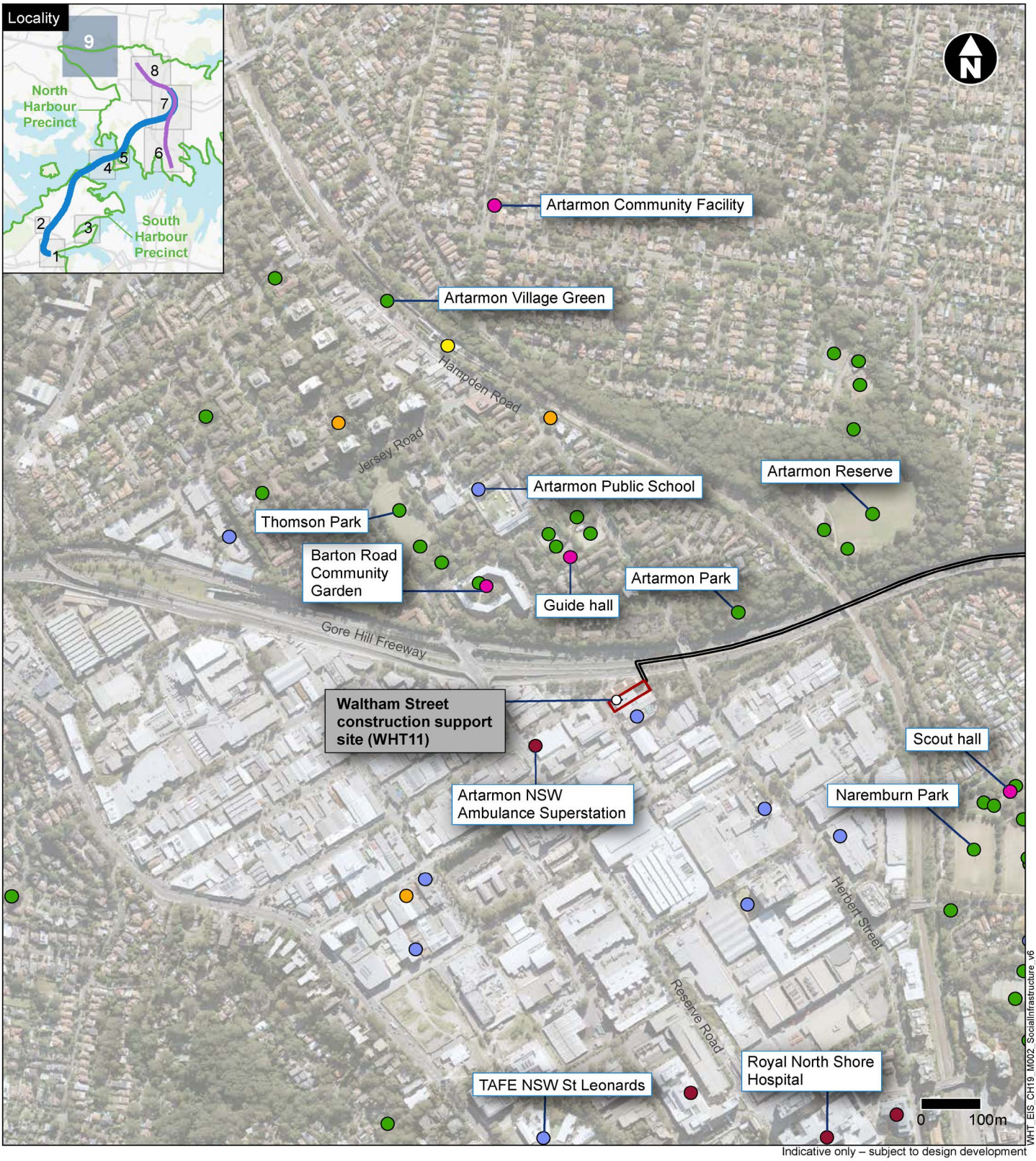
Construction features

- Tunnel section
- Construction footprint
- Construction support site

Social infrastructure

- Community centre
- Library and performing arts
- Education and child care
- Health, medical and emergency services
- Places of worship
- Sport, recreation and leisure facilities

Figure 21-10 Social infrastructure near the project (map 8)



Legend

Construction features

- Tunnel section
- Construction footprint
- Construction support site

Social infrastructure

- Community centre
- Library and performing arts
- Education and child care
- Health, medical and emergency services
- Places of worship
- Sport, recreation and leisure facilities

Figure 21-11 Social infrastructure near the project (map 9)

21.3.3 Community values

This section provides an overview of those values or features within the precinct areas that are likely to be important to local and regional communities within Greater Sydney. This has been informed by the review of existing literature (including council planning and strategy documents), assessment of places likely to be important to community members such as open space, heritage places and recreation facilities, review of community and stakeholder engagement outcomes, and observations of the precinct areas.

Local amenity and character

Community values relating to local amenity and character refer to natural and physical qualities and characteristics that contribute to a person's appreciation of their surroundings. They relate to such things as built form and landscape, environmental conditions (such as existing noise levels and air quality), and heritage and cultural features.

Local amenity and character in the precinct areas are generally characterised by a diversity of land and water-based uses including:

- Predominantly residential neighbourhoods within the South Harbour Precinct, such as at Lilyfield, Balmain, Rozelle and Birchgrove
- Industrial and maritime uses at Rozelle Bay and White Bay. Port facilities, such as the White Bay Cruise Terminal and Glebe Island, are also located within this area
- Pockets of high-density residential areas within the North Harbour Precinct, such as at McMahons Point, Waverton, Wollstonecraft, North Sydney and Cammeray
- Local centres and shopping precincts within both precincts, including at Rozelle, Balmain, St Leonards, and Crows Nest, as well as a major commercial centre at North Sydney
- Major social infrastructure such as hospitals (including Balmain Hospital, Royal North Shore Hospital and North Shore Private Hospital), educational uses (such as the University of Tasmania Campus at Rozelle) and cultural facilities (such as places of worship, community centres, and libraries)
- Parks and recreational facilities, such as Cammeray Golf Course and St Leonards Park
- Open space areas, reserves and parks that are valued by local and regional communities for their landscape amenity, heritage and recreational values. These include Sydney Harbour National Park, Yurulbin Park, Birchgrove Park, Callan Park, St Leonards Park, ANZAC Park, Balls Head Reserve, and Waverton Park
- Water based recreational activities and sporting clubs based on Sydney Harbour
- Major events on Sydney Harbour, including the Sydney New Years' Eve fireworks, Australia Day celebrations, Sydney to Hobart yacht race, Chinese New Year celebrations and Vivid Sydney
- Tourist attractions, such as Luna Park.

Community cohesion

Community cohesion refers to the connections and relationships between individuals, groups and neighbourhoods, and is encouraged by the existence of local social infrastructure, a sense of local identity, and opportunities for community participation. Levels of community cohesion and sense of belonging in the communities surrounding the project are expected to be good, with communities having access to a diverse range of local and regional level social infrastructure, strong support networks and a variety of meeting places such as local centres, community centres, sporting clubs and cafes.

Community cohesion is also encouraged by connectivity or discouraged by barriers to movement. The existing scale of the Warringah Freeway creates a barrier between adjoining areas, reducing east-west connectivity for pedestrians and traffic as described in Chapter 20 (Land use and property).

Community and social networks are associated with social infrastructure such as schools, places of worship, sporting clubs such as Cammeray Golf Club and North Sydney Bowling Club, and community, heritage and resident groups. Many of these community and social networks are long-standing and are supported by contributions from volunteers, which further strengthen community cohesion.

Communities in the precinct areas host a variety of local events, including festivals, exhibitions and markets. These provide opportunities to involve local communities and for residents to connect with and participate in community life, helping to foster a sense of community and local identity. These include:

- Local festivals, such as Willoughby Spring Festival and North Sydney Children's Festival
- Cultural and sporting events such as the Bay Run at Leichhardt, Classics at Callan Park (classical music), Balls Head Reserve Wellness Walk, Guringai Festival, Big Bash cricket, Twilight Food Festival and Spring into Jazz at North Sydney
- New Year's Eve, Chinese New Year and Australia Day celebrations
- Community volunteering programs, for example opportunity for community volunteering at the former coal loader and opportunities with the Balls Head Reserve Bushcare Group
- Weekly and monthly farmer's markets and arts markets, including at Rozelle, Crows Nest, Kirribilli, and North Sydney.

Community health and wellbeing

Maintaining a high level of community safety and ensuring people feel safe in public places is likely to be important to communities in the precinct areas, with concerns regarding road safety and safety impacts associated with locating construction works or operational infrastructure near local streets and social infrastructure raised during community and stakeholder engagement for the project. Air quality during the operation of the project and potential impacts for local communities, schools and park users near to tunnel portals and ventilation outlets have been raised by the community. In particular, concerns were related to the location of the tunnel portals and ventilation outlets and potential air quality impacts for school students and users of open space areas.

21.3.4 Business profile

Business centre profiles

A hierarchy of centres has been applied to the area based largely on work in the *Greater Sydney Region Plan* by the Greater Sydney Commission. North Sydney forms part of the Harbour CBD metropolitan area and St Leonards is a strategic centre. There are several local centres within the precincts. These are generally clustered on the main transport routes (such as rail corridors or bus routes) and provide either a specialist service to the broader area or a convenience service for the local community. Some business centres are within the precinct areas for the Beaches Link and Gore Hill Freeway project. A summary of businesses within business centres within each precinct is provided in Table 21-4. Businesses that operate outside of business and industrial zones have not been overviewed in the existing environment, however, have been considered in the assessment of impacts (refer to section 21.4.7 and 21.5.6).

Table 21-4 Summary of businesses within business centres

Centre	General description
South Harbour Precinct	
Catherine Street Centre, Lilyfield	The Catherine Street Centre contains two small business centres, including a larger convenience store located on the corner of City West Link and a small mixed-use retail centre containing a variety of small businesses. Businesses in the cluster cater to a neighbourhood catchment and are likely to be reliant on passing trade.
Victoria Road/Darling Street Centre, Rozelle	Businesses on Victoria Road comprise a variety of retail and personal medical services. Businesses on Darling Street include food retailing, a mix of clothing retailing and personal services as well as a small number of commercial businesses (banks and post offices) and health services (gyms and medical centre). Darling Street would rely on passing trade and would service both a neighbourhood and wider catchment. The north-western end of the cluster contains a mix of business types including automotive, service station/convenience store and pub/hotel, which are likely to service both a neighbourhood and wider catchment and are more likely to be dependent on passing trade.
Robert Street Industrial Centre, Rozelle	The Robert Street Industrial Centre comprises industrial businesses including a number of automotive, construction-related retail and storage businesses. A number of commercial businesses are located north along Victoria Road to Darling Street. Businesses service both a neighbourhood and wider catchment and are unlikely to be dependent on passing trade, as these businesses are destination services.
James Craig Road Working Waterfront, Rozelle	This waterfront cluster is comprised of a number of maritime related businesses, including dry storage, slipways, harbour cruises, government agency (Transport for NSW), public marina berths as well as supportive food services such as cafes. White Bay Cruise terminal is at this centre. The Terminal is also utilised as venue hire for private events. The Sydney Harbour Boat Storage, a dry stack boat storage, service, maintenance and fuel facility is also located along James Craig Road Working Waterfront. At Glebe Island, the Port Authority of NSW is proposing to construct and operate a multi-user facility for the import, storage and distribution of dry bulk materials such as sand and aggregates. There is also a proposal (yet to obtain planning approval) for the relocation of the Hanson Construction concrete batching plant to Glebe Island. The working waterfront would be dependent on access and connectivity, servicing a wide catchment. The businesses are unlikely to be dependent on passing trade.
Chapman Road Working Waterfront	This waterfront cluster comprises a number of maritime related businesses including boat hire, a multi-hull marina, charter boating and a slipway. The working waterfront would be dependent on access and connectivity, servicing a wide catchment. The business cluster is unlikely to be dependent on passing trade.
North Harbour Precinct	
Waverton Working Waterfront	This waterfront cluster comprises a number of maritime businesses, including yacht charter companies and boat repair and storage

Centre	General description
	facilities. Businesses located in the cluster are a specialist business and do not rely on passing trade.
Miller Street Centre, Cammeray	This cluster comprises a diverse mix of uses including a shopping centre, food and drink retailers, commercial businesses and neighbourhood shops. The cluster caters primarily to a neighbourhood catchment. However, as a major through road, businesses along Miller Street would also attract passing trade from residents of neighbouring suburbs.
North Sydney CBD	This centre comprises commercial offices and businesses as well as food and drink retailers, gyms and fitness centres. The area surrounding North Sydney CBD comprises a wide range of uses including residential, community facilities and schools. Businesses in the area service a neighbourhood catchment as well as those visiting for work.
Kirribilli Centre	Kirribilli Centre contains a school, church, convenience retail stores, various food and drink retailers and neighbourhood shops, including a florist, convenience store and post office. The cluster caters primarily to a neighbourhood catchment.
Bay Road Centre, Waverton	This centre contains a church and a small number of neighbourhood businesses (for example, convenience store, chemist, butcher, restaurants and a cafe). The cluster caters primarily to a neighbourhood catchment.
St Leonards - Crows Nest Centre	This cluster comprises commercial offices and businesses (for example food and drink retailers as well as gyms and fitness centres). The area has a wide range of different uses including residential, community facilities and schools as well as various food and drink retailers and specialty stores. Most businesses in the area service a neighbourhood catchment as well as those visiting for work or a night out. The specialty businesses are destination stores as many customers would drive specifically to the businesses.
Military Road Centre, Cremorne	This cluster comprises commercial offices, food and drink retailers, sports clubs and accommodation services. It includes a car dealership, medical centre and a mixed use building. Businesses serve local residents as well as commuters and those visiting for work. The car dealership is a destination business while the medical centre services a neighbourhood catchment. Commercial businesses are not likely to rely on passing trade.
Neutral Bay Junction	This cluster comprises commercial offices, food and drink retailers, sports clubs and accommodation services. Businesses serve local residents as well as commuters and those visiting for work. Commercial businesses are not likely to rely on passing trade.
Artarmon Industrial Centre	This industrial centre comprises automotive businesses (for example vehicle sales, rental and repair) and film related businesses as well as construction related commercial businesses (such as equipment sale and hire). It includes a gym and fitness facilities, warehouse/storage facilities and commercial businesses. Businesses in the area service both a neighbourhood and wider catchment and are unlikely to be dependent on passing trade.

Maritime businesses

Businesses reliant on Sydney Harbour for operation include:

- Ports: Dry bulk imports, general cargo, fuel facility, oil tankers
- Transport: Public ferries, private ferries and water taxis
- Navy bases: Defence and training facilities
- Maritime: Boat moorings, boat licensing, marine rescue, boat maintenance and repairs, tow boats, marina facilities
- Tourism: Cruise ships, harbour cruises, outdoor recreation and sporting activity operators and hire facilities, recreational boat hire, Sydney Fish Market, seaplane operations
- Commercial: Commercial fishing movements (commercial fishing is not allowed in the harbour however, boats travel in the harbour to moor and distribute catch), charter boats, science and research, refuelling.

Sydney Harbour is also a leading cruise ship destination and the only port in Australia with two dedicated cruise terminals, one at White Bay and one at Circular Quay. Cruise ship movements in 2018 were in excess of 230 for the Overseas Passenger Terminal at Circular Quay and 120 for the White Bay Cruise Terminal at Balmain. A number of moorings are also available for commercial use throughout Sydney Harbour.

Businesses assessed

Businesses within the precinct areas are generally clustered on the main transport routes and provide either a specialist service to the broader area or a convenience service for the local community. The location of the business centres in proximity to the project are shown on Figure 21-12. The location of construction support sites are also shown as businesses within close proximity who may experience impacts. The precinct areas also contain a wide variety of businesses located outside of a business centre. The top three industries of employment are professional, scientific and technical services; health care and social assistance; and financial and insurance services.

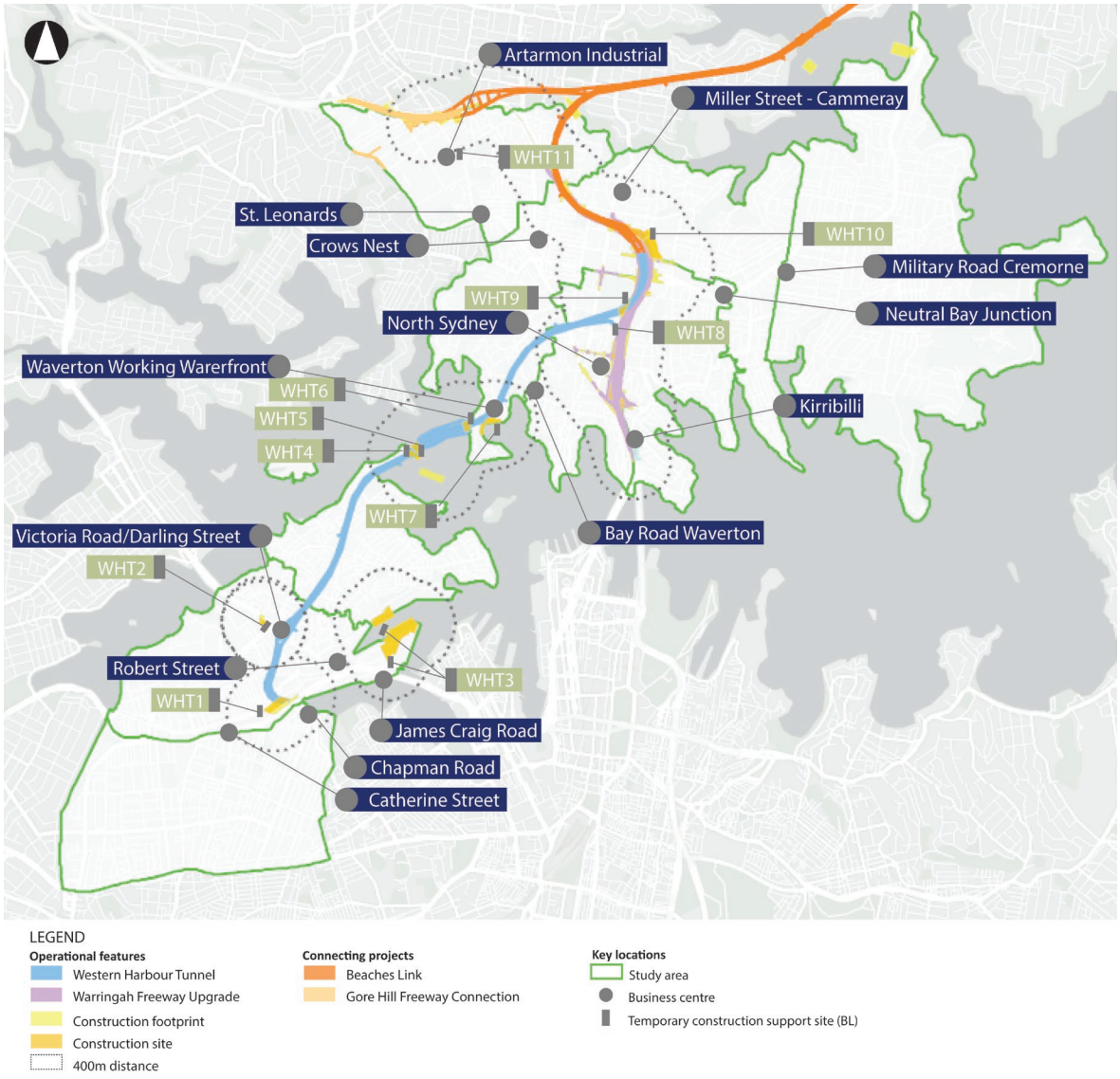


Figure 21-12 Business centres

Business surveys results

Business survey results revealed that businesses in the area have varying degrees of sensitivity and dependency to project construction and operational aspects. Generally, there was a high dependency (75 per cent) on vehicular passing trade, with 43 per cent of businesses surveyed majorly dependent. Eighty-four per cent of surveyed businesses perceived a dependency on pedestrian and cyclist passing trade, with 66 per cent majorly dependent. In response to these findings, changes in traffic, pedestrian and cycle movements have been given detailed consideration in the assessment of business impacts. Permanent or long-term changes in access to a centre, for example through changes in travel times (increases or decreases), may result in long-term changes to consumer and worker behaviour. The business survey found that 80 per cent of businesses perceived that they were sensitive to travel time delays, with 45 per cent of the respondents perceived to be majorly sensitive.

The majority of customers and employees use private vehicles as their primary transport mode. During construction, 64 per cent of businesses surveyed perceived construction of the project would have no discernible positive or negative effects on travel time and access, however upon operation half of business respondents perceived that the project would be positive for employee and customer access. Convenient customer parking was considered a dependency for 74 per cent businesses with 54 per cent of respondents indicating a major dependency on convenient customer parking. The majority of businesses (84 per cent) were dependent on on-street parking,

with 63 per cent of businesses recording major dependencies. For deliveries and loading arrangements, the impact was considered by businesses to be neutral or positive with 64 per cent of businesses perceiving construction would have a neutral effect and about 47 per cent stating that the operation of the project would have a positive effect on servicing and delivery.

There is potential for reduced exposure due to changes in pedestrian or vehicle routes and traffic volumes. Ninety one per cent of businesses indicated that they were dependent on business exposure and visibility with 62 per cent majorly dependent. Miller Street, Cammeray, Military Road, North Sydney, Spit Junction and Victoria Road/Darling Street were the surveyed business centres that recorded the highest dependencies. Changes to the local character and amenity of a place can affect the enjoyment and desirability of the environment, visitor numbers and trends, and consequently the economic activity of a commercial centre and the businesses located there. Overall, 80 per cent of businesses identified that they were dependent on the identity and character of the commercial centre they were located in, with 43 per cent majorly dependent. Sixty-five per cent identified that they were dependent on a pleasant visual amenity, 18 per cent had a high sensitivity to noise, 39 per cent had a high sensitivity to air quality and 37 per cent had a high sensitivity to odour.

Overall, the business survey indicated that the majority of businesses perceived the project would have a neutral effect on demand for goods and services. The findings of the business survey assisted in determining the sensitivity of businesses and their ability to adapt and respond to project related changes to the socio-economic environment.

21.3.5 Access and connectivity

A detailed description of the existing traffic and transport environment surrounding the project is provided in Chapter 8 (Construction Traffic and transport).

Road network

A number of major roads are located near the project that provide access for communities to employment and infrastructure within the precinct areas as well as for communities in the Greater Sydney region. Major roads near the project include:

- City West Link, which passes through Rozelle, providing access within the Inner West local government area and to Sydney Olympic Park, Parramatta, Blacktown, Penrith and the Blue Mountains (via the M4 Motorway)
- Victoria Road, which passes through Rozelle, providing access to Parramatta and Sydney's North Shore
- Western Distributor, which provides access from Rozelle (City West Link and Victoria Road) to the Sydney CBD, North Sydney and beyond
- James Craig Road/Sommerville Road, which connects to the White Bay Cruise Terminal and other maritime-related land uses in Rozelle Bay, Glebe Island and White Bay
- Darling Street, which connects Rozelle and Balmain town centres
- Warringah Freeway, which provides access to and from local centres at Naremburn, Cammeray, St Leonards and North Sydney and provides regional access from the Northern suburbs of Sydney to the Sydney CBD, Eastern suburbs (via the Sydney Harbour Tunnel and Cahill Expressway) and Western suburbs (via the Western Distributor)
- Pacific Highway, which passes through North Sydney, Crows Nest, St Leonards, and on to other centres in the northern suburbs of Sydney
- Falcon Street/A8 Military Road, which connects Crows Nest, Mosman and the Northern Beaches.

At the 2016 Census, car travel was the predominant mode of travel to work for residents in the precinct areas, with about 38 per cent of people aged 15 years or over using a car for all or part of their journey to work.

Public transport

Public transport modes across the precinct areas include rail, bus and ferry services:

- The northern precinct area is serviced by railway stations located near the project footprint at Milsons Point, North Sydney, Waverton, Wollstonecraft and St Leonards
- The southern precinct area is serviced by the Dulwich Hill Light Rail
- There are multiple bus corridors within the precinct areas that use major roads such as Warringah Freeway, Military Road, Pacific Highway, Miller Street and Victoria Road and ANZAC Bridge
- Ferry route F3 Parramatta River line operates between Circular Quay and Parramatta, and route F8 Cockatoo Island operates between Circular Quay and Cockatoo Island. Balmain East wharf is also serviced by the F4 Cross Harbour line.

At the 2016 Census bus transportation was the second preferred mode of transport across the precinct areas after travel by car, carrying about 17 per cent of residents, followed by rail with about 10 per cent. At the 2016 Census, about 2622 people living in the precinct areas used the ferry for all or part of their journey to work. This represented 2.9 per cent of people aged 15 years or over and was above the Greater Sydney region average, at 0.5 per cent.

Further details for public transport services in the precinct areas are included in Chapter 8 (Construction traffic and transport).

Active transport

In 2016, walking and cycling were both common forms of active transport for commuters across the precinct areas, with about 10 per cent of residents walking or cycling to work. A number of shared user paths are located in the precinct areas, including separated off-road dedicated cycleways and dedicated on-road cycling lanes.

The pedestrian network in the Warringah Freeway and North Sydney area is well-developed with footpaths provided alongside the vast majority of roads and controlled crossings provided at most signalised intersections. Pedestrians are prohibited from walking along the Warringah Freeway. Significant pedestrian activity associated with retail and commercial land uses occurs within North Sydney CBD, and also in the vicinity of the numerous schools located west of the Pacific Highway and along Miller Street. Balls Head Reserve is also a significant generator of pedestrian activity associated with people carrying out exercise activities. The Warringah Freeway presents a barrier to east-west movements for pedestrians and cyclists, with crossings available at select locations including:

- Merrenburn Avenue at Naremburn
- Brook Street at Naremburn
- West Street at Cammeray
- Miller Street at Cammeray
- Ernest Street at Cammeray
- Shared user path bridge connecting Falcon Street in North Sydney and Merlin Street in Neutral Bay
- Falcon Street at North Sydney
- Shared user path bridge connecting Ridge Street in North Sydney and Alfred Street North in Neutral Bay

- Mount Street at North Sydney
- High Street at North Sydney.

The pedestrian network in the Rozelle area is also well-developed with footpaths provided alongside the vast majority of roads and controlled crossings provided at most signalised intersections. Significant pedestrian activity associated with the Rozelle and Balmain local town centre occurs along Victoria Road and Darling Street. Two shared user bridges span Victoria Road – one about 90 metres north of The Crescent and the other about 70 metres east of The Crescent.

The regional strategic cycle network provides connections between the precinct areas and Sydney CBD, Redfern, Green Square, Sydney Airport, Pyrmont, Surry Hills, Haberfield, Summer Hill, Lane Cove and Macquarie Park. Off-road shared pedestrian and cyclist paths are provided at the following locations:

- Victoria Road between The Crescent and Drummoyne
- ANZAC Bridge at Pyrmont
- Along the foreshores of Iron Cove, Rozelle Bay and Blackwattle Bay
- Along the southern side of the Gore Hill Freeway at Artarmon.

Maritime transport

Maritime transport within Sydney Harbour includes cruise and tanker traffic, commercial fishing, water taxis, charter companies and boat storage facilities, government maritime traffic (including ferries and the Royal Australian Navy maritime traffic). Further detail on maritime transport as well as navigation restrictions in Sydney Harbour are discussed in Chapter 8 (Construction traffic and transport).

21.4 Assessment of potential construction impacts

Construction of the project would have the potential to affect the social and economic environment of the precinct areas. These potential impacts are assessed in this section.

21.4.1 Property impacts and acquisition

The project has been designed to minimise the need for surface property acquisition. This has been done by locating road infrastructure in tunnels and, where possible, using government-owned land for construction and operation of the project. Nonetheless, some property acquisition would be required to facilitate construction of the project.

Property acquisition and temporary leases

The project would require the acquisition or temporary use of 28 properties. Temporary leases of land would also be required for construction support sites and other construction works. The nature of direct property impacts, including details of property acquisitions and temporary occupation of land, is discussed further in Chapter 20 (Land use and property).

Some residents and communities near the project may experience a level of stress and anxiety due to uncertainty about potential property impacts, property acquisition and proposed changes that may be associated with the project. These concerns were raised by community members during consultation for the project.

Sixteen residential properties would be wholly acquired for the project, requiring affected households to relocate prior to construction. Some individuals impacted by acquisition of residential properties may also experience impacts on health and wellbeing associated with disruptions to social networks and personal relationships associated with their permanent or

temporary relocation or relocation of neighbours. These impacts are likely to have the greatest effect on groups such as elderly, people with a disability, longer term residents and people on lower incomes, who are often more reliant on personal and community networks.

Properties required for the project would be acquired by Transport for NSW in accordance with the provisions of the *Property Acquisition (Just Terms Compensation) Act 1991* and the Land Acquisition Reform 2016 process. The *Property Acquisition (Just Terms Compensation) Act 1991* provides the basis for assessing compensation. Transport for NSW has started consultation with affected property owners about the acquisition process and potential adjustments required to properties. Consultation will continue through the project development.

The sensitivity of affected individuals and households are considered to be high. However, the magnitude of the change is considered to be low given the small number of affected residential properties relative to residential properties in the vicinity of the project. As a result, the overall significance of potential impacts from the acquisition of residential properties is considered moderate.

Other property impacts

The main tunnels would pass beneath a large number of properties, including residential, commercial and industrial uses and social infrastructure properties. Potential impacts of tunnels on the use of properties and future development potential was raised during community consultation for the project. Under the *(NSW) Property Acquisition (Just Terms Compensation) Act 1991*, compensation is generally not payable for acquisition of land under the surface unless the surface of the overlying soil is disturbed or the support of that surface is destroyed or affected by construction of the tunnel.

Potential impacts on future development above tunnels generally only occurs in locations where the tunnel depth is shallow, for example close to portals. Any limitations on future development of properties above the tunnel would only affect a very small number of properties along the alignment. For most properties along the alignment, the location of the tunnels beneath properties is not expected to impact on the future use or development of properties at the surface. Subject to council regulations and approvals, landowners would generally be able to:

- Carry out improvements, such as installing a swimming pool
- Dig deeper foundations for a new building or second storey additions.

The overall significance of potential impacts on future development of properties directly above the tunnel is considered negligible, with the sensitivity of affected properties considered to be moderate, while the magnitude of the change is considered to be negligible given that the potential for impact is expected to be minor and any potential impacts would mainly be to a very small number of properties close to the portals.

Concerns were raised during community and stakeholder engagement about potential for property damage, including to basement car parks, unit developments and pools, due to vibration from tunnelling activities. During construction, some properties located above or near the tunnel alignment may experience short-term vibration and ground-borne noise impacts due to the use of equipment such as rock hammers and roadheaders. For most properties, vibration levels would generally be below levels that may cause potential risk to buildings or structures, including minor cracking. However, there is potential for cosmetic damage risks to a small number of properties closest to vibration intensive construction activities. Further discussion about potential vibration impacts on buildings and structures is provided in Chapter 10 (Construction noise and vibration).

The excavation of tunnels also has potential to result in settlement at the ground surface, potentially impacting properties above or near the project. Some properties near the project may experience very slight to slight cosmetic damage due to settlement, although this is not expected to impact on the serviceability or stability of buildings which is discussed in Chapter 16 (Geology, soils and groundwater). The overall significance of potential damage to properties above the tunnel

during construction is considered low, with the sensitivity of affected properties and magnitude of change considered to be low.

21.4.2 Equity

Equity refers to a fair distribution of the resources that allow residents full participation in their community. Equity requires that the well-being of people with fewer resources is protected. Changes to conditions which may affect equity in the precinct areas include impacts to amenity, liveability, access and connectivity.

During construction, it is anticipated that impacts to equity would be more acutely experienced by those communities closest to surface works, construction support sites, or occupants of properties above the tunnel alignment. Potential equity impacts would mainly relate to construction noise, dust and vibration affecting the amenity and liveability of the area, as well as changes in local access and connectivity. These impacts would be relatively short-term and localised to discrete locations as construction activities at each construction support site would be comparatively less than the overall construction program. After construction, many of these communities would experience benefits relating to improved access and connectivity to destinations across the Greater Sydney region. The overall significance of potential impacts on equity during construction is considered moderate-low, with the sensitivity of affected residents considered to be moderate and the magnitude of change considered low.

21.4.3 Population and demography

The construction workforce would generally be sourced from across the Greater Sydney region and would not change population and demography in the precinct areas.

The relocation of residents associated with the acquisition of residential properties have potential to result in minor changes to population and demography at a local neighbourhood level, although potential changes in population would represent a very small proportion of the study area's population and are not expected to impact on the population and demography of the study area as a whole. They are also likely to be very minor in the context of expected population and demography changes associated with planned development within the study area. The sensitivity of communities to changes in population and the magnitude of change is low given the existing population of the study area. As a result, the overall significance of potential impacts of the project's construction on population and demography is considered low.

Further information on property acquisition as a result of the project is provided in Chapter 20 (Land use and property) and discussed in Section 21.4.1.

21.4.4 Social infrastructure

During construction, potential impacts on social infrastructure in the precinct areas may result from:

- Loss of open space, parks and recreational facilities, due to use for construction support sites and permanent project facilities
- Reduced visual amenity and increased air-borne construction noise, dust and traffic, impacting on amenity for users of some social infrastructure
- Ground-borne noise and vibration from construction of the tunnels, impacting on amenity for users of social infrastructure above the tunnel alignment
- Changes in local access and traffic disruptions and delays due to construction activities and increased construction traffic
- Access restrictions to sections of Sydney Harbour near to proposed works.

Directly impacted social infrastructure

Social infrastructure would be directly impacted through the use of land for construction support sites and project infrastructure. In particular, impacts would include:

- Temporary use of parks and open space areas for construction support sites, resulting in the temporary loss of access to, and use of, land within the construction footprint
- Permanent loss of some open space at Cammeray Golf Course
- Reduced amenity due to location of construction works and construction support sites, detracting from the use and enjoyment for people using the remaining parts of the social infrastructure.

Table 21-5 provides a summary of potential impacts on social infrastructure directly impacted by the construction of the project.

Table 21-5 Direct impacts on social infrastructure

Social infrastructure	Summary of potential impacts
Yurulbin Park and Birchgrove Wharf	The use of the park as a construction support site (Yurulbin Point - WHT3) would result in the temporary loss of access to, and use of, land within the construction footprint, which is assessed as of high-moderate significance. The sensitivity of Yurulbin Park to impacts is considered high while the magnitude of impacts is expected to be moderate given the duration of potential construction impacts. Construction would temporarily disrupt the use of this land for informal recreation activities such as walking and fishing, including access to Birchgrove Wharf, requiring users to access alternative facilities. Impacts to Birchgrove Wharf would be temporary for the duration of construction at Yurulbin Point construction support site (WHT3). Yurulbin Park is also a popular vantage point for New Year's Eve celebrations on Sydney Harbour. Alternative informal recreation facilities are located at Birchgrove Park, Elkington Park, Ballast Point Park and Mort Bay Park. The project would require the clearing of some established trees within the park for construction, however, trees along Louisa Road would be retained. The loss of trees is likely to be a concern for community members and impact on landscape and visual amenity for park users. This impact is likely to diminish over time as new landscaping planted as part of the site rehabilitation becomes established. There would also be an increase in the amount of built form visible and a perceptible decrease in vegetation at the end of the Birchgrove peninsula, with high temporary visual impacts expected for users of Yurulbin Park. The park would be rehabilitated in line with the design vision provided by the original landscape architect, Bruce Mackenzie AM. Heritage, biodiversity and visual impacts on Yurulbin Park are discussed in Chapter 14 (Non-Aboriginal heritage), Chapter 19 (Biodiversity) and Chapter 22 (Urban design and visual amenity) respectively.
St Leonards Park	There would be temporary loss of access to, and use of, a portion of land within St Leonards Park associated with the Ridge Street north construction support site (WHT9) which has been assessed as of high-moderate significance. The sensitivity of St Leonards Park to impacts is considered high while the magnitude of impacts is expected to be moderate given the duration of potential construction impacts. Previous consultation has identified open space, trees and greenery and quietness to be important values of St Leonards Park to the local

Social infrastructure	Summary of potential impacts
	community. The presence of construction works and increased noise, dust and construction traffic would temporarily diminish amenity of nearby facilities and other areas of the park. In particular, amenity impacts may occur for users of the North Sydney Bowls Club, North Sydney Oval and Bon Andrews Oval due to their proximity to construction works. Increased construction traffic and the presence of construction works may also impact on perceptions of safety for park users.
Rose Avenue Reserve	During construction, increased noise, dust and construction traffic may impact on the amenity of the reserve for some users. This reserve has very limited recreational values and amenity of the reserve is currently impacted by traffic using the Warringah Freeway. Clearing of some existing vegetation within this reserve may be required during construction, potentially impacting on landscape and visual amenity from surrounding areas. Overall, the significance of potential impacts to Rose Avenue Reserve during construction of the project are assessed as low, with the sensitivity of the reserve and the magnitude of the impact considered low.
Merlin Street Reserve, Neutral Bay	Merlin Street Reserve would be used as a construction support site (WFU7) to support the Warringah Freeway Upgrade. Construction of the project would require the temporary closure of the reserve which has been assessed as of low significance, with the sensitivity of the reserve to impacts and the magnitude of the impact considered low. The use of the park for construction would result in the temporary loss of access to, and use of, open space within the construction footprint. This would temporarily disrupt the use of this land for informal recreation activities. Following construction, the reserve would be rehabilitated and reinstated and would be available for ongoing informal recreation uses.
Cammeray Golf Course	Impact on land within Cammeray Golf Course would result from the establishment of a construction support site (WHT10/WFU8) and infrastructure required for the project and has been assessed as of moderate-high significance. The sensitivity of the golf course to change is considered moderate and the magnitude of the impact considered high given that the project's construction would result in a permanent change to the existing golf course. The impacted section of the golf course adjoins the Warringah Freeway corridor and Ernest Street. Construction and longer term operation of the motorway facilities and other project support infrastructure would require reconfiguration of the golf course, including changes to some holes on the golf course (for example, reducing the length of fairways) and relocation of maintenance and water storage facilities. This would allow the course to remain operational during construction, although changes to the golf course may impact on the amenity and use of the golf course for some members. During construction, increased noise, dust and construction traffic may potentially impact on the amenity of the golf course. The implementation of safeguards and management measures would assist in managing potential impacts. After construction, areas of the golf course not required for permanent project infrastructure would be reinstated and rehabilitated, including replacement trees and landscaping. Refer to Chapter 22 (Urban design

Social infrastructure	Summary of potential impacts
	and visual amenity) for an assessment of landscape and visual amenity impacts on Cammeray Golf Course.
Jeaffreson Jackson Reserve	During construction, increased noise, dust and construction traffic may impact on the amenity of the reserve for some users due to works for the Warringah Freeway Upgrade, including the demolition and replacement of the Falcon Street shared user bridge. Clearing of some existing vegetation within this reserve may be required during construction, potentially impacting on landscape and visual amenity from surrounding areas. Overall, the significance of potential impacts to Jeaffreson Jackson Reserve during construction of the project are assessed as low, with the sensitivity of the reserve and the magnitude of the impact considered low.
ANZAC Park, Cammeray	Construction of the project would require the temporary lease of land within ANZAC Park. The affected area would include grassed areas and vegetation and has been assessed as of moderate-low significance, given the sensitivity of the park to impacts is expected to be moderate and the magnitude of the impact is considered low. Construction would result in the temporary loss of access to and use of land within the construction footprint, temporarily disrupting the use of the affected land for informal recreation. Access would be maintained to other areas within the park for these activities. Following construction, land would be reinstated and is not expected to impact on the long-term use of ANZAC Park. The presence of construction works and increased noise, dust and construction traffic would temporarily diminish amenity within areas of the park outside of the construction support site. This may detract from the use and enjoyment of park users and discourage some people from accessing the park. Consideration of community events, such as ANZAC Day services at the memorial statue, in the planning of major construction activities would be important in managing potential construction impacts on the ongoing use of the park. Clearing of mature trees would be required along the Warringah Freeway and within the park for construction. The loss of these trees would temporarily impact on the landscape and visual amenity of the park until new trees or landscaping becomes established. Clearing of these trees is also likely to be a concern for the local community with the desire to retain all trees in the park identified through community consultation for the project. Refer to Chapter 22 (Urban design and visual amenity) for an assessment of landscape and visual amenity impacts on ANZAC Park.
ANZAC Avenue Reserve, Cammeray	The presence of construction works and increased noise, dust and construction traffic associated with the Warringah Freeway Upgrade may temporarily diminish amenity within the reserve. This may detract from the use and enjoyment of the reserve for some users. The sensitivity of the area affected by the project's construction and the magnitude of the impact are considered low, resulting in the overall significance of potential impacts to ANZAC Avenue Reserve during construction of the project being assessed as low.

Indirectly impacted social infrastructure

During construction, impacts on amenity may be experienced by some users of social infrastructure near the project due to the presence of construction infrastructure, increased traffic, (including increased heavy vehicle movements) and construction noise and dust. Changes in amenity can affect how users interact with or enjoy an environment or their ability to participate and concentrate. A reduction in the enjoyment or convenience of social infrastructure access may also deter users and potentially impact on community participation levels, which would have an impact on community values.

A number of schools and childcare facilities would be located near the project (refer Figure 21-3, Figure 21-4 and Figure 21-8 to Figure 21-11). Students, teachers and visitors at the schools may experience temporary amenity impacts due to increased noise and dust from construction activities at construction support sites and surface road upgrades.

Construction activities at the Victoria Road construction support site (WHT2) at Rozelle would have the potential to impact on the amenity of nearby social infrastructure such as Rozelle Public School. During construction there is potential to affect the use of outdoor areas along Victoria Road. Impacts to Wenona School at North Sydney may also occur during the most noise intensive construction activities associated with Ridge Street east construction support site (WFU6) for the widening of Warringah Freeway and Ridge Street pedestrian bridge. Potential noise impacts for attendees of ANZAC Park Public School and North Sydney Boys are generally expected to be low due to the distance between the main construction works and the school buildings.

Construction works at Ridge Street north construction support site (WHT9) and for the widening of Warringah Freeway are also expected to have noise impacts on two child care centres at Berry Street. Noise impacts are also expected at the Independent Theatre at Miller Street during out of hours works. The sensitivity of social infrastructure to amenity impacts is considered moderate with some ability of social infrastructure to adapt to change. The magnitude of the impact is also considered moderate given the duration of potential construction impacts, resulting in the overall significance of amenity impacts at social infrastructure being assessed as moderate.

Construction activities for the Warringah Freeway Upgrade would also be located near to the James Milson Village (nursing home and retirement village) at Clark Road, North Sydney. Temporary impacts may be experienced by residents of the nursing home and retirement village due to noise, vibration and dust from construction activities and increased construction traffic, particularly at night when most of the Warringah Freeway upgrade activities would take place. Some residents of these facilities may be more sensitive to effects of construction noise, due to their age or illness. The sensitivity of this facility to amenity impacts is considered high, while the magnitude of potential impacts is considered low. As such, the overall significance of amenity impacts to this facility are assessed as moderate.

Short-term impacts on amenity may also be experienced for users of some social infrastructure located above or near to the tunnel alignment due to short-term vibration and ground-borne noise impacts from tunnelling. Facilities that may be more sensitive to the effects of ground-borne noise and vibration include:

- Places of worship, such as Darling Street Anglican Church and Rozelle Presbyterian Church at Rozelle, St John the Evangelist Church at Balmain, and St Thomas' Anglican Church at North Sydney
- Community uses such as the Balmain Court House, The Coal Loader Centre for Sustainability at Waverton, North Sydney Stanton Library
- Educational uses such as North Sydney Public School, and Wenona School.

Some users may notice ground-borne noise and vibration for a short period as works occur beneath or near to the property. Potential impacts would be managed through ongoing consultation with managers and users of these facilities. Further information about potential noise and vibration impacts are discussed in Chapter 10 (Construction noise and vibration). Overall, the sensitivity of social infrastructure located along the tunnel and magnitude of potential amenity impacts from

tunnelling are considered low, resulting in the significance of potential impacts from tunnelling on the amenity of social infrastructure being assessed as low.

Temporary changes to local access and connectivity for motorists, pedestrians, cyclists and public transport users may impact on access to social infrastructure near to the project. A number of schools and child care centres are located near to surface works and construction support sites at Rozelle, North Sydney, Cammeray and Artarmon. Increased construction traffic may impact on perceptions for safety for children and students (refer to Section 21.4.5). The implementation of safeguards and management measures would assist in managing potential impacts.

21.4.5 Community values

Potential impacts on community values during construction may be experienced by communities within the precinct areas due to:

- Temporary adverse changes in local amenity for residents, businesses, facilities and natural areas near construction support sites and surface works due to noise and dust generated from construction activities
- Temporary adverse changes in local amenity for occupants of properties located above the tunnel alignment due to ground-borne noise and vibration from tunnelling activities
- Light spill from night-time construction activities at construction support sites and construction works in road reserve areas at Rozelle and North Sydney
- Temporary changes in local access and connectivity, including for motorists, public transport users, pedestrians and cyclists, resulting in delays and disruptions
- Adverse changes in visual amenity and local character due to the presence of construction support sites and surface works, infrastructure, and clearing of vegetation within the construction footprint.

Local amenity and character

Noise, dust, vibration, traffic, and visual impacts from construction activities may temporarily impact on the amenity for some residents and social infrastructure closest to surface works. Impacts on night-time amenity due to construction noise and vibration and light spill may also be experienced should works need to be carried out outside of standard day-time hours. This may impact on night-time amenity or sleeping patterns for some residents. These impacts would be short-term and may potentially impact on the use and enjoyment of some homes, businesses, facilities and natural areas, particularly of outdoor areas.

Sydney Harbour provides a range of formal and informal recreational opportunities to both local and regional communities (including tourists). Sydney Harbour would experience visual and noise impacts during construction activities at locations near to the construction of the cofferdams. Visual and noise impacts during construction may disrupt or reduce the use and enjoyment of areas of the harbour and harbour front for some people in areas near to construction activities. This includes formal and informal recreational users.

The significance of potential impacts on local amenity and character as a result of the project's construction, at locations closest to surface works and construction support sites, are assessed as moderate, with the sensitivity of land uses to changes and the magnitude of potential impacts considered moderate.

Community cohesion

The project construction phase has the potential to result in impacts on community cohesion within the precinct areas by temporarily restricting access to some social infrastructure and meeting places, such as Yurulbin Park, and impacting on amenity, such as Cammeray Golf Course. This

may reduce opportunities for social and community interaction, temporarily impacting on community cohesion. Increased construction noise, dust and traffic may impact on the amenity of the golf course for some users and may deter some people from using the golf course during the construction phase. This has potential to disrupt some social networks associated with the golf club. Overall, potential impacts to community cohesion as a result of construction of the project have been assessed to have a moderate-low significance, with the sensitivity of meeting places to changes identified as moderate and the magnitude of the impact considered low.

Community health and wellbeing

Some areas near construction support sites and along the Warringah Freeway are expected to experience impacts from construction activities that create extended periods of noise above the relevant assessment thresholds including for sleep disturbance. This has the potential to result in sleep disturbance for some residents and occupants of buildings nearest to these works, potentially impacting health and wellbeing for some individuals. Underwater noise from some construction activities within Sydney Harbour has potential to cause sound pressure levels that may potentially affect people diving or swimming (refer to Chapter 13 (Human health)).

The potential for construction dust to impact on health and wellbeing of some sections of the community who may be more sensitive to changes in air quality (such as children or elderly people who suffer asthma or similar conditions), is likely to be of concern for some community members near to construction activities, for example for residents of the James Milson Village (nursing home and retirement village).

Increased construction traffic and heavy vehicles using Ernest Street and Ridge Street could impact upon the perceptions of safety. For example, for children and students attending ANZAC Park Public School and Wenona School, particularly during drop-off and pick-up times. Increased construction traffic and the presence of construction works along Victoria Road could also impact upon the perceptions for safety for children and students at Rozelle Public School. Construction traffic will be managed appropriately in accordance with the environmental management measures detailed in Chapter 8 (Construction traffic and transport).

The sensitivity of the general community to perceived health and safety impacts and the magnitude of possible impacts was considered low, resulting in the overall significance of potential impacts to community health and safety from the construction of the project being assessed as low.

21.4.6 Economics

Employment

During construction, the project would benefit employment through direct employment opportunities on the project and indirect employment opportunities in businesses and industries that support this construction.

A project of this scale is expected to support up to 7500 full time equivalent jobs (direct employment) during the five years of construction, including construction workers and professional and administration staff. About 2600 full time equivalent jobs (2000 for Western Harbour Tunnel and 600 for the Warringah Freeway Upgrade) can be expected to be supported during peak construction. Indirect employment opportunities would be generated across local, regional and national businesses in industries that support construction such as manufacturing and services.

The construction workforce would generally be sourced from across the Greater Sydney region. It is expected that there would be capacity within the regional labour force for the project.

Freight and efficiency costs

Increases to travel times directly affect businesses' expenditure and productivity. During construction, the closure of the Warringah Freeway during various night-time periods and access restrictions between Miller Street and High Street would cause delays and disruptions for road users, including freight. Detours may result in increased traffic on other alternate routes during the closure periods. These changes would influence travel time and efficiency of freight trips, potentially resulting in additional costs to businesses and reduced productivity. These changes can also influence product distribution and delivery with servicing to businesses generally happening outside business hours. Overall, the significance of impacts on freight and efficiency costs during construction is expected to be moderate, with the sensitivity of affected businesses and magnitude of impacts considered to be moderate.

Refer to Chapter 8 (Construction traffic and transport) for safeguards to manage impacts on transport routes during construction.

21.4.7 Business and industry

Businesses across the precinct areas may be affected during the construction phase by temporary changes in passing trade, access and travel time (for employees, customers, deliveries and/or servicing), parking, serving and deliveries and amenity. Depending on the nature of the business, the actual impact on business revenue may vary (positively or negatively). These impacts may be an inconvenience for some businesses, although they would be temporary in nature as construction activities at each construction support site would be comparatively less than the overall construction program. There may also be benefits for businesses due to increased passing trade and business exposure.

Potential impacts have been assessed for those business centres identified as being most likely to experience direct and indirect construction impacts. Potential impacts at these locations are discussed below. Further information is provided in the business impact assessment in Appendix U (Technical working paper: Socio-economic Assessment).

Passing trade

Passing trade refers to customers who choose to visit a business because they see it when walking, cycling or driving past, not because they planned to go there.

Construction of the project would result in changes to vehicle, pedestrian and cyclist flows that could influence the level of passing trade. Some businesses could benefit due to passing trade being re-directed towards them or due to increases in construction workers in the area. Conversely businesses might be disadvantaged as traffic is diverted away, or as they become less attractive to passing trade due to construction impacts (such as reduced visibility, amenity, ease of access, or parking availability).

Impacts of moderate significance are expected on passing trade at Neutral Bay Junction with both the magnitude of change and level of sensitivity at the centre being moderate. At the North Sydney CBD the level of sensitivity and magnitude of change is expected to be low; as a result the significance of construction impacts on the centre is low. These impacts are generally due to temporary lane closures, detours, surface works and road alterations that would result in people avoiding these centres in favour of more easily accessible locations.

Employee and customer access

The construction phase of the project would result in changes to road, public transport and active transport networks, which may affect employee and customer access. Increased journey times can affect staff recruitment and retention, which may in turn impact on business productivity and function. Similarly, customers may respond to access difficulties and delays by visiting alternative centres that offer similar goods or services, resulting in a loss of trade for affected businesses.

Businesses often rely on parking facilities for deliveries and/or services and parking convenience for workers and customers. Increased demand and competition for car parking could influence customers to drive to an alternative business providing similar goods or services in a more accessible location. A reduction in parking spaces may also impact on visitor numbers to the broader area and therefore reduce opportunities for passing trade. Limitations on business parking could also reduce productivity, employee attraction and retention. For example, there is expected to be removal of parking spaces along the eastern end of Ridge Street to provide suitable access to the Ridge Street north construction support site (WHT9) in the North Sydney CBD. The level of sensitivity of North Sydney CBD and magnitude of change are considered moderate. Overall the significance of impacts for nearby business users is considered moderate.

The traffic and transport assessment (refer to Chapter 8 (Construction Traffic and transport)) identified that road network performance would be affected during construction, with a number of temporary road closures and increased construction traffic resulting in increased travel times in some areas. Impacts on employee and customer access would be experienced by businesses within the Victoria Road/Darling Street Centre and North Sydney strategic centre; overall the significance of impacts at these centres would be moderate. The significance of impacts on employee and customer access experienced by businesses within the James Craig Road Working Waterfront, Chapman Road Working Waterfront and Neutral Bay Junction would be moderate-low. At other business centres, impacts of construction works on access and travel time would be of low significance or negligible impact.

Servicing and deliveries

Businesses rely on deliveries and dispatch of goods to support the sale of products and/or services. Businesses also require services from other businesses such as refuse collection. These activities are often required to occur daily or multiple times per day. The construction phase of the project would result in changes to loading zones, road performance and road network configuration, which can affect the reliability and capacity of servicing and delivery. This would result in time and vehicle related costs as well as lost revenue for businesses. The overall significance of construction impacts on servicing and deliveries at business centres would generally be moderate to low or low and would be temporary in nature.

Construction of the project may also have negative impacts on maritime operations due to temporary changes in access. Some businesses within the James Craig Road Working Waterfront may experience impacts to servicing and deliveries of low significance due to increased usage of the waterway by construction vessels and to changes in access, respectively.

Amenity

The construction phase of the project would affect the amenity of an environment, including for people visiting or working at local businesses in the precinct areas. This would be as a result of increased noise, vibration and dust, or reduced visual outlook and business visibility. Changes to amenity can affect business ambience, productivity, functionality, exposure and client patronage. Business clusters that have higher dependency on amenity to attract and retain customers would be more susceptible to changes in amenity as a result of construction activity.

During construction, visual amenity would be affected by the removal of vegetation and the introduction of construction support sites, equipment and other visible elements such as hoardings and fencing. This is most likely to impact on those retail, personal service providers, cafes and restaurants that rely on the pleasantness and quality of an environment to attract customers. Important aspects of visual amenity which may be affected include access to natural daylight, clear sightlines and permeability to the surrounding landscapes. Businesses that rely on storefront exposure to attract customers may be affected by reduced visibility or safety concerns to customers as a result of the presence of construction machinery and materials.

Increased noise and vibration levels from construction activities and traffic could also impact on customer amenity, and on the amenity and productivity levels of employees. Exposure to dust and

air pollutants could impact on cleanliness and attraction in particular for sensitive business receivers such as education, accommodation and food services that rely on outdoor dining.

Reductions in the amenity as a result of construction were assessed as having a moderate significance on local businesses in the Victoria Road/Darling Street Centre as the result of a moderate level of sensitivity and moderate magnitude of change. The significance of construction on impacts to amenity was assessed as being moderate to low for local businesses in the North Sydney CBD, and low in Artarmon Industrial. At other business centres the impacts would generally be low or insignificant (negligible).

Business visibility

The construction phase of the project would result in changes to vehicle, pedestrian and cyclist flows that could influence the level of business exposure and visibility. Some businesses could benefit as they might be exposed to more potential customers (ie through pedestrian or traffic diversions) while others might not as traffic is diverted away or construction hoardings reduce the ease of access to or visibility of their business, which could result in a loss of trade. Generally the impact of construction on the visibility of business would be positive.

Demand for services

The construction phase of large infrastructure projects can affect demand for local and regional goods and services. This can result in both negative and positive impacts with some businesses experiencing a loss of customers avoiding particular areas due to construction activities while other businesses may experience increased trade from construction workers in the area. Demand for services, such as construction recruitment agencies, construction companies and resource suppliers, can also be generated from infrastructure projects, creating employment opportunities both within and outside local business centres.

Construction of the project would benefit short-term local employment opportunities through the creation of direct construction related employment on the project and indirect employment opportunities in businesses and industries that support the construction works. An increase in construction workers in an area often provides an economic injection into the local economy due to increased demand for local services. As a consequence of the increase in workers associated with construction of the project, the largest benefits from increased trade are anticipated for convenience retail and the food and beverage industry.

Demand for services of business centres along the project are generally assessed as being benefited during construction of the project.

Displacement of businesses

The acquisition of properties including cessation of leases, and subsequent relocation or closure of businesses, has the potential to result in:

- Disruptions to business operation
- Loss of revenue
- Relocation and re-establishment costs
- Employee training expenses for new employees
- Trade catchment alterations
- Business closure.

The significance of property acquisition or lease cessation on businesses would vary in scale, depending on the number of business properties to be acquired, their associated contribution to the local economy and the ability of the remaining local business catchment to absorb the change. Although the impact on individual businesses may be significant, the compensation process is generally designed to reduce this impact. Overall, negative impacts would be limited to the

individual businesses and would unlikely affect the broader business environment or industries (refer to the Business Impact Assessment in Appendix U (Technical working paper: Socio-economic assessment)).

Maritime businesses

Construction activities have the potential to impact maritime businesses as follows:

- Construction activities have potential to affect employee and customer access from the Birchgrove Ferry Wharf closure and partial closure of the harbour between Birchgrove and Berrys Bay (moderate significance)
- The scheduled partial closures of the harbour would restrict larger vessels, including oil tankers, to cross the harbour between Birchgrove and Berrys Bay at times. Cruise ships would not be affected by these closures as the terminals are positioned outside the restriction zone (moderate-low significance)
- Glebe Island and White Bay land with deep water frontages impacts: White Bay berths 2, 4, and 5 (Cruise Terminal) and Baileys Marine Fuels and Glebe Island berths 1, 2, 7 and 8 would not be impacted by the construction activities. White Bay berth 3 is proposed to be used for handling dredged material for the project (moderate-low significance)
- Impacts from delayed commercial operations during scheduled partial harbour closures. This has the potential to affect tourism businesses such as harbour cruises or Cockatoo Island visitors as the appeal of the experience is reduced due to time delays and reduced amenity. Customers for water taxis and boat hire may also reduce as the efficiency of the trips or appeal of accessing certain areas is altered. Ferry operators may also experience a decline in patrons due to the delayed journey. The increased construction traffic on the harbour may also generate delays in vessel movements, particularly for larger vessels such as cruise ships. This may be particularly experienced around White Bay where the cruise terminal and temporary construction support site are on the same peninsular (moderate significance)
- Changes on character and amenity of the harbour during construction has the capacity to effect businesses, particularly tourism businesses that attract clients due to the experience and appeal of the harbour. The increase in vessel numbers and presence of marine construction activities may deter customers from hiring or chartering boats or recreational marine crafts, particularly from businesses around the construction area (moderate significance).

While there may be temporary impacts during construction, there is not expected to be a lasting impact on businesses. Any effects would be experienced at an individual business level, with no discernible changes to overall performance of the broader marine industry. Overall, construction of the project would have short term negative effects at an individual business level, with no discernible changes to the broader maritime business environment.

Refer to Chapter 8 (Construction traffic and transport) for safeguards to manage impacts from maritime construction activities.

21.4.8 Access and connectivity

Potential short-term impacts on access and connectivity are identified below.

Roads and private access

The following potential impacts are anticipated:

- Temporary changes to road conditions near construction activities, including partial and full road closures, temporary diversions and access changes, removal of some on-street parking, resulting in possible delays and disruptions for motorists and other road users
- Increased construction traffic on roads within the precinct areas, including heavy vehicles used to deliver materials and equipment and construction worker vehicles, potentially impacting on perceptions of road safety for motorists, pedestrians and cyclists
- Removal of parking spaces along Ernest Street, Ridge Street and Alfred Street North, resulting in a reduction of available parking. At Ernest and Ridge streets reduced parking could be accommodated on nearby local roads, however a net loss of on-street parking in North Sydney and Neutral Bay would be experienced as there no alternatives nearby
- Access to private properties near to proposed works is generally expected to be maintained during construction. Where temporary changes are required, suitable access arrangements would be implemented in consultation with affected property owners
- Establishment of maritime speed restrictions around construction equipment, resulting in possible increases in transit time for recreational, commercial and government vessels. Maritime transport and construction vessel routes and numbers are discussed in Chapter 6 (Construction works).

The sensitivity of road users to changes in construction traffic and the magnitude of impacts are considered moderate. As such, the overall significance of impacts on road users is assessed as moderate. The sensitivity of individuals to changes in private property access and magnitude of impact are considered negligible, resulting in an overall significance of impacts on property access being assessed as negligible.

Public and active transport

The following potential public transport impacts are anticipated:

- Potential disruptions to bus services, including from changes to road conditions and the temporary relocation of some bus stops near to construction works for safety, resulting in possible delays and disruptions for bus users and changes in bus access for some people
- Temporary relocation of some bus stops, as well as delays or changes in local routes due to temporary road closures, such as during the closure periods of the Warringah Freeway
- Temporary closure of Birchgrove Ferry wharf.

The sensitivity of commuters to changes in public transport services are considered moderate, with the magnitude of impacts considered low. As such, potential impacts to public transport during construction of the project are generally assessed as being of moderate-low significance.

The following potential active transport impacts are anticipated:

- Temporary closures of the shared user path along Ernest Street would be required for safety of pedestrians and cyclists. Detours would be provided for pedestrians and cyclists during temporary closure periods
- The cycleway underpass below the eastern side of the Falcon Street Bridge would be removed during construction. Pedestrians and cyclists would be required to travel further distances via

existing zebra and signalised pedestrian crossings spanning Falcon Street and Military Road, or travel across the Falcon Street shared user bridge. Due to existing low volumes of pedestrians and cyclists using the underpass, this impact is considered to be low.

Overall, the sensitivity of individuals due to changes to existing access and magnitude of potential impacts are considered low. As such, the overall significance of impacts on active transport are considered low.

Maritime transport

The following potential maritime transport impacts are anticipated:

- Around seven closures of Sydney Harbour to maritime traffic between Birchgrove and Berrys Bay for a period of about 48 hours. Ferry services would be impacted during the closure of Sydney Harbour, with passengers travelling via the F3 Parramatta River Line and F8 Cockatoo Island Line required to use replacement bus or alternate services. Recreational marine traffic would also not be able to use this section of Sydney Harbour during the closure
- Closure of the Birchgrove Wharf for a period of about 48 months, during use of the construction support site at Yurulbin Park (WHT3). During construction, people would be required to use alternatives available such as the Balmain Ferry Wharf (located about 2.2 kilometres from Birchgrove Wharf) which serves the same ferry routes, as well as bus route 441, accessible from Grove Street (located about 750 metres from Birchgrove Wharf) and providing connections to Sydney CBD and other bus services operating along Victoria Road. Customers would be notified of any anticipated changes to the ferry network to allow for customers to plan their journey well ahead of time. Appropriate signage would also be provided at ferry wharves informing patrons of any changes. The closure of Birchgrove Wharf may require some passengers to walk further distances to access alternative modes of transport
- Construction activities in the inner harbour (related to the Sydney Harbour crossing) would periodically result in minor increases to transit time for recreational, commercial and government vessels
- Navigational restrictions would temporarily restrict access of larger vessels such as oil tankers to cross the Harbour between Birchgrove and Berrys Bay
- Sailing clubs would need to alter their courses to maintain a competitive outcome while construction activities are underway
- Marine Rescue NSW would not be directly impacted by the construction activities. However, the construction activities may increase its emergency response time in the outer harbour or offshore. Marine Rescue NSW would be consulted with to increase patrols operating out of Middle Harbour that could service the outer harbour and offshore during periods when construction activities may impact the response time of the Marine Rescue NSW base at Birkenhead Point
- Around ten swing-moorings in the vicinity of the Berrys Bay construction support site (WHT7) would be relocated to provide safe access to and from the site. Relocated moorings would be placed as close as possible to their original locations during construction and would be restored to their original position on completion of the project.

Overall, potential impacts on maritime transport during construction have been assessed to have moderate-low significance, with the sensitivity of maritime users considered moderate and magnitude of impacts considered low. Potential impacts on maritime users and movements elsewhere, including the outer harbour, are assessed as negligible, with the sensitivity of maritime users considered low and the magnitude of impacts considered negligible.

21.5 Assessment of potential operational impacts

The operation of the project has the potential to positively and negatively affect residents, businesses, road users, users of social infrastructure and the wider community. This section provides an assessment of potential social and economic impacts within the precinct areas during operation of the project.

21.5.1 Equity

The operation of the project would provide improved access and connectivity which would benefit the wider community and people living and working in or near the precinct areas. In particular, reduced congestion, improved journey times and improved movement of people and freight provided by the project would help to reduce travel times for individuals, families and the wider community, increase time available to individuals and families for leisure and increase access to employment opportunities within convenient commuting times. Reduced traffic congestion and upgrades and amendments to bus infrastructure delivered by the project would also have benefits that would be shared by local and regional communities.

In conjunction with the Beaches Link and Gore Hill Freeway Connection project, the project would help to reduce traffic on arterial roads. It would also support local environment and amenity improvements in the precinct areas and surrounding region and improve access and connectivity for residents, business and industry in the precinct areas, northern suburbs, south-western suburbs and the Greater Sydney region.

21.5.2 Population and demography

Travel time savings and improved accessibility provided by the project are likely to make some areas within or near to the precinct areas more attractive for people looking to relocate. While this change has been occurring and is expected to continue, the project is likely to contribute to the acceleration of development locally and regionally, particularly when considered in conjunction with the Beaches Link and Gore Hill Freeway Connection project.

21.5.3 Social infrastructure

As discussed in Section 21.4.4, a number of open spaces would be used during construction of the project. At completion, land not required would be rehabilitated and reinstated, however some land would be retained for operational purposes as follows:

- A portion of land at Cammeray Golf Course would be acquired to accommodate operational facilities and other utilities, including those shared with the Beaches Link and Gore Hill Freeway Connection project. This would require the reconfiguration of the golf course to allow its ongoing use. The establishment of operational facilities would change the visual setting of this location. Landscaping would be provided to reduce the visual impacts of these facilities. Further discussion about the project's impacts on visual and landscape impacts are provided in Chapter 22 (Urban design and visual amenity). The sensitivity of the golf course to change is considered moderate and the magnitude of the impact considered high given that the project would result in a permanent change to the existing golf course. As a result, the overall significance of potential impacts to Cammeray Golf Course during operation of the project are assessed as moderate-high
- Kerb and footpath adjustment works would occur on Miller Street southbound around the intersection with Falcon Street as part of construction of the project. These works would provide a new dedicated lane for left turning traffic from Falcon Street westbound to Miller Street

southbound. Further review of the impacts in this area are currently being carried out and permanent impacts to St Leonards Park would be minimised or, where possible, eliminated

- Small areas of ANZAC Avenue Reserve, Merlin Street Reserve and Rose Avenue Reserve would be impacted to accommodate the widening of the Warringah Freeway. This is not expected to impact on the ongoing use or functioning of the park and facilities within the park. The sensitivity of the areas affected by the project's operation and the magnitude of the impact are considered low, resulting in the overall significance of potential impacts is assessed as low.

During operation, the project would contribute to improved access and connectivity through improved travel time and improved travel time reliability, including to local and regional infrastructure within and near the precinct areas including major hospitals, tertiary education facilities, regional and state sport and recreation facilities, and major retail, commercial uses, cultural and community support facilities (refer to Section 21.3.2). Noise impacts may be experienced by social infrastructure adjacent to some surface roads (Johnston Street at Rozelle and Ernest Street, West Street and Miller Street at North Sydney) which would experience increased traffic demands as a result of the project. Overall, the significance of impacts on social infrastructure from the project's operation is considered low, with the sensitivity of social infrastructure to changes and the magnitude of potential impacts considered low.

21.5.4 Community values

Local amenity and character

Operation of the project may result in changes to traffic noise levels for communities near to the tunnel connections and Warringah Freeway. In particular, increased traffic noise may be experienced by some receivers near to the Rozelle Interchange due to forecast increases in traffic volumes on roads leading to and from the interchange. Conversely, decreased traffic noise impacts may be experienced at some properties near the Warringah Freeway Upgrade due to the forecast reduction in traffic volumes along existing surface roads with traffic being moved to tunnels. The sensitivity of communities near the tunnel connections to adverse changes in local amenity and character and the magnitude of potential changes are considered low. As such, the overall significance of potential impacts on local character and amenity from the project's operation are assessed as low.

Community cohesion

During operation, the project would support improved travel and access to work, business and leisure activities in the precinct areas and wider Greater Sydney region. Regionally, improved accessibility and connectivity is likely to provide long-term benefits for community cohesion. In particular, travel facilitates social interactions and where access on major routes is constrained, some people may avoid making trips. Decreased travel times and improved travel time reliability may encourage some people to make trips they otherwise would not, helping to facilitate community cohesion.

Community cohesion is encouraged by connectivity or discouraged by barriers to movement. Changes to traffic volumes on roads leading to and from interchanges may increase perceived barriers to local movements for pedestrians and cyclists, potentially influencing some people's access to services and meeting places.

Changes to the Cammeray Golf Course may impact on the use of the golf course for some members. The sensitivity of affected individuals is considered moderate and the magnitude of impact is considered low. As such, the overall significance of potential impacts on community cohesion due to permanent changes to Cammeray Golf Course are assessed as moderate-low.

Community health and wellbeing

Some residents and communities near the project may experience a level of stress and anxiety (refer to Chapter 13 (Human health)) due to uncertainty about potential property impacts and proposed changes. This may impact on the health and wellbeing of some individuals. Some residents impacted by acquisition of residential properties may also experience impacts on health and wellbeing associated with disruptions to social networks and personal relationships associated with the relocation of residents.

The operation of ventilation outlets at Rozelle and Cammeray may influence people's perceptions of air quality in surrounding areas. This was raised as a concern for surrounding residents and users of social infrastructure near ventilation outlets during consultation for the project (for example, Easton Park, ANZAC Park Public School, ANZAC Park, Cammeray Park, Cammeray-Neutral Bay Skate Park, Cammeray Tennis Club, ANZAC Park Public School and Wenona School). The project tunnel ventilation outlets would be unlikely to result in adverse impacts on local air quality. Refer to Chapter 12 (Air quality) for an assessment of air quality impacts from the project. The health impact assessment carried out for the project also found that potential health impacts associated with changes in air quality in the local community are considered to be acceptable. Further information on health impacts associated with the project's operation is provided in Chapter 13 (Human health) of the environmental impact statement. The overall significance of this impact is assessed as negligible, with the sensitivity of affected communities considered moderate and the magnitude of the impact considered negligible.

21.5.5 Economics

Employment

The project would support improved access and connectivity to employment areas in the study area and the wider Sydney region. Changes to the business environment or the acquisition of properties accommodating businesses as part of the project may cause some loss of local employment. While the potential loss of local employment would be a concern for employees and owners of affected businesses, given the small number of commercial properties affected, this is not expected to impact on the overall levels of employment in the precinct areas.

Freight and efficiency costs

Operation of the project would provide travel time savings for freight trips that currently use the Sydney Harbour Bridge, Western Distributor and ANZAC Bridge corridor. Although unlikely to directly affect business and business centres through improvements in amenity, the additional capacity and travel time savings would improve product distribution and delivery, generating direct cost savings to businesses.

Employment and customer connectivity

The introduction of an additional transport connection provided by the project would improve the efficiency and capacity of the broader road, public and active transport network and assist in alleviating congestion and improving travel times. This would have a direct consequence on employment and customer connectivity, enhancing access to the North Sydney CBD, the strategic centre of St Leonards and the metropolitan Harbour CBD.

The introduction of an additional transport connection can lead to expanded trade catchment opportunities. There is capacity for the secondary trade catchment (the area from which the business attracts or services 20-30 per cent of customers) to increase due to the project. While not all centres within the study area would experience expanded trade catchment benefits, those businesses offering speciality services or products, or destination centres (such as North Sydney) may benefit from the expanded catchments.

Tolling

While no decision on tolls has yet been made, works for Warringah Freeway Upgrade includes provision for tolling gantries for northbound traffic should the government elect to introduce a northbound toll. The potential introduction of northbound tolling where it currently does not exist may add expense to businesses, employees and customers crossing Sydney Harbour. If introduced, the potential additional tolling expense may deter some customers from driving to a business centre (that induces a toll charge) if there is another centre offering similar services in a location without the toll charge. This would cause a redistribution of customer expenditure, potentially benefiting some locations while others are disadvantaged. Although customer behaviour may alter, the trade catchments of businesses would generally remain consistent as customer expenditure is redistributed equally on either side of the connection.

The assessed significance of impacts associated with tolling, should northbound tolling be introduced, are expected to be moderate-low, with the sensitivity of affected businesses to tolling changes expected to be moderate and the magnitude of impacts considered to be low. Overall, although the potential introduction of tolling would be a direct cost to businesses and persons, this would be offset by the reductions in congestion and travel time savings.

21.5.6 Business and industry

During operation, potential impacts on businesses located near the project may result from:

- Changes to passing trade at businesses due to changes in traffic volumes
- Improved travel times for employees and customers accessing the centres due to increased travel speeds
- Changes to access for employees and customers
- Potential increase to the trade catchment for some businesses, due to improved accessibility.

Potential impacts on business and industry have been assessed for those business centres identified as being most likely to experience direct and indirect operational impacts as discussed below.

Passing trade

Operation of the project may result in changes to vehicle, pedestrian and cyclist flows that could influence the level of passing trade.

Localised impacts on passing trade at the North Sydney CBD are expected to be negligible with the level of sensitivity low and the magnitude of change negligible. These impacts would generally result from localised road changes and congestion and the removal of on-street parking during peak periods (refer to Chapter 9, Operational traffic and transport). The net increase in traffic flows to North Sydney throughout the day would also contribute to offsetting any potential impact. The Neutral Bay Junction centre is generally expected to benefit by increased passing trade as a result of increased vehicles travelling through the area.

Employee and customer access

Operation of the project may result in changes to road, public transport and active transport networks, which may affect employee and customer access.

Overall, there would substantial improvements to the broader traffic and transport network from surrounding areas that would enhance connectivity and travel time efficiency. Generally, the North Sydney CBD would experience changes in some localised accessibility of businesses during operation of the project due to reconfigurations in the local road network and increase in traffic demands to some areas. Mobility by vehicle or bus in the centre would decrease with more vehicles moving through the centre and alterations in the road configuration to prioritise certain

movements in peak periods. However, this would be offset by the forecast travel time improvements across the broader network. The level of sensitivity and magnitude of change at this centre would be low.

Employee and customer access to Neutral Bay Junction would benefit from improved access to and travel times on the Sydney Harbour Bridge and Sydney Harbour Tunnel due to redistribution of traffic flows. Businesses would generally not be affected by parking alterations on Ben Boyd Road and Ernest Street as part of the project. Overall the significance of impacts would be negligible as the sensitivity of the centre is negligible and the magnitude of change is considered to be negligible.

Other business centres are expected to experience a negligible or positive impact on employee and customer access.

Servicing and deliveries

The project would generally result in benefits to servicing and deliveries for businesses due to increased travel speeds, which would improve connectivity to the broader network and enhance service and delivery capacity.

Some localised impacts to servicing and delivery for businesses within the St Leonards - Crows Nest Centre may be experienced due to alternative route arrangements, potentially resulting in delays or inefficiencies. The sensitivity of the centre would be low and the magnitude of change would be negligible. As a result the significance of the operation of the project on servicing and deliveries within the St Leonards - Crows Nest Centre would be negligible. Within the North Sydney CBD, the project would result in some localised traffic congestion, intersection delays and clearway operation which would reduce mobility within parts of the centre for servicing and deliveries during peak traffic periods. Parking restrictions on Miller Street northbound between Pacific Highway and Berry Street would have the potential to impact the efficiencies and convenience of servicing and deliveries in this localised area. The level of significance of these localised servicing and delivery impacts would be low. However, in general North Sydney CBD would experience benefits due to the substantial improvements to strategic accessibility from surrounding areas.

Amenity

Cammeray Golf Course would experience some negative visual impact during operation of the project due to the presence of motorway facilities. The motorway facilities would constitute major new built form within the view, adversely affecting the visual amenity of the club users. As the club house is used for events and functions, this long-term change could impact on business revenue. The impact would be reduced by the retention of screening vegetation along the boundary of sports facilities. For the individual business the sensitivity is moderate and the magnitude of impact is moderate. The broader Neutral Bay centre would be able to adapt to the change. Level of sensitivity is negligible.

Other business centres are expected to experience an insignificant or positive impact amenity.

Business visibility

The operation of the project may result in benefits for businesses within the James Craig Road Working Waterfront due to improved business visibility as a result of increased traffic at this location.

Demand for services

During operation of the project, businesses are generally expected to experience positive impacts on demand for services due to improved access and connectivity and increased trade catchments.

Maritime businesses

Once in operation, the project would have negligible impacts on businesses reliant on the harbour. The project would not result in a reduction in water depth at the proposed harbour crossing and would not impact Glebe Island and White Bay land with deep water frontages. Refer to Chapter 9 (Operational traffic and transport) for further details.

21.5.7 Access and connectivity

Road and private access

The project would improve regional access and connectivity for motorists and other road users by providing an alternate crossing of Sydney Harbour. The project would improve travel times for road users on Sydney Harbour Bridge, Sydney Harbour Tunnel, ANZAC Bridge and Western Distributor, improving traffic flow and journey times for buses, freight and other vehicles accessing key commercial and employment centres including the Sydney CBD and North Sydney. This would have positive long-term impacts for all road users.

Localised traffic and transport impacts, including localised delays and increased traffic demands on some roads, may result from the operation of the project, particularly at either end of the project where it would integrate with the existing transport network. These localised impacts would generally be offset by large strategic travel time benefits provided by the project. Overall, the broader network travel time and reliability benefits delivered by the project are expected to outweigh increases to localised delays. As such, the sensitivity of communities are considered low and the magnitude of change of localised delays and disruptions in the context of the overall project are generally considered negligible, resulting in an overall significance of localised delays and disruptions being assessed as negligible.

Public and active transport

The project would also provide opportunity for improved access to public transport for local communities. The project would improve bus services currently operating on the Warringah Freeway and Sydney Harbour Bridge through reduced congestion and increased reliability during peak periods. The project would also allow new public transport routes to be developed in response to diverse travel demands and support new social and economic development. The new motorway tunnel would provide opportunities to introduce new express services, as well as improved travel times and reliability in peak periods on existing corridors, both of which would make buses a more attractive transport option, supporting future mode shift to public transport.

The project would improve cyclist and pedestrian connectivity along the project corridor through increased provision of dedicated cyclist and pedestrian links. This includes the provision of a new and upgraded pedestrian and cyclist infrastructure around surface connections and along the upgraded Warringah Freeway. It is anticipated that these improvements in connectivity would encourage greater use of this infrastructure by pedestrians and cyclists.

During operation of the project, there would be no ongoing impacts to the use of Birchgrove Wharf. Moorings impacted during construction would be reinstated as close as possible to their current locations.

Local adverse impacts on public and active transport would mainly be associated with localised increases to travel times during the busiest peak periods on some bus routes through North Sydney, in the absence of further mitigation measures. Given the localised nature of potential impacts, the sensitivity of communities to changes in public transport and the magnitude of change are generally considered low, resulting in an overall significance of public transport impacts being assessed as low.

A detailed assessment of potential operational traffic impacts of the project is included in Chapter 9 (Operational traffic and transport).

21.6 Environmental management measures

Measures to avoid, minimise or manage social and economic impacts as a result of the project are detailed in Table 21-6. Additional measures relevant to the management of socio-economic impacts are also outlined in other chapters of the environmental impact statement, including:

- Chapter 8 (Construction traffic and transport)
- Chapter 10 (Construction noise and vibration)
- Chapter 11 (Operational noise and vibration)
- Chapter 12 (Air quality)
- Chapter 13 (Human health)
- Chapter 20 (Land use and property)
- Chapter 22 (Urban design and visual amenity).

Table 21-6 Environmental management measures – socio-economics

Ref	Phase	Impact	Environmental management measure	Location
SE1	Design	Social infrastructure	Where feasible and reasonable, the extent of permanent impact on public open space areas (for example, ANZAC Park, St Leonards Park, Cammeray Golf Course) will be minimised in further design development.	WHT/WFU
SE2	Construction		Parks, open space and sport and recreation areas impacted by construction and not required for permanent infrastructure will be reinstated and rehabilitated.	WHT/WFU
SE3	Construction		Ongoing engagement will be carried out with managers of social infrastructure located near to surface construction works/construction support sites and sensitive social infrastructure above the tunnel alignment (for example, schools, places of worship, aged care, child care, health and medical facilities) about the timing and duration of construction works and management of potential impacts.	WHT/WFU
BU1	Pre-construction and construction	Business	Where businesses are affected by property acquisition, or lease cessation, the acquisition and compensation process will be implemented in line with the *Determination of compensation following the acquisition of a business guideline*. Compensation for a business conducted on land that is acquired will be determined in accordance with *the Land Acquisition (Just Terms Compensation) Act 1991* (NSW) as relevant.	WHT/WFU
BU2	Construction		Specific consultation will be carried out with businesses potentially impacted during construction. Consultation will aim to identify specific potential construction impacts for	WHT/WFU

Ref	Phase	Impact	Environmental management measure	Location
			individual businesses.	
BU3	Construction		Based on consultation with businesses, specific feasible and reasonable measures to maintain business access, visibility and parking and address other potential impacts as they arise through the construction process will be identified and implemented. A phone hotline that enables businesses to find out about the project or register any issues will be maintained.	WHT/WFU

Western Harbour Tunnel = WHT, Warringah Freeway Upgrade = WFU.

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