Annexure A - Site analysis

A

Annexure A - Site analysis

Contextual analysis

Existing conditions and contextual analysis is provided below for all land within, and surrounding, the construction boundary (project area) as shown on **Figure A-1**. Additionally, analysis is undertaken for the on-road cycleway between, and including, Bruce Street and England Street, and opportunities for the project to incorporate works to the remaining parts of the route. **Figure A-7** identifies the finding from the contextual analysis and the key facilities and amenities adjacent to the project area.

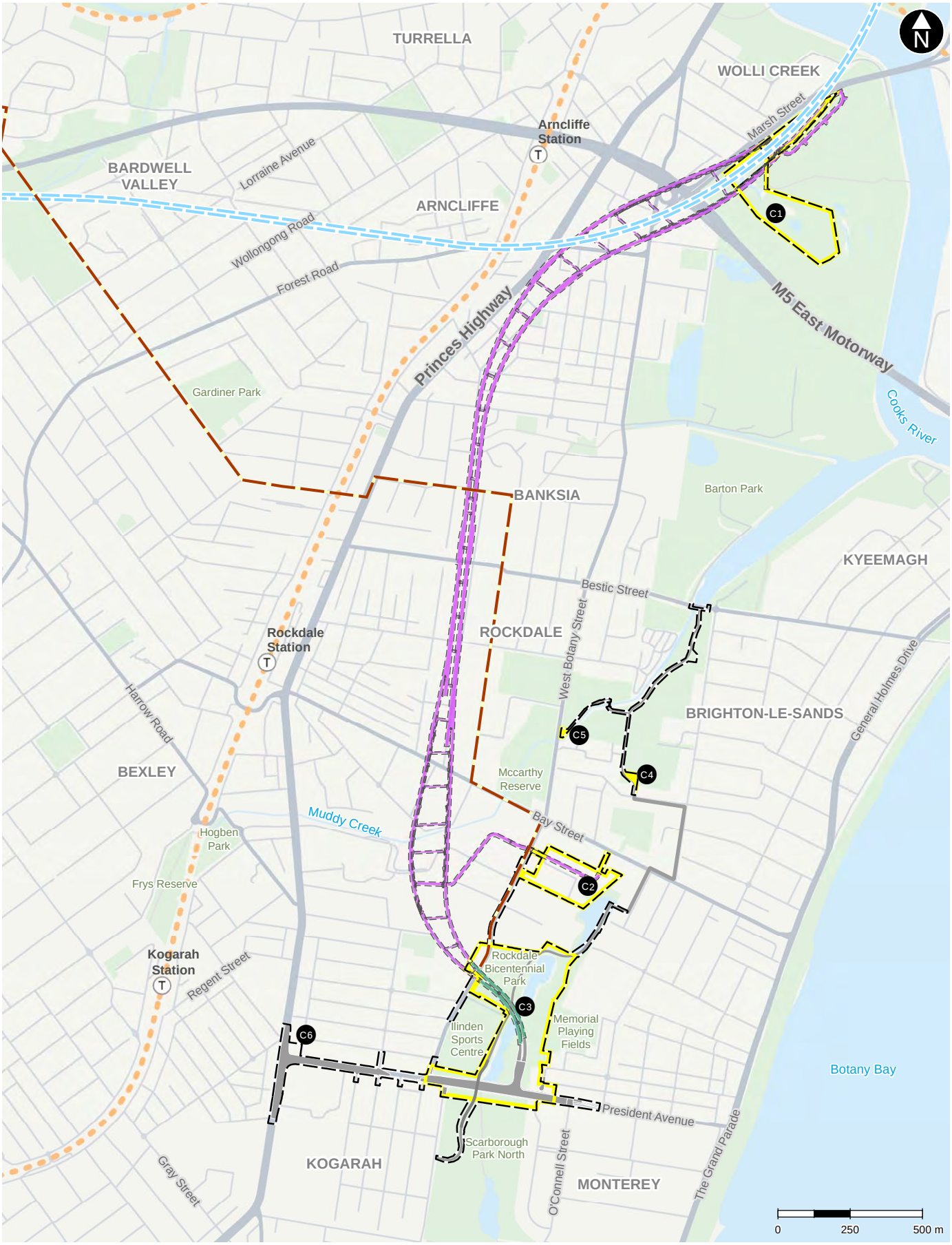


Figure A-1: Construction boundary

Landscape context

The project would be located along part of an extensive, contiguous north-south open space corridor which runs parallel with and about 700 metres behind the Botany Bay foreshore dune. This open space corridor is part of the Rockdale Wetlands Open Space Corridor and extends from the Cooks River in the north over a distance of some three kilometres to Scarborough Park North, just south of President Avenue, creating a substantial barrier to east-west travel (refer to **Figure A-4**). This results in a limited number of highly trafficked east-west roads, and 'two halves' of predominantly low density residential development either side of it. The project is located midway, within 800 metres of Rockdale Plaza (to the west) and the town centre of Brighton-le-Sands located on the shore of Botany Bay (to the east), which also incorporates an extensive public open space corridor along the Botany Bay foreshore. The corridor has a strong linkage with the Cooks River Open Space Corridor which runs west over further distance of some 12.5 kilometres.

Geology

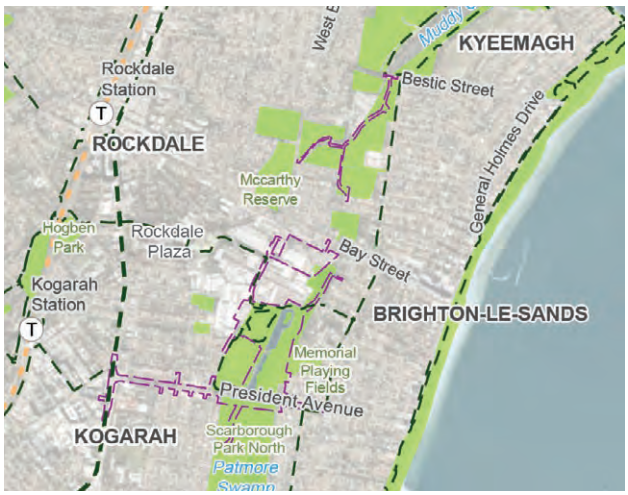
The geological setting of the project area comprises of Quaternary Period Aeolian deposits, typically stretching over a distance of about 1.5 kilometres inland from the Botany Bay shoreline, with topography ranging between one metre and six metres AHD (refer to **Figure A-5** and **Figure A-6**).

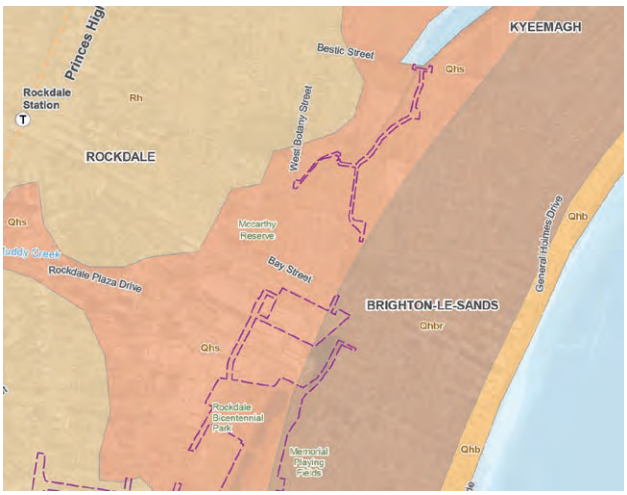
The area behind the foreshore dune comprises a beach ridge (Qhbr) in the order of 700 metres wide, forming a succession of low dune ridges. The suburbs of Brighton-le-Sands, Monterey and Ramsgate Beach are built over this area.

The project area predominantly falls within a band of terrestrial swamp deposits (Qhs) set behind the beach ridge. This is typically between 300 metres and 600 metres wide, and composed of peat and organic mud with a high sand content, laid over the Botany sand beds (refer to **Figure A-5**). Most of this band of material is dedicated to land uses such as open space and industrial development.

The geology then transitions to Triassic Period deposits comprising:

- A relatively narrow band of Hawkesbury Sandstone (Rh) up to about two kilometres wide, with the topography rising to about 30 metres AHD, and over which the suburbs of Arncliffe, Rockdale and Kogarah are built
- A broad band of Ashfield Shale (Rwa) of Ashfield Shale (west of the above), upon which suburbs such as Kingsgrove, Bexley and Hurstville are built.





Land use zoning

The open space corridor and linking development areas incorporates a continuous infrastructure corridor (zoned SP2 Infrastructure) around 100 to 150 metres wide, which has been historically reserved for the F6 Extension. Land use adjoining the open space corridor comprises mainly of low density residential development, some of which is zoned for medium density development.

Development adjoining the project comprises:

- Light industrial development north and north-west alongside West Botany Street
- Brighton-le-Sands Public School to the east
- Low density residential development to the east and west, with the area north of the school zoned for medium density.

Figure A-8 shows the land use zoning along and surrounding the open space corridor

Public transport corridors

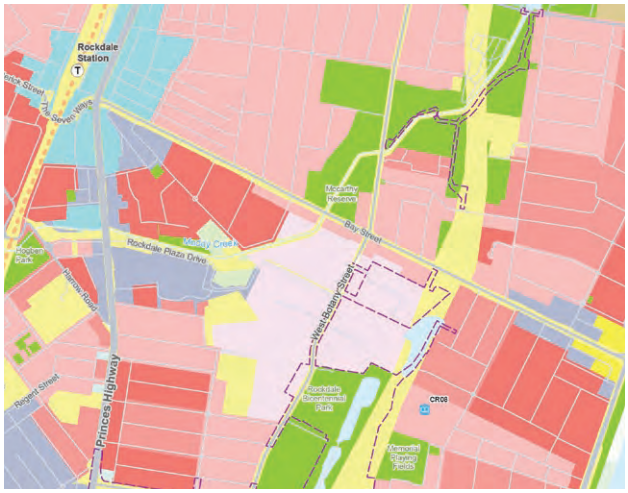
The project area is well serviced by public transport with the T4 Illawarra rail line located about 1.3 kilometres west of the project. Buses from Rockdale Station and Kogarah Station cross through the project area along President Road and Bay Street, and run along West Botany Street near Bestic Street, and Civic Avenue and O'Connell Street either side of Patmore Swamp (refer **Figure A-10**).

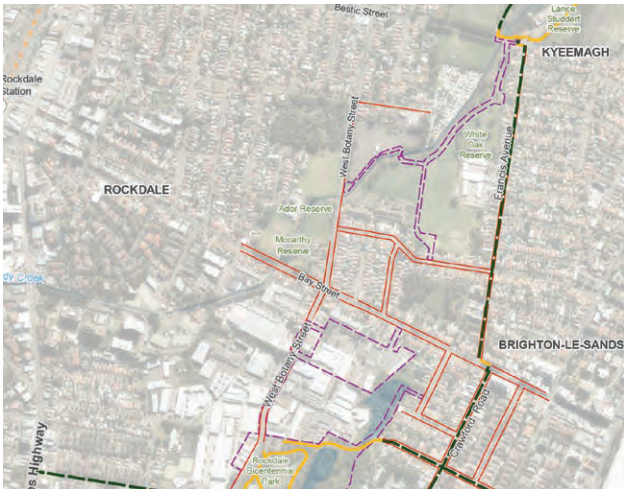
Road hierarchy

- The project area is broadly bounded along the southern, western and northern boundaries by busy, often congested streets comprising President Avenue (primary road) along the southern boundary area and Bay Street (secondary road) north of the project, both of which comprise major east-west links between The Grand Parade and Princes Highway. West Botany Street (secondary road) runs along the western boundary of the project area which services the nearby industrial area. Crawford Road to the east (secondary road) is a quieter residential street containing both medium and low density development. Quiet local streets provide good east-west connectivity within the project area, These local streets include Kings Road / Kings Lane and O'Neill Street, which intersects with The Grand Parade, and French Street, which intersects with the Princes Highway. Several local streets also provide similar east-west connectivity with the open space corridor north and south of the project Site. **Figure A-9** provides an overview of the local road network.

Pedestrian and cyclist circulation

- Provision for bicycles is provided via a north-south link along Francis Avenue, Crawford Road and O'Connell Street. An existing pedestrian and cyclist path provides an east-west link between Kings Road and West Botany Street and includes a circuit around the northern open space recreation area of Rockdale Bicentennial Park and north-south along the West Botany Street verge to President Avenue (refer **Figure A-11**).





Plant community types

Existing plant community types present within the project area include three endangered ecological communities, comprising:

- Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion
- Swamp Mahogany / Cabbage Tree Palm – Cheese Tree – Swamp Oak tall open forest (Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions)
- Common Reed on the margins of estuaries and brackish lagoons along the New South Wales coastline.

A fourth community was mapped as Urban Exotic and Native Cover consisting of planted, non-indigenous native and exotic species within local parklands, with species including *Ficus microcarpa hillii* and the occasional Eucalyptus species planted as park and street trees (ELA, 2018). **Figure A-12** shows the existing plant community types within the project area.

Most of the of the vegetation within Rockdale Bicentennial Park adjoining Brighton-le-Sands Public School and north of that, all within Kings Wetland, is heavily weed infested. It is assumed this part of Kings Wetland has not been subject to active management given the SP2 Infrastructure corridor that runs through this area.

The following additional plant community types were mapped within the open space corridor north and south of the project area (ELA, 2016), including two endangered ecological communities adjoining Patmore Swamp (south of President Avenue):

- Coastal Freshwater Swamp Forest (Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions (Swamp Mahogany / Cabbage Tree Palm – Cheese Tree – Swamp Oak tall open forest)
- Coastal Flats Swamp Mahogany Forest (Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions.

The remnant patches of Coastal Flats Swamp Mahogany Forest demonstrated excellent resilience within the context of urban parkland management (Refer to **Figure A-2**).

A further community of Coastal Enriched Sandstone Dry Forest (not listed under the *Biodiversity Conservation Act 2016*) was mapped north of the Bay Street within Tony Baker Reserve (refer to **Figure A-3**).

Figure A-2: View looking south along Civic Avenue edge of Scarborough Park North showing a highly weed resistant tractor-slashed edge of remnant Coastal Flats Swamp Mahogany Forest

Figure A-3: View looking north in Tony Baker Reserve of Coastal Enriched Sandstone Dry Forest

Waterways and drainage

The project area is situated within a Quaternary Aeolian landscape and is subject to a coastal sand bed aquifer (Botany Sand Beds aquifer) that is readily recharged by rainfall, and extends from Botany Bay northwards to Surry Hills and Centennial Park. Groundwater within the aquifer generally flows in a northeast-southwest orientation from areas around Centennial Park and Moore Park into Botany Bay and the Botany Wetlands. It has a relatively shallow water table, often less than one to two metres below the natural ground surface in low-lying areas, with levels varying relative to rainfall and evaporation. The aquifer is highly vulnerable to contamination.

Waterways and drainage fall into two distinct areas across the project area, comprising the area north of Bay Street, and the area south of Bay Street. The northern works area generally drains towards Muddy Creek, which in this location comprises a wide concrete-lined stormwater channel subject to tidal influence. Where rainfall does not percolate into the sandy soils, run-off flows towards Muddy Creek.

Within the southern works area, run-off flows from Brighton-le-Sands and Kings Wetland into the Rockdale Wetlands within Rockdale Bicentennial Park. These open water bodies are regulated by a small weir located just north of President Avenue, which when overcapacity, flows south through Patmore Swamp for a distance of about 2.5 kilometres behind sand dune formations to Ramsgate, before being piped eastward and discharging directly into Botany Bay to the south of Ramsgate Beach. Patmore Swamp comprises a saline affected environment with large areas of estuarine reedland and a series of ponds. **Figure A-13** provides an overview of the key waterways within the project area.

Views

Views across the project area tend to be enclosed within Whiteoak Reserve, Kings Wetland, and Rockdale Bicentennial Park with substantial stands of screening trees, and in the case of Rockdale Bicentennial Park a focus on internal features of playground and skate park. By contrast, CA Redmond Field and the adjoining netball fields provide more extensive open views with little internal visual structure, although again then enclosed by adjoining residential development and Cairnsfoot Special School. Views of Patmore Swamp are characterised by an extensive walled effect of tall reedland. Views across the top of this to the broader corridor are generally difficult to obtain. **Figure A-14** shows the key views within the project area.

Heritage

The project area has two listed heritage areas (local) within it comprising:

- Kings Wetland: The wetland is described as an area of regionally significant aquatic plants and demonstrates the geography and vegetation of the area prior to white settlement. That part of the wetland located within the SP2 Infrastructure zoned land appears to have not been subject to management for many years, and contains many weed tree species in addition to much of it being smothered with Morning Glory (*Ipomoea purpurea*). The western portion of the wetland is subject to active bushland and water quality management.
- Patmore Swamp: Part of the central wetland system which drains into Botany Bay, the place has a historical value for its role in the depression era program of public works, including building of the ponds.

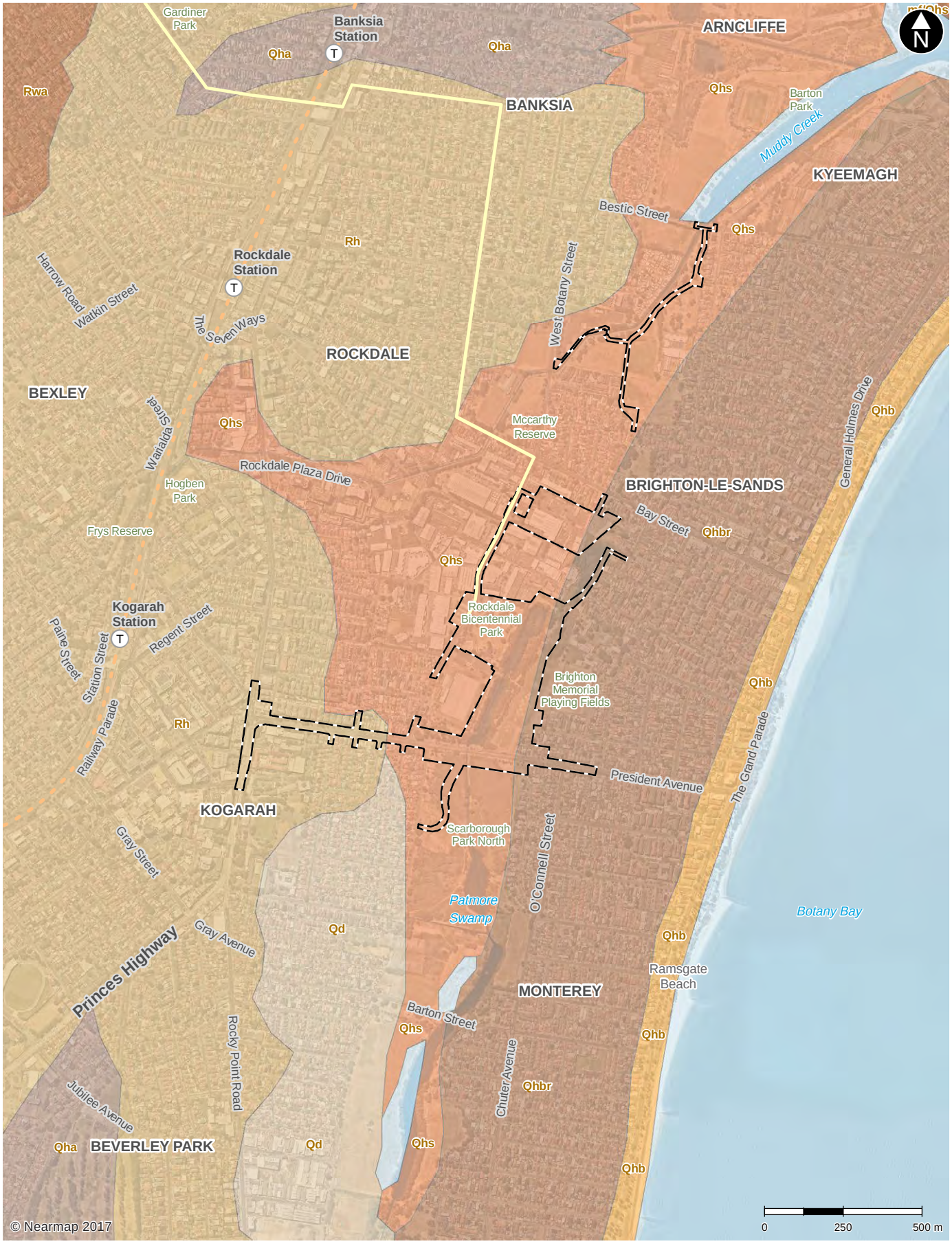
Kings Wetland is adjoined by Brighton-le-Sands Public School which was opened in 1916 and is subject to a local heritage listing.

Figure A-15 identifies the key local heritage listings within the area.

LEGEND

- Construction boundary
- Existing cycleway
- Railway line
- Railway station
- Parks and recreation
- Waterbody
- Waterway
- Permanent power supply construction boundary

Figure A-4: Landscape context

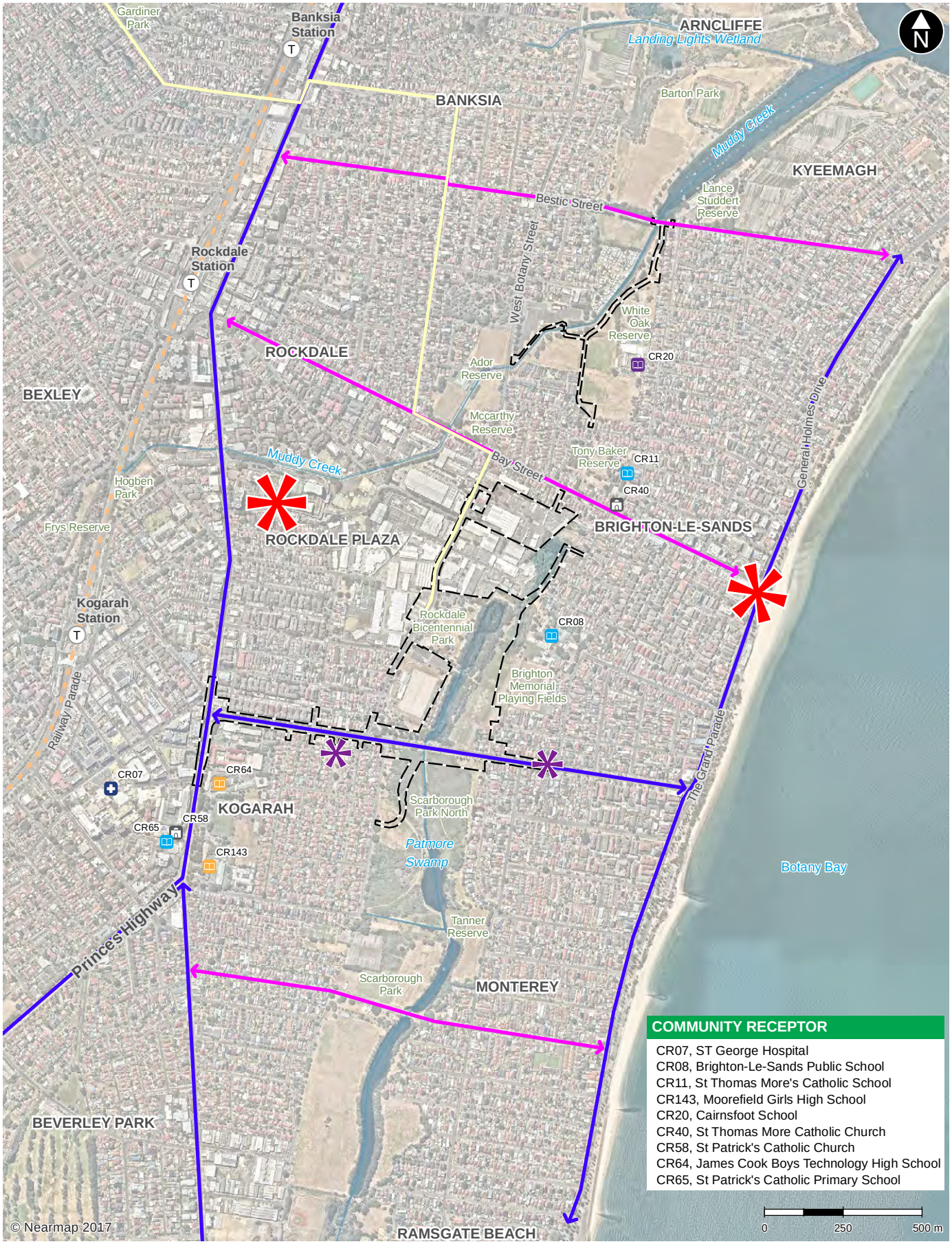


LEGEND

- Construction boundary
- mf/Qhs
- Qd Quaternary
- Qha Quaternary
- Qhb Quaternary
- Qhbr Quaternary
- Qhs Quaternary
- Rwa Triassic
- Rh Triassic
- water
- Railway line
- Railway station
- Permanent power supply construction boundary

Figure A-5: Geology

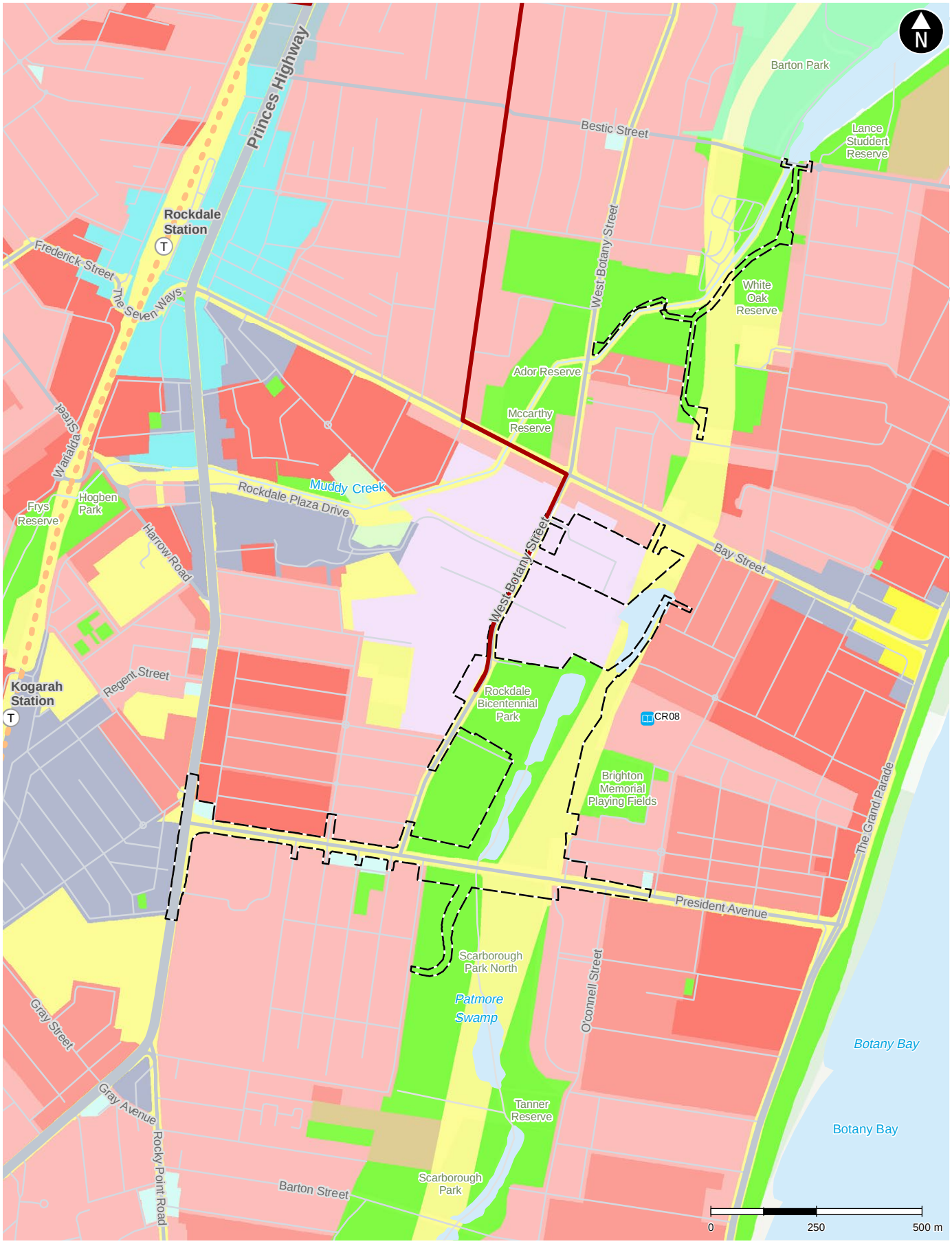
Figure A-6: Topography



LEGEND

- Construction boundary
- Primary road
- Secondary road
- High school
- Hospital and medical facilities
- Place of worship
- Primary school
- Special school
- Waterbody
- Waterway
- Railway line
- Railway station
- Permanent power supply construction boundary

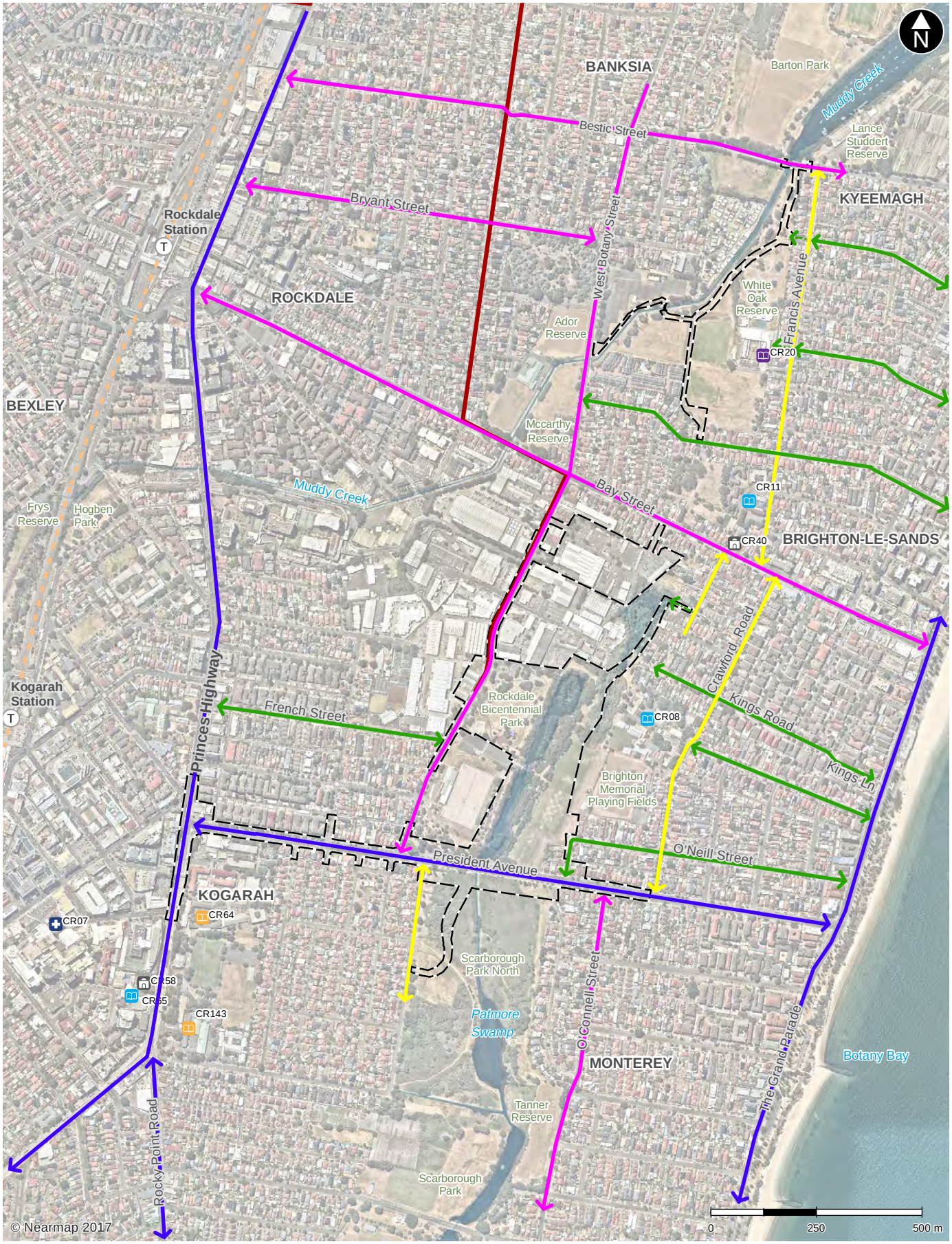
Figure A-7: Contextual analysis



LEGEND

- Construction boundary
- Primary school
- **Cooks Cove SREP 33**
- Open Space
- Special Use
- B1 Neighbourhood Centre
- B2 Local Centre
- B4 Mixed Use
- B6 Enterprise Corridor
- IN2 Light Industrial
- R2 Low Density Residential
- R3 Medium Density Residential
- R4 High Density Residential
- SP3 Tourist
- RU4 Primary Production Small Lots
- RE1 Public Recreation
- RE2 Private Recreation
- SP2 Infrastructure
- UL Unzoned Land
- Road
- Waterway
- Parks and recreation
- Permanent power supply construction boundary

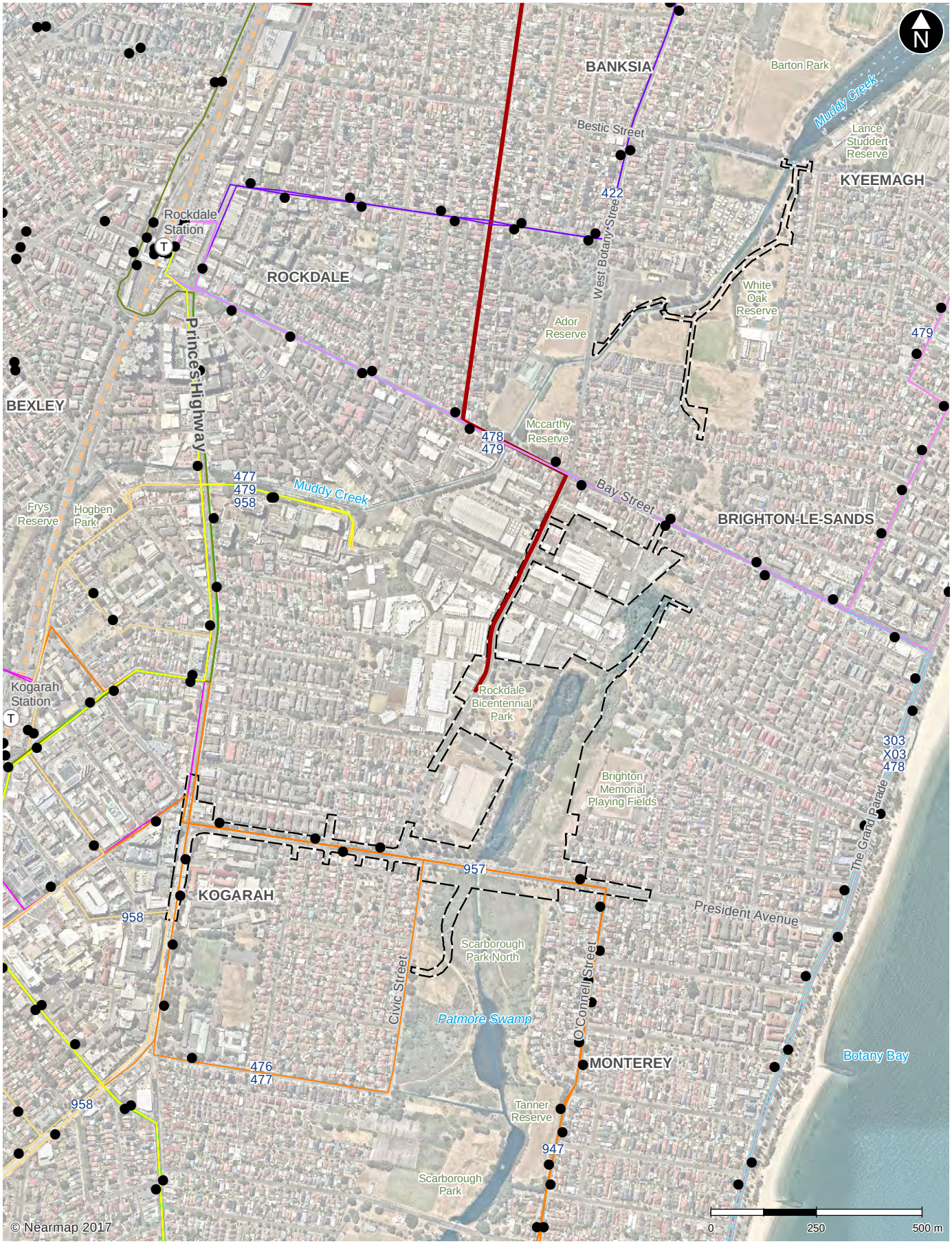
Figure A-8: Land zoning



LEGEND

- Construction boundary
- High school
- Hospital and medical facilities
- Place of worship
- Primary school
- Special school
- Primary road
- Secondary road
- Key local road-East-West access
- Key local road-North-South access
- Pedestrian link
- Waterway
- Waterbody
- Railway line
- Railway station
- Permanent power supply construction boundary

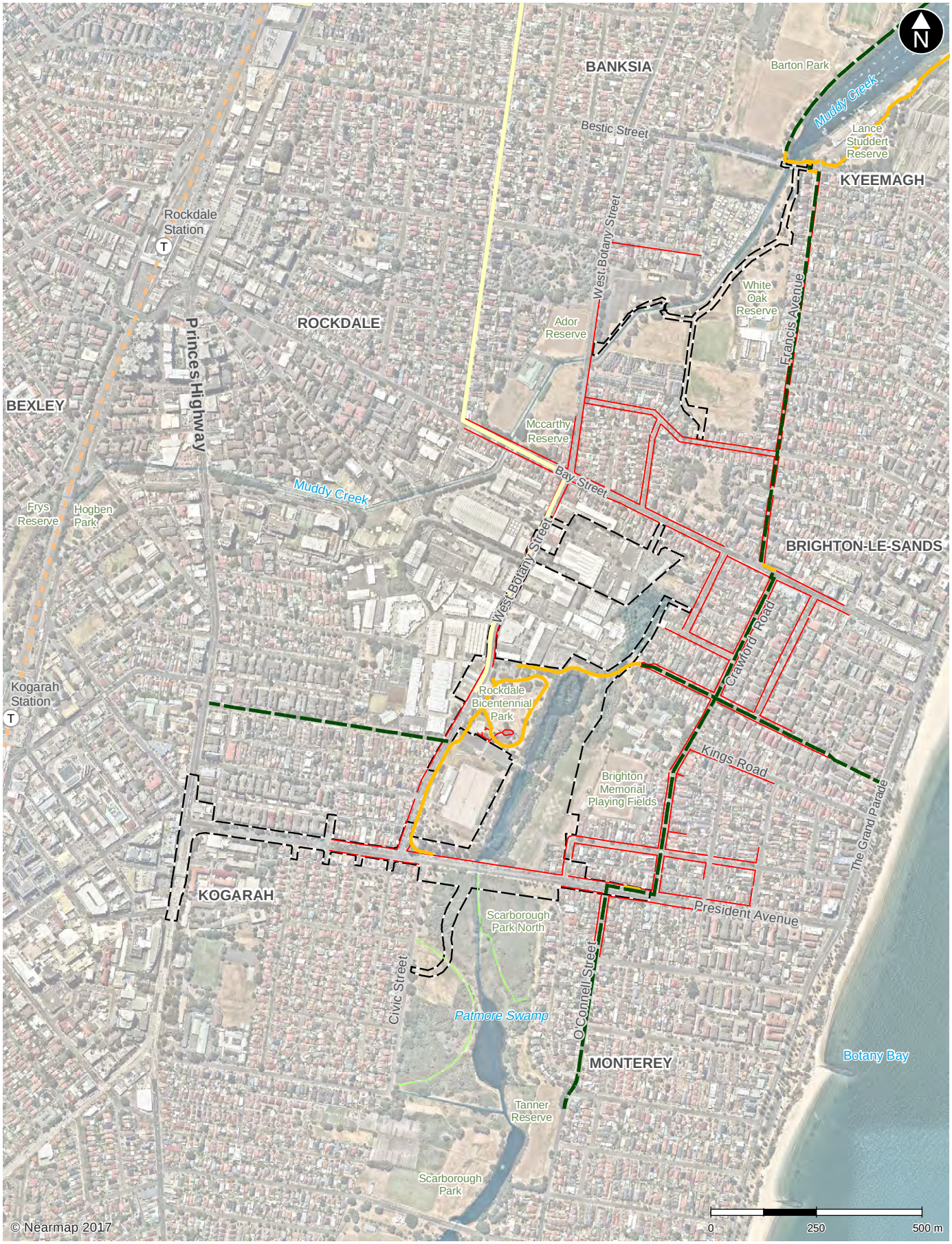
Figure A-9: Road Hierarchy



LEGEND

- Construction boundary
- Bus stop
- Bus route 303
- Bus route 422
- Bus route 455
- Bus route 476
- Bus route 477
- Bus route 478
- Bus route 479
- Bus route 947
- Bus route 958
- Bus route N10
- Bus route N11
- Bus route X03
- Waterway
- Waterbody
- Railway line
- Railway station
- Permanent power supply construction boundary

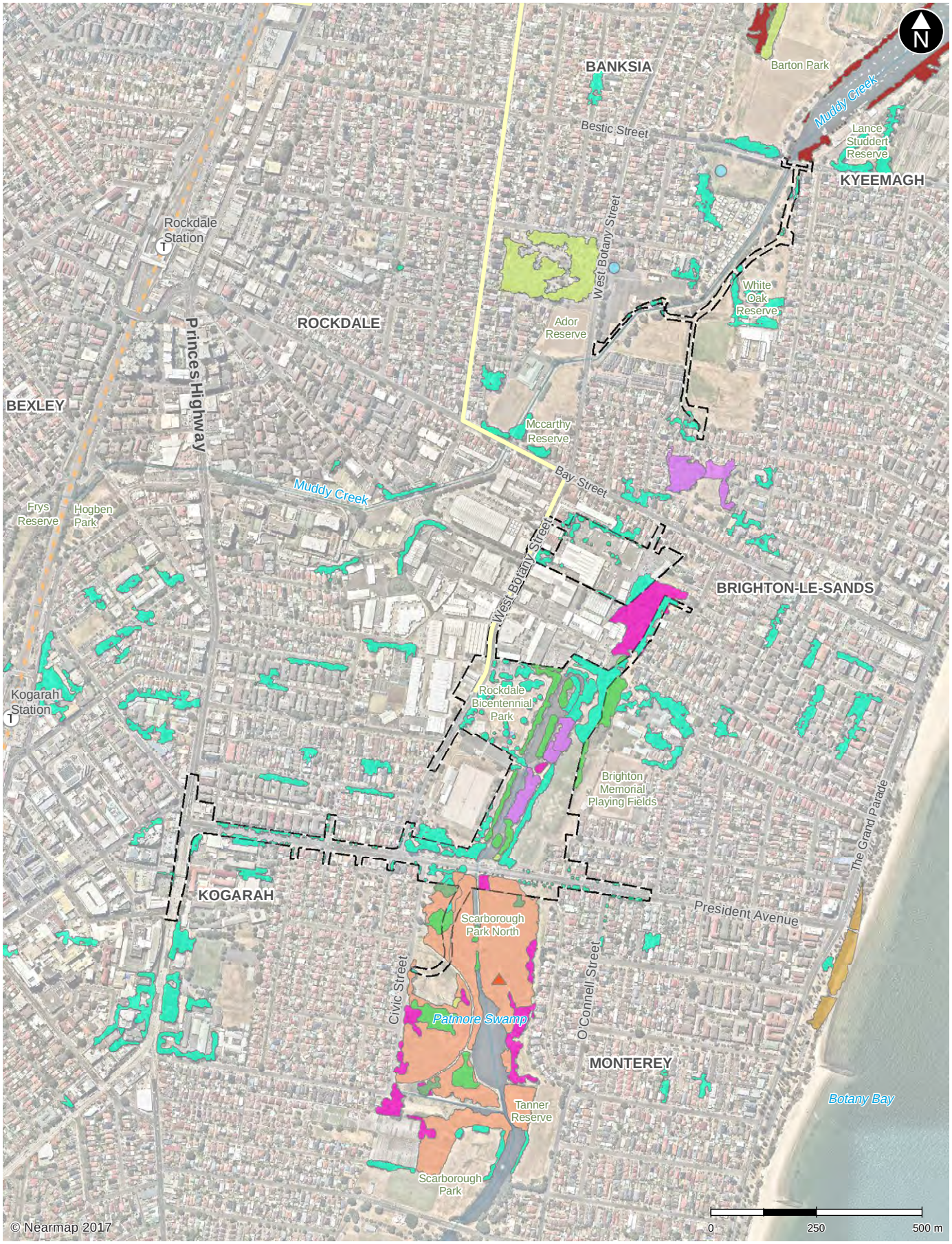
Figure A-10: Public transport corridors



LEGEND

- Construction boundary
- Existing footpath
- Existing unsealed footpath
- Existing shared path
- Existing on-road cycleway
- Waterway
- Waterbody
- Railway line
- Railway station
- Permanent power supply construction boundary

Figure A-11: Pedestrian and cyclist circulation



LEGEND

- Construction boundary
- Waterway
- Railway line
- Railway station
- Permanent power supply construction boundary
- Coastal Flats Swamp Mahogany Forest
- Coastal Foredune Wattle Scrub
- Coastal Freshwater Swamp Forest
- Coastal Swamp Paperbark-Swamp Oak Scrub
- Estuarine Mangrove Forest
- Estuarine Reedland
- Estuarine Saltmarsh
- Planted
- Undifferentiated Regenerating Shrubs
- Urban Native and Exotic Cover
- Weeds and Exotics
- Threatened Fauna (Green and Golden Bell Frog)
- Threatened Fauna (Southern Myotis)

Figure A-12: Plant community types / threatened fauna

LEGEND

- Construction boundary
- Mound batter
- Site drainage
- Waterbody/Wetlands
- Waterway
- Railway line
- Railway station
- Permanent power supply construction boundary

Figure A-13: Waterways and drainage

LEGEND

- Construction boundary
- Framed views
- Enclosed views
- Opened long views
- Visual Barriers
- Waterbody
- Waterway
- Railway line
- Railway station
- Permanent power supply construction boundary

Figure A-14: Views

LEGEND

- Construction boundary
- Local listed heritage items
- Waterbody
- Waterway
- Railway line
- Railway station
- Permanent power supply construction boundary

Figure A-15: Heritage

Place analysis

A high level place analysis has been undertaken to assess the environment surrounding the project area, specific to urban design considerations, as described below. A total of seven (7) high level place types have been identified as below (refer to **Figure A-17** for locations).

Muddy Creek

This place comprises the mouth of Muddy Creek, north of the Bestic Street bridge. This reach of the waterway comprises a long, narrow natural tidal waterbody highly enclosed by mangroves to both sides of creek, with exception of Muddy Creek Boating and Amateur Fishing Association club house and jetties located along the edge of the waterway, just north of Bestic Street within Lance Studdert Reserve. The serene setting of mangroves and still water is set with a substantial coverage of small, moored recreational boats.

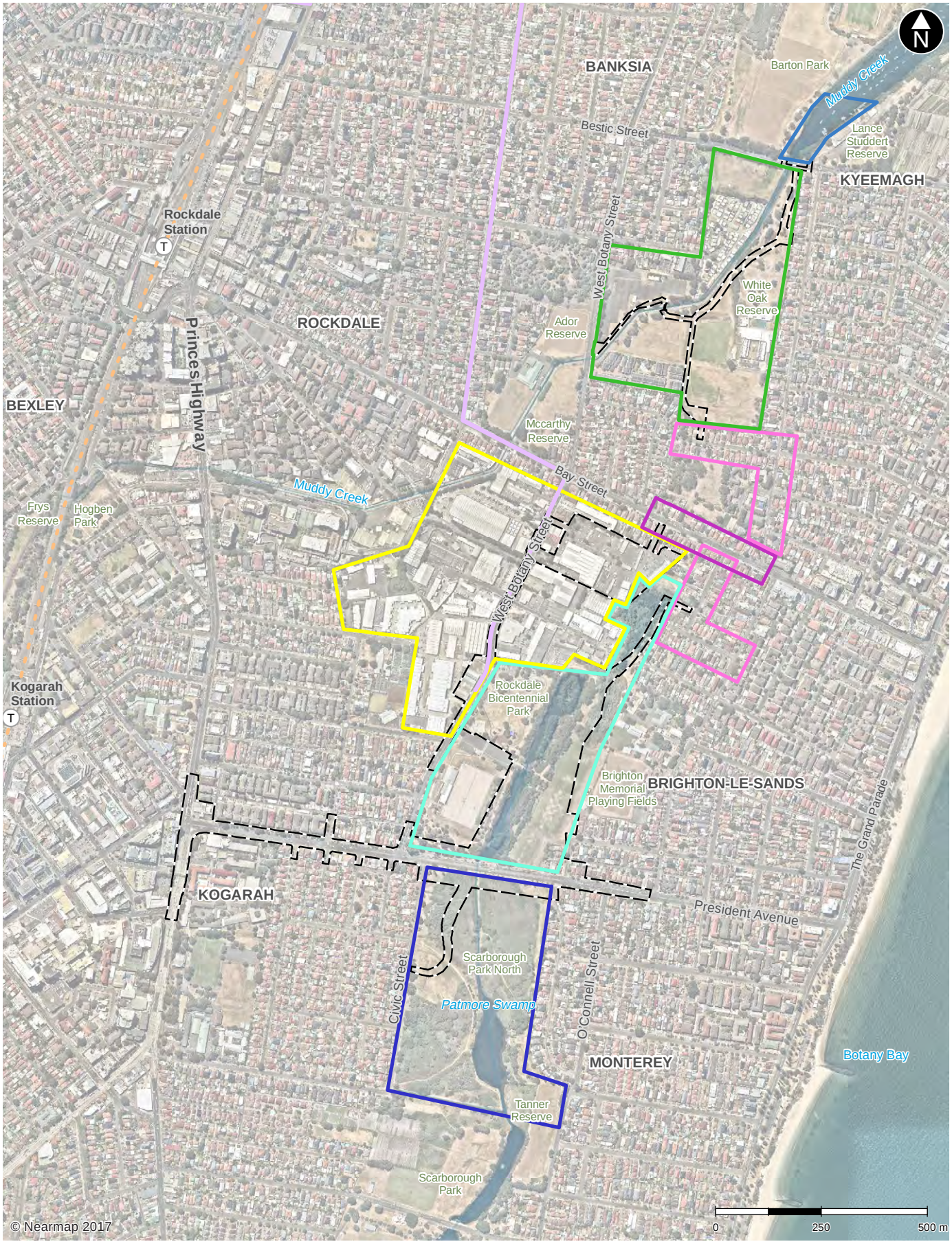
Muddy Creek changes to a fenced concrete channel upstream from this point.

Whiteoak Reserve / CA Redmond Field / Womens Playing Fields

For the purposes of this assessment, Whiteoak Reserve, CA Redmond Field and the hard and soft netball courts west of CA Redmond Field are considered to comprise a single place type. The key elements that tie these otherwise apparently disparate elements together comprise:

- The connection of all these areas with the concrete-lined channel (Muddy Creek)
- A sense of enclosure by adjoining development in conjunction with highly limited street access
- Architectural, connecting of the different spaces with:
  - the centrally located, colourful and well-articulated Cairnsfoot Special School visible from most parts of the place, and
  - Sheralee Tourist Caravan Park, also visible from most parts of the place.

Figure A-16: View looking north from Bestic Street to the tidal mouth of Muddy Creek



Construction boundary
Permanent power supply construction boundary
Bay Street
White Oak Reserve
Residential streets
Industrial zone
Estuarine Reedland and Forest
Muddy Creek Downstream of Bestic Street
Rockdale Wetlands/Bicentennial Park & Memorial Fields
Waterbody
Waterway
Railway station
Railway line

Figure A-17: Place analysis types

Whiteoak Reserve

Whiteoak Reserve has two single house block wide entries from Bestic Street, and from Francis Street at the intersection with McIntyre Avenue. It is enclosed along its eastern boundary by a broad assortment of back fence types and heights, and along its western boundary an 1800 millimetre high chain mesh fence. The reserve is generally flat, with spaces articulated by a series of landscape mounds, some of which are planted to well established stands of trees, with casuarina stands being particularly successful.

In addition to the residential edge, the reserve has views to:

- the colourful and well-articulated Cairnsfoot Special School, which clearly addresses the reserve, and comprises an interesting and attractive backdrop to the park, and
- the Muddy Creek concrete-lines channel, opposite which is located an eclectic, but often well-presented mix of permanent caravan-type dwellings within the Sheralee Tourist Caravan Park which is also of considerable visual interest.

The reserve includes existing amenities comprising an aging and unattractive toilet block that was locked at the time of inspection, and appears to be disused, infants playground in the centre of the reserve with two covered settings of table and seats, and a swing set at the southern end of the site.

Notwithstanding the considerable tree planting within the reserve, within the context of its enclosed setting, it gives a feeling of being open and exposed, with some of the open grassed areas reliant on rainfall and subsequently struggling to survive.

Natural communities present within this area include: a healthy row of mangroves aligning with the western boundary of Cairnsfoot Special School, and sporadic stands of casuarina alongside the Muddy Creek concrete channel edge.

Sydney Water propose to undertake a creek naturalisation project to the channelised section of Muddy Creek, with a substantial saltmarsh restoration proposed to be incorporated within existing grassed areas at the Bestic Street end of the reserve (refer to **Section 6**).

Figure A-18: View looking south from Bestic Street to Whiteoak Reserve, with Muddy Creek (channelised) to right of frame

CA Redmond Field and Netball Courts

The southern extent of this area where it adjoins Whiteoak Reserve has good examples of naturally recruiting native plant communities comprising mangroves and saltmarsh (saltwater), and swamp oak forest and phragmites reedland (brackish water). All of these communities are robust, look healthy (unlike some of the introduced native trees) and are excluding weeds.

CA Redmond Field and the adjoining football playing field has a highly exposed and barren character with large areas of grass cover failing in several places.

The raised grassed field of netball courts is visually moderately well contained between stands of trees alongside Muddy Creek to the north and west, and Brighton Terraces to the south. The 'neat', consistent form and colouration of the two storey terraces with its highly 'European' cultural planting provides a good visual foil to, and point of visual interest for this otherwise open grassed area notable for its lack of trees. The 'manicured' nature of the netball courts compliments the cultural, closely tended landscape character of the Brighton Terraces.

An interesting find within this area was a well-tended vegetable garden along the residential perimeter and located within the CA Redmond Field reserve. This type of highly productive, industrious residential activity comprised a welcome relief and point of interest within this otherwise barren expanse of grassed fields and run-off areas.

Figure A-19: Whiteoak Reserve looking south near Francis Street entry with Cairnsfoot Special School in the background

Figure A-21: Figure A-20 View looking south-west across CA Redmond Field to Brighton Terraces and grassed netball courts

Figure A-20: Productive co-opting of public space along the southern residential edge of CA Redmond Field reserve

Residential streets

This place comprises ‘quiet’ residential streets along which the shared cycle and pedestrian pathways is proposed to run. Two distinct sub-character types are contained within this place as described below.

Bruce Street and England Street

Bruce Street and England Street comprise quiet and wide residential streets with a limited range and small range of street trees and parking both sides. Generally free-standing single storey houses with a mix of typically small street trees. Overhead power lines run along one side of street. The original housing is of Federation era single storey free-standing bungalow style, a moderate proportion of which is well conserved. Other buildings comprise modified federation bungalows, e.g. new windows with rendered and painted walls, and contemporary single and double storey brick dwellings.

Figure A-22: View looking east along Bruce Street

Francis Avenue

Francis Avenue comprises a narrow, and periodically busy street, linking Bestic Street and Bay Street, but still with a strong residential presence. Housing presents side fences to this part of the street, with views along intersecting quiet residential streets. Low-rise social housing and St Thomas More's Catholic School is located towards the Bay Street end.

The street is narrow. Overhead power lines run down the western side of this part of the street, with a footpath under it, and street parking permitted to part of this side of the road. There is no footpath on the other side of the street, or parking permitted. There are trees alongside the street, however, these are predominantly small trees within front gardens, providing varying levels of streetscape amenity.

Figure A-23: View looking south along Francis Avenue near corner of Bruce Street

Bay Street

The character of this place is that of a busy, noisy residential road with very few street trees and low pedestrian amenity. There is a strong visual connection with the contrasting character of high rise development and Norfolk Island Pines at eastern end of street when travelling east.

Figure A-24: View looking west along Bay Street near the corner of Francis Avenue

Figure A-25: View looking east along Bay Street at the corner of Francis Avenue

Industrial zone

This area comprises two sub-types as relevant to the project, as follows:

West Botany Street

This area comprises aging one to two storey commercial road frontage warehouses with a garish palette of colours, in visually jarring combinations. The landscape comprises a harsh urban setting with four lanes of heavy traffic and associated noise, and low pedestrian amenity, including no street trees, overhead powerlines to both sides of the street, and high levels of glare. Rockdale Bicentennial Park is located along part of eastern side of street.

Figure A-26: View looking north along West Botany Street to industrial development located opposite Rockdale Bicentennial Park

Bermill Street Industrial Area

Built form comprises a mix of new and old buildings. Those buildings within proximity of the project comprise a combination of corrugated iron and fibre cement clad workshop structures which are of low visual amenity.

Figure A-27: View looking west from open space corridor north of Rockdale wetlands to adjoining industrial development

Rockdale Wetlands / Bicentennial Park and playing fields

This area comprises two sub-types as relevant to the project, as follows:

Rockdale Wetlands

This area comprises a regenerated remnant of Coastal Freshwater Swamp Forest and new areas presumably planted to this community. The area is under active management and generally has low weed cover. A permanent water level is maintained to the wetlands by a weir at the President Avenue end of the pond. This has potentially encouraged the observed high numbers of waterbirds and ibis, which may be significant contributors to the high nutrient levels affecting the water quality of the system.

Informal access is available to the western edge of the pond via a steep batter. An existing shared path is in place along the eastern edge of Bicentennial Park.

Figure A-28: View looking south from walkway to Rockdale Wetlands

Kings Wetland

This wetland is located east of the Rockdale Wetlands, adjoin and extending from the southern boundary of the Brighton-le-Sands Primary School, north to a point midway along England Street. The heritage listing identifies the presence of a Swamp Oak Forest remnant that was typical for this area in the early days of the colony. The southern end patch of the wetland is subject to major recruitment by silver poplars. Virtually all of the area is subject to weed invasion by Morning Glory, a smothering vine that has likely prevented any plant growth below it other than the emergent swamp oaks and other native and exotic trees.

Figure A-29: View looking south at part of Kings Wetlands heritage area

Rockdale Bicentennial Park and Ilinden Sports Centre

Bicentennial Park and Ilinden Sports Centre is located between West Botany Street and the Rockdale Wetlands. Bicentennial Park provides a number of passive and active facilities including a skate park and playground to the south, circular walking track around the perimeter and scattered picnic shelters throughout. The park has large stands of grouped evergreen trees to the outer edges providing an informal grassed area in the centre for multi-purpose use. West Botany Street and Rockdale Wetlands are also both well-screened with mature evergreen tree planting.

The Ilinden Sports Centre includes an enclosed playing field with lighting and an associated grandstand structure and clubhouse facilities to the west of the playing field. The Sports Centre is home to the Rockdale City Suns. A car park with capacity for approximately 300 vehicles is located to the north and west of the Sports Centre. A toilet block facility is located close to the car park and easily accessible from Bicentennial Park.

The playing field, grandstand and clubhouse are elevated above the surrounding ground levels, particularly along West Botany Street and President Avenue. This corner is also densely screened with a mix of established evergreen and deciduous trees. Access is provided from West Botany Street and is identified by masonry entry walls.

Figure A-30: Rockdale Bicentennial Park looking south-west towards the skate park and playground

Figure A-31: Masonry entry walls to Rockdale Bicentennial Park and Ilinden Sports Centre on West Botany Street

Rockdale Bicentennial Park East playing fields

The Rockdale Bicentennial Park East playing fields include a series of formal playing fields on the east side of the Rockdale Wetlands. The playing fields are accessed from Bicentennial Park by a pedestrian bridge and can also be accessed from President Avenue. An enclosed playing field is located to the east, with Brighton-le-Sands Public School to the north-east.

The playing fields are currently floodlit and are positioned to the edge of the residential area of Brighton-le-Sands. As a result, the playing fields are densely enclosed with vegetation to the west and north with residential and cultural landscape to the east. The playing fields are open to President Avenue in the south.

Figure A-32: Bicentennial Park East playing fields, Brighton-le-Sands, looking south to President Avenue

Figure A-33: View looking east along President Avenue at the southern perimeter planting of Bicentennial Park and Rockdale Wetlands

Estuarine reedland and forest

This area comprises an extensive reedland of predominantly Common Reed (*Phragmites australis*) with small patches of remnant Coastal Freshwater Swamp Forest. Substantial areas of weeds and exotic species are present, including Lantana (*Lantana camara*) and Blackberry (*Rubus fruticosus*). This is particularly prevalent along edges of Civic Avenue, and Colston Crescent where housing backs onto the Reserve. A relatively small portion of the area comprises an enclosed dog park, and open slashed grassed areas along much of the residential edge. The area is not easily able to be viewed from perimeter areas due to the flat terrain and height of the reeds.

Figure A-34: View looking south from President Avenue across Scarborough Park North (Patmore Swamp) estuarine wetland

Figure A-35: View looking south along the Civic Avenue edge of Scarborough Park North showing a highly weed resistant tractor-slashed edge of remnant Coastal Flats Swamp Mahogany Forest

President Avenue

President Avenue is a major arterial road between Princes Highway and The Grand Parade. The road primarily contains residential buildings along the entire corridor with commercial buildings at the intersection with Princes Highway. Small retail shops are scattered at the corner of Crawford Road and Oakdale Avenue, however the road is mainly characterised by the punctuation of the Rockdale Wetlands, which intersects President Avenue and provides a contrast to the built form that otherwise exists along the road corridor. Pedestrian access is limited and available at the signalised intersections along the road.

Figure A-36: President Avenue looking east from intersection with Princes Highway towards TAFE NSW St George College

Figure A-37: President Avenue looking east from the corner of Civic Avenue to Rockdale Bicentennial Park

Princes Highway

Princes Highway is the main road connecting many of Sydney's southern suburbs with the CBD, as well as the St George Hospital nearby. The highway is the main road heading south towards the M1 Princes Motorway. Locally, at the intersection with President Avenue, the character is dominated by a number of recently built high-density residential developments to the west and community facilities (TAFE NSW St George College, James Cook Boys High School and Moorefield Girls High School) to the east. Pedestrian access across Princes Highway is restricted to signalised intersections, however an existing pedestrian bridge provides a link to the Kogarah CBD and train station with community facilities to the east.

Figure A-38: View north along Princes Highway from pedestrian overbridge to intersection with President Avenue

Annexure B - Design guidelines

B

Annexure B - Design guidelines

Shared cycle and pedestrian pathways

Bestic Street to Bruce Street

The shared cycle and pedestrian pathways interfaces a number of varying site conditions as it makes its way south from Bestic Street. Commencing at Whiteoak Park through playing fields. The key considerations of the shared cycle and pedestrian pathways to ensure it is integrated with parklands and through the playing fields would need to include:

- Materiality – including colour and texture
- Pedestrian connectivity – possible provide pedestrian connections to surrounding neighbourhoods that can easily link into the shared cycle and pedestrian pathways
- Tree planting – the shared cycle and pedestrian pathways shall be tree-lined to provide shade and amenity and to reduce the heat-island effect of the pavement surface. Planting associated with the shared cycle and pedestrian pathways shall respond to the surrounding context through which it passes through in terms of species and groupings
- Amenity – the shared cycle and pedestrian pathways route shall provide adequate provision for amenity and furniture along the entire route including, but not limited to:
  - Frequent rest stops at key nodal points with paved areas
  - Where appropriate, changes in pavement material to respond to the local context and conditions, including high pedestrian or traffic areas and boardwalks for sensitive landscape zones
  - Drinking fountains
  - Bench seating
  - Consistent approach to signage
  - Provision for bicycle racks at key destinations
  - Adequate lighting along the entire route.

On-road connections

The design shared cycle and pedestrian pathways provides for an on-road connection through the following streets:

- Bruce Street
- Francis Avenue
- Bay Street, and
- England Street.

Considerations for the shared cycle and pedestrian pathways route at the on-road connections shall include:

- Provision of safe locations to access and cross, in particular at Bay Street
- Integration with the existing streetscape and neighbourhood character
- Identify locations to reinforce the shared cycle and pedestrian pathways through signage and pavement line marking to ensure legibility
- Clear delineation for pedestrians.

England Street to President Avenue

The shared cycle and pedestrian pathways system reconnects with the open space and parkland setting from England Street. It is important that the shared cycle and pedestrian pathways maintains legibility to provide users with a sense consistency and of safety when travelling on the shared cycle and pedestrian pathways network. The same principles shall be applicable as described in **Section 2.4**. Additional landscape considerations through this section shall include:

- Interaction with Bicentennial Park and Rockdale Wetlands, including views to both
- Provide a safe environment for users due to a higher number of pedestrians at this location
- Connectivity to the local pedestrian footpath system associated with the Park and Wetlands, including connectivity to Memorial Playing Fields to the east.
- Safe and legible access to the associated President Avenue shared cycle and pedestrian bridge.

Figure B-1: Bench seating adjacent pedestrian path

Figure B-2: Drinking fountain

Figure B-3: Shared user path

Figure B-4: Bicycle racks

Figure B-5: Lighting along a shared user path

Figure B-6: Picnic shelter

Open Space

The design intent for the landscape of open space along the project would focus on integration with the surrounding context and existing site conditions, and reinstatement of disturbed areas with upgraded amenity. As the road corridor would impact the open space at President Avenue, the primary consideration at this location is to integrate the associated works with the surrounding landscape setting.

The dominant landscape design driver at Whiteoak Reserve is to integrate the shared cycle and pedestrian pathways with the existing parkland setting. This would require the shared cycle and pedestrian pathways to meander between the raised mounds containing existing tree planting and to link to key amenities though the site including the existing playground.

At Redmond Field and the Women's Sporting Fields the shared cycle and pedestrian pathways would provide access to these amenities. More importantly it would provide structure for additional amenity to be incorporated. Tree planting associated with the shared cycle and pedestrian pathways should respond to the surrounding context and reinforce its alignment.

The landscape intent for local streets along the shared cycle and pedestrian pathways route is to improve pedestrian amenity through the provision of continuous tree canopy. The regularity of street trees would define the local street network and provide a buffer between pedestrians / cyclists and traffic. The continuous canopy would provide shade and contribute to Sydney's urban ecosystem.

Through Rockdale Bicentennial Park the landscape intent is to ensure the shared cycle and pedestrian pathways is legible and provides consistency for users. Pedestrian footpaths should connect into the shared cycle and pedestrian pathways system, however should not compromise its functionality. Amenity along the shared cycle and pedestrian pathways would be provided in the adjacent spaces which would provide an opportunity for users to engage and interact with these spaces.

Bicentennial Park would be reinstated to provide a similar landscape setting to existing with evergreen tree planting to the edges and a large informal grassed area in the centre. The reinstated car park would incorporate water sensitive urban design and water quality elements such as bio-swales to treat surface water. A new skate park and playground would be located in the centre of Bicentennial Park with provision for additional shade, connectivity and amenity for families and communities to gather.

Rockdale Wetlands would be significantly impacted by construction works and would need to be reinstated. The wetlands would be reinstated to provide water quality benefits incorporating a macrophyte benches across the flow path to enhance cycling of nutrients through biological uptake and reduce nutrient concentrations in the water. Recreational paths, including timber boardwalks are proposed along the benched edges of the wetlands to provide opportunities for interaction and educational opportunities. The pedestrian bridge from Bicentennial Park to the playing fields would be reinstated to provide an improved and safer pedestrian connection.

The playing fields would be arranged to integrate into the remaining space following construction of the entry and exit ramps and tunnel portal for the project. The playing fields would be nestled with the existing landscape setting of the adjacent Rockdale Wetlands, with supplementary planting provided to screen the tunnel entry. An improved pedestrian footpath system is proposed to provide amenity to the playing fields along with furniture, fixtures and shelters to provide all-weather protection.

President Avenue would be impacted by removal of trees at the Princes Highway intersection. These trees would need to be reinstated to provide a visual screen for adjacent residents from the widened road. Tree planting would be provided at the interface of the tunnel to reinforce the landscape character at the Rockdale Wetlands and to provide a legible tunnel portal experience. The scale of tree planting would assist in integrating the entry and exit ramps and tunnel portal into the surrounding context.

Water quality basin

A water quality basin in proposed on the eastern side of the entry and exit ramps and tunnel portal at President Avenue. The landscape intent is to provide an asset that adds to the visual and ecological amenity of the areas, and can be integrated with the functionality of the adjacent Rockdale Wetlands. The form, shape and plant species would be consistent with that at the wetlands.

Figure B-7: Tree planting on mound / embankment

Figure B-8: Children's playground

Figure B-9: Wetland planting

Figure B-10: Shared cycle and pedestrian path

Figure B-11: Playing fields

Figure B-12: Water quality and sedimentation basins

Plant schedule

Species	Common name	Type	Character			
		Streetscape	Shared cycle and pedestrian pathways	Restoration	Wetland	President Avenue
Trees						
Acmena smithii	Lilly Pilly		■			■
Angophora bakeri	Narrow-leaved Ironbark	■		■		■
Angophora costata	Smooth-barked Apple	■		■		■
Banksia serrata	Old Man Banksia	■	■	■		■
Casuarina glauca	Swamp Oak			■	■	
Cupaniopsis anacardioides	Tuckeroo	■	■			■
Elaeocarpus reticulatus	Blueberry Ash	■	■			■
Eucalyptus microcorys	Tallowwood	■		■	■	■
Eucalyptus robusta	Spotted Gum	■		■	■	■
Eucalyptus sclerophylla	Scribbly Gum	■		■	■	■
Livistona australis	Cabbage Palm	■	■	■		
Melaleuca decora	White Feather Honey-myrtle	■		■	■	
Melaleuca quinquenervia	Broad-leaved Paperbark	■		■	■	
Xanthorrhoea resinifera	Grass Tree		■			
Shrubs						
Acacia longifolia	Sydney Golden Wattle			■	■	
Backhousia myrtifolia	Grey Myrtle	■		■	■	■
Banksia aemula	Wallum Banksia	■	■	■	■	
Banksia ericifolia	Heath-leaved Banksia	■	■	■	■	
Banksia oblongifolia	Fern-leaf Banksia	■	■	■	■	
Callistemon citrinis	Crimson Bottlebrush	■	■			■
Correa alba	White Correa	■	■			■
Dillwynia sericea	Showy Parrot Pea	■	■	■	■	
Dodonaea triquetra	Common Hop Bush	■	■	■	■	
Eriostemon australasius	Pink Wax Flower	■	■			■
Grevillea linearifolia	Linear Leaf Grevillea	■	■	■	■	■
Kunzea capitata	Pink Kinzea	■	■			■
Leptospermum laevigatum	Coastal Tea Tree	■	■			■
Leptospermum polygalifolium	Tantoon	■	■			■
Leptospermum trinervium	Paperbark Tea Tree	■	■			■
Melaleuca thymifolia	Thyme Honey-myrtle			■	■	
Monotoca elliptica	Tree Broom Heath			■	■	
Persoonia nutans	Nodding Geebung		■	■	■	
Ricinocarpus pinifolius	Wedding Bush		■	■	■	
Westringia fruticosa	Coastal Rosemary	■	■			■
Ground covers / native grasses						
Conospecrmum taxifolium	Devils Rice			■	■	
Hardenbergia violacea	False sarsaparilla	■	■			■
Hibbertia scandens	Snake Vine	■	■	■	■	■
Imperata cylindrica	Blood Grass	■	■	■	■	
Lomandra longifolia	Spiny-headed Mat-rush	■	■	■	■	■
Microleana stipoides	Weeping Grass	■	■	■	■	■
Phragmites australis	Common Reed			■	■	
Poa labillardieri 'Eskdale'	Tussock Grass	■	■			■
Themeda australis	Kangaroo Grass	■	■	■	■	■

Species selection

Trees

Angophora bakeri

Angophora costata

Banksia serrata

Casuarina glauca

Eucalyptus microcorys

Eucalyptus robusta

Eucalyptus sclerophylla

Livistona australis

Melaleuca quinquenervia

Shrubs

Acacia longifolia

Backhousia myrtifolia

Banksia aemula

Banksia ericifolia

Callistemon citrinus

Dillwynia sericea

Dodonaea triquetra

Leptospermum polygalifolium

Melaleuca thymifolia

Ground covers / native grasses

Hardenbergia violacea

Hibbertia scandens

Imperata cylindrica

Lomandra longifolia

Microlaena stipoides

Phragmatis australis

Poa labillardieri 'Eskdale'

Themeda australis

Xanthorrhoea resinifera

Crime Prevention through Environmental Design

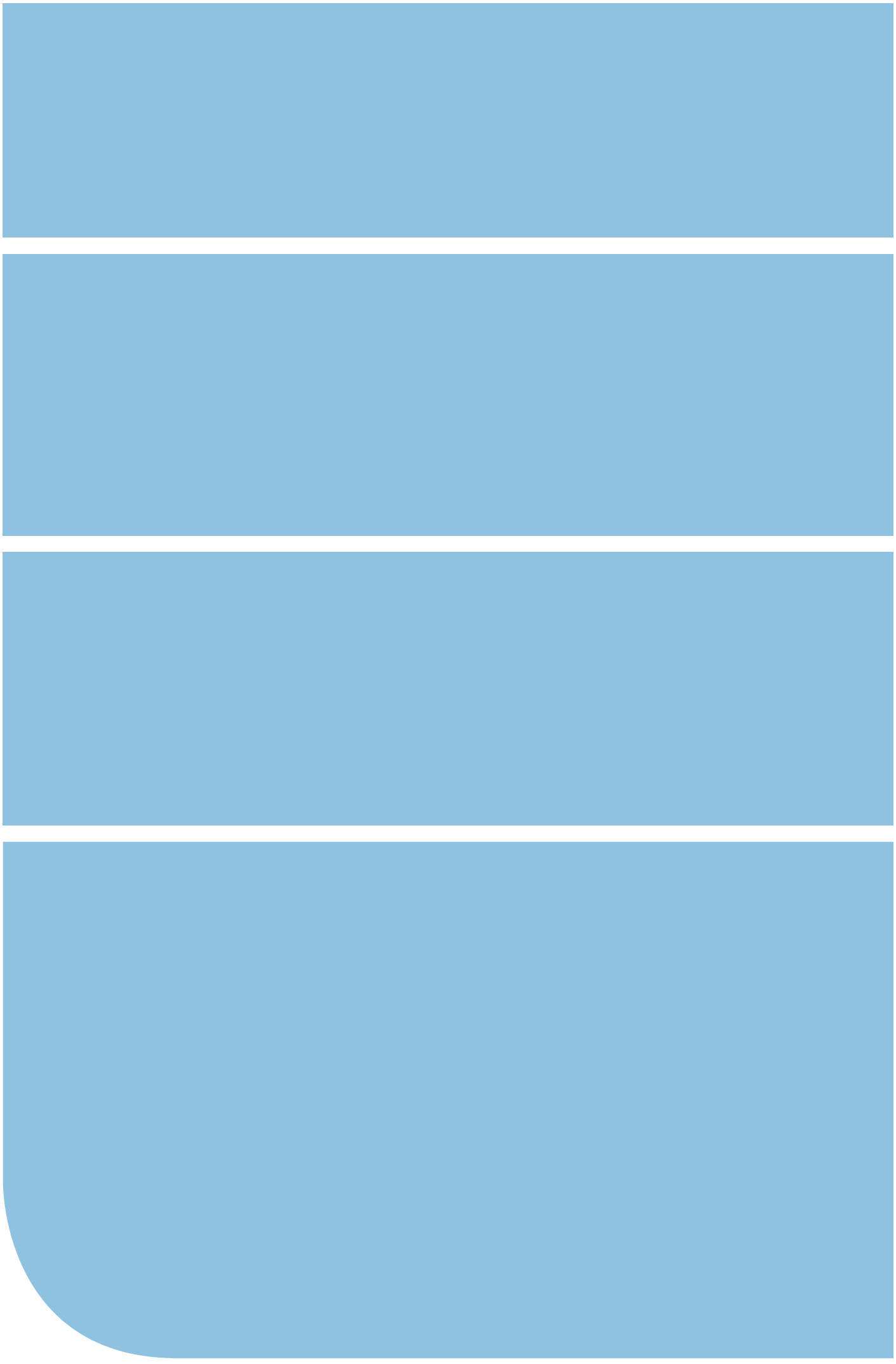
The Principles of Crime Prevention through Environmental Design (CPTED) shall be considered and incorporated into the urban design through the development of the Urban Design and Landscape for the project. The key CPTED principles to reduce opportunities for crime are outlined below:

- Surveillance – the public realm, buildings and any structures should be designed and managed to maximise the potential for passive surveillance
- Legibility – the public realm should be designed, detailed and managed to make them easy to navigate and understand for users, especially pedestrians and cyclists, without losing capacity for variety and interest
- Territoriality – security should be supported by designing and managing spaces, buildings and structures to define clearly legitimate boundaries between private, semi-private, community group and public space
- Ownership of outcomes – a feeling of individual and community ownership of the public realm and associated built environments must be promoted to encourage a level of shared responsibility for their security
- Management – the public realm should be designed and detailed to minimise damage and the need for undue maintenance, without undermining the aesthetic and functional qualities that make the public realm attractive to the community. Systems of both regular and reactive maintenance and repair should be implemented to maintain the quality of these spaces. A regular auditing system of CPTED issues in the public domain should be implemented

- Vulnerability –
  - The public domain should be designed and managed to reduce or limit risk from assault by providing self-lit, active and overlooked places and pedestrian and cyclist systems and routes to important places
  - The design and management of places should avoid creating or maintaining hidden spaces close to pedestrian / cyclist travel routes in the public realm, in ways that remain consistent with the purpose of the place
  - The design and management of the public domain should provide a variety of routes and other ways to avoid potential or actual problems
  - The pursuit of safety should be delivered in ways consistent with the purpose of the place.

During detailed design, specific measures at surface operational infrastructure would be identified to prevent crime.

Figure B-13: Balancing park amenity and visibility - low shrubs and high canopied trees with clean trunks provide natural surveillance



Roads and Maritime Services

F6 Extension Stage 1

New M5 Motorway at Arncliffe to President Avenue at Kogarah

Environmental Impact Statement

Appendix C2
Landscape and Visual Technical Report

Volume 3

C2

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Contents

Glossary of terms and abbreviations

Term	Definition
Amenity	The pleasantness of a place as conveyed by desirable attributes including visual, noise, odour etc. (AILA 2018)
Glare	The uncomfortable brightness of a light source when viewed against a darker background. (ILE 2011)
Landscape	All aspects of a tract of land, including landform, vegetation, buildings, villages, towns, cities and infrastructure.' (Roads and Maritime 2018)
Landscape character	The combined quality of built, natural and cultural aspects that make up an area and provide its unique sense of place. (Roads and Maritime 2018).
Landscape character zone	An area of landscape with similar properties or strongly defined spatial qualities, distinct from areas immediately nearby. (Roads and Maritime 2018)
Light intrusion or trespass	The spilling of light beyond the boundary of the property or area being lit. (ILE 2011)
Magnitude	Magnitude is the … 'measurement of the scale, form and character of a development proposal when compared to the existing condition. In the case of visual assessment this also relates to how far the proposal is from the viewer.' (Roads and Maritime 2018)
Sensitivity	Capacity of a landscape or view to accommodate change without losing valued attributes. (AILA 2018) The sensitivity of a landscape character zone or view is 'its capacity to absorb change'. (Roads and Maritime 2018)
Sky glow	The brightening of the night sky (ILE 2011)
Values	Any aspect of landscape or views people consider to be important. Landscape and visual values may be reflected in local, state or federal planning regulations, other published documents or be established through community consultation and engagement, or as professionally assessed. (AILA 2018)
View	Any sight, prospect or field of vision as seen from a place, and may be wide or narrow, partial or full, pleasant or unattractive, distinctive or nondescript, and may include background, mid ground and/or foreground elements or features. (AILA 2018)
Viewpoint	The specific location of a view, typically used for assessment purposes. (AILA 2018)
Visual absorption capacity	The potential for the physical attributes (landform, vegetation and built form) of a scene to absorb a particular change. (AILA 2018)

Executive summary

Landscape character impacts

Northern surface works area (Arncliffe)

Landscape character zones

The landscape of the study area includes high and low density residential landscape character zones (LCZ1 Residential), several recreational areas including both open space and waterways (LCZ2 Recreation), and large areas with an infrastructure landscape character (LCZ3 Infrastructure).

The sensitivity of the residential and open space landscape character zones (LCZ1 and LCZ2) is low and moderate respectively due to the value placed on these landscape and frequency of users. The infrastructure landscape character zones (LCZ3 Infrastructure) are of low sensitivity in transport corridors where views are somewhat valued and negligible at the airport and at the New M5 Motorway temporary construction compound due to the focus on function rather than aesthetics.

Landscape character impact during construction

There would be **moderate-low landscape character impacts** at the northern surface works area (Arncliffe) during construction due to the conversion of open space to a construction ancillary facility adjacent to the New M5 motorway operations complex at Arncliffe (LCZ2c), including the installation of a substation and water treatment plant building.

Landscape character impact during operation

There would be **moderate-low landscape character impact** at the northern surface works area (Arncliffe) during operation due to the limited scope of the project in this area, and low sensitivity of the landscapes in the study area (LCZ2c). The northern part of the construction site would be converted into a Motorway Operations Centre with two additional buildings, a water treatment plant and substation, and would be consistent with the adjacent landscape character of the New M5 Motorway Operation Complex (LCZ3g). The remaining part of the site would be restored and returned to previous recreational uses.

Southern surface works area (President Avenue)

Landscape character zones

The landscape of the study area at the southern surface works area (President Avenue) includes a recreational corridor extending north-south through the centre of Rockdale including Bicentennial and Scarborough Parks (LCZ4 and LCZ9), surrounded by the low density residential landscape character zones of Kogarah and Brighton-Le-Sands (LCZ6 and LCZ5), industrial and commercial areas at the Princes Highway and along West Botany Street (LCZ7 and LCZ8).

The sensitivity of the open space landscape character zones (LCZ9 and LCZ4) are moderate as they are locally valued for a higher visual quality and include several community sporting facilities and passive recreation areas, attracting residents and visitors from across the region. The residential landscape character zones are of low sensitivity and would have some absorption capacity. The sensitivity of the Princes Highway commercial centre (LCZ7) is low as this zone has the capacity to absorb change due to its diverse built form. The West Botany Street industrial and commercial area (LCZ8) is considered to be of low sensitivity and has the capacity to absorb change due to the variety and scale of the built form.

The proposed permanent power supply corridor includes a mix of residential, open space and infrastructure character areas. This corridor is therefore of low to moderate landscape sensitivity.

Landscape character impact during construction

There would be a **high-moderate landscape character impact** on the Rockdale Bicentennial and Scarborough Parks (LCZ4). This is due to the extensive modification of the park including the removal of trees and wetlands and the loss of access to recreation facilities during construction.

There would be **low landscape character impacts** on the surrounding landscape character zones. This is because most of the proposed roadworks would occur within the open space character zone (LCZ4). Works to construct the intersection at Princes Highway and President Avenue within the Princes Highway commercial centre (LCZ7) would result in a **moderate-low landscape character impact**. This is due to the scale of the works including the removal of trees, establishment of a Construction ancillary facility (C6) and roadworks. The construction of both the Rockdale ventilation facility and MOC would be located at the West Botany Street industrial and commercial areas (LCZ8) a light industrial landscape character zone, which is of low sensitivity. There would be a **moderate-low landscape character impact** on the Muddy Creek open space (LCZ9) due to the construction of the shared pedestrian and cycle pathway and associated reduction in amenity and accessibility of the recreation areas. Construction of the proposed permanent power supply would have a **moderate-low landscape character impact** due to the sensitivity of the local streets and open spaces through which it would pass. All of these impacts would be short term and temporary.

Landscape character impact during operation

There would be **low landscape character impact** across much of the southern surface works area (President Avenue) due to the compatibility of the Rockdale ventilation facility, MOC and the President Avenue and Princes Highway intersection, with the existing landscape character, and the relatively low sensitivity of these landscape character zones. The shared pedestrian and cycle pathway would be in character with the surrounding open space and sporting field character of the Muddy Creek open space (LCZ9), resulting in a **moderate-low landscape character** impact.

There would, however, be a **high-moderate landscape character impact** experienced at the LCZ4: Rockdale Bicentennial and Scarborough Parks open space and recreation character area due to the transformation of a large section of the park at the south eastern corner into road infrastructure (including tunnel portal, entry and exit tunnels and ramps), as well as the widening and raising of President Avenue. Much of surrounding parkland would be reinstated with new tree planting, however, some areas of wetland would not be replaced. This would result in a permanent loss of access to the area of open space, passive and active and recreation opportunities.

Visual impacts

Northern surface works area (Arncliffe)

Visual impact during construction

Daytime

There would be **moderate**, **low** and **negligible visual impacts** at the northern surface works area (Arncliffe) as although there would be continued use of this area for large scale construction activity, it would be screened in views from the north by the M5 MOC. The surrounding landscape has a high visual absorption capacity and views in this area vary between moderate and negligible sensitivity.

Night time

At night there would be a **negligible visual impact** as much of the works would be contained by an acoustic enclosure and seen within a brightly lit setting.

Visual impact during operation

Daytime

There would **negligible** and **low visual impact** to views from residential and infrastructure areas to the north, east and south of the northern surface works area (Arncliffe) during operation due to the small area of additional development within the open space and consistency in character with the adjacent MOC. Views from recreational areas with the south, including the Eve Street cycleway and Kogarah Golf Course, would have **moderate-low visual impact** as most of the Arncliffe construction ancillary facility would have been restored and returned to recreational use, restoring the visual quality of these views.

Night time

At night, as there are no additional lit elements proposed by the project, there would be a **negligible visual impact**.

Southern surface works area (President Avenue)

Visual impact during construction

Daytime

There would be **high-moderate visual impacts** experienced in views from the Ilinden Sports Centre, Rockdale Bicentennial Park south, Rockdale Bicentennial Park East and President Avenue due to the high level of modification caused by the removal of trees, major earthworks, tunnelling and construction works, and moderate sensitivity of these views.

There would be a **moderate visual impact** on views from the Brighton-Le-Sands school, due to the removal of trees and scale of construction work in proximity to this location which is of moderate sensitivity.

A **moderate visual impact** would be experienced in views at the intersection of President Avenue and the Princes Highway due to the scale of the works at the intersection. From elevated locations within the high density residential building, this intersection construction work and construction ancillary facility (C6) would be seen in combination with long views along President Avenue to the raising and widening of President Avenue, construction of the President Avenue intersection, and the President Avenue construction ancillary facility (C3).

There would be a **moderate visual impact** experienced in views from West Botany Street due to works extending across the road, temporary diversion of the road, and works to construct the Rockdale ventilation facility.

There would be a **moderate-low visual impact** on views from Civic Avenue due to the removal of vegetation, earthworks, roadworks and construction of the shared pedestrian and cycle pathway bridge. This work would result in a moderate level of modification to these low sensitivity views.

A **low visual impact** would be experienced in views to the Roads and Maritime maintenance depot as despite the removal of mature vegetation within the site, these works would be visually contained and compatible with the existing predominantly light industrial setting.

Night time

Works at the President Avenue intersection with the Princes Highway and construction ancillary facility (C6) would create a moderate magnitude of change, on this setting of low sensitivity, resulting in a **moderate-low visual impact** on views from adjacent residential and residential properties.

Construction of the shared cycle and pedestrian bridge at President Avenue would result in a moderate magnitude of change to views from residential properties on Civic Avenue and southwest from properties on President Avenue. These locations are of low sensitivity, resulting in a **moderate-low visual impact**.

Areas within the Scarborough Park would not be used at night, however from the Ilinden Sports Centre and carpark, at Rockdale Bicentennial Park, there would be a moderate magnitude of change in night time views, resulting in a **moderate-low visual impact** at night.

Construction at the construction ancillary facility and ventilation facility site, and the temporary diversion of traffic from West Botany Street through Rockdale Bicentennial Park would create a moderate magnitude of change in night time views, and result in a **moderate-low visual impact** at night.

Visual impact during operation

Daytime

There would be a **high-moderate visual impact** from President Avenue and into the entry and exit ramps due to the extensive changes to these views which would be transformed from open space to an intersection and tunnel entrance.

A **moderate visual impact** would be experienced in views from Rockdale Bicentennial Park south due to the modification of landform, reduction in vegetation cover and introduction of culverts at the wetland crossing, which would alter the character of views in this location.

Views from the Ilinden Sports Centre and Rockdale Bicentennial Park East would experience **moderate-low visual impacts** due to the reinstatement of parkland and introduction of new vegetation, which would in time soften the appearance of views to the tunnel entry and exit lanes, ramps and portal. Similarly, there would be a **moderate-low visual impact** on views from the Brighton-Le-Sands school due to intervening existing and new vegetation.

Low and **moderate-low visual impacts** would be experienced in views from West Botany Street, President Avenue (including the intersection at the Princes Highway) and residential areas such as Colson Crescent and Civic Avenue. This would be due to the installation of new planting which would assist to visually integrate the project into the open space and recreational landscape setting and adjacent residential areas. The built form and massing of the Rockdale ventilation facility and Operational Motorway Control Centre would also be visually compatible with the surrounding commercial and light industrial character.

Night time

At night there would be lighting introduced at the President Avenue intersection and lighting would be upgraded along President Avenue. Although proposed planting would filter views to this light from adjacent residential properties somewhat, the project would result in a **moderate-low visual impact** in this area.

The shared pedestrian and cycle pathway would be lit, introducing lighting through open space and adjacent to residential areas between Bestic Street in the north and via a bridge over Presidents Avenue to Civic Avenue reserve in the south. This would result in a **low visual impact** in some areas along the route.

The lighting at the President Avenue intersection with the Princes Highway would result in a **low visual impact** in this area, due to the consistency of lighting with the character with the setting.

1 Introduction

The project would comprise a new multi-lane road between the New M5 Motorway at Arncliffe and President Avenue at Kogarah. The project would connect underground with the New M5 Motorway tunnel and to a new surface level intersection at President Avenue, Kogarah.

1.1 Overview of the project

Key components of the project would include:

- An underground connection to the existing stub tunnels at the New M5 Motorway at Arncliffe
- Twin motorway tunnels (around four kilometres in length) between the New M5 Motorway at Arncliffe and President Avenue, Kogarah
- A tunnel portal and entry and exit ramps connecting the tunnels to a surface intersection with President Avenue
- Intersection improvements at the President Avenue / Princes Highway intersection
- Mainline tunnel stubs to allow for connections to future stages of the F6 Extension
- Shared pedestrian and cycle pathways connecting Bestic Street, Rockdale to Civic Avenue, Kogarah via Rockdale Bicentennial Park (including an on-road cycleway)
- An Operational Motorway Control Centre to be located off West Botany Street, Rockdale
- Ancillary infrastructure and operational facilities for signage (including electronic signage), ventilation structures and systems at Rockdale, fire and safety systems, and emergency evacuation and smoke extraction infrastructure
- A proposed permanent power supply connection from the Ausgrid Canterbury sub-transmission substation
- Temporary construction ancillary facilities and temporary works to facilitate the construction of the project.

Once complete, the F6 Extension Stage 1 would improve connections and travel times between Sydney and the Princes Highway and enhance connections for residents and businesses within the broader regional area as well as promote and support economic development in areas to the south, such as Sutherland and the Illawarra.

Approval for the project is being sought under Part 5, Division 5.2 of the EP&A Act. Future stages of the F6 Extension would be subject to separate planning applications and assessments would be undertaken accordingly.

The configuration and design of the project will be further developed to take into consideration the outcomes of community and stakeholder engagement.

1.2 Project location

This project would be generally located within the Bayside local government area. The project commences about 8 kilometres south west of the Sydney central business district (CBD). The proposed President Avenue intersection would be located about 11 kilometres south east of the Sydney CBD.

1.3 Purpose of this report

This report has been prepared to support the Environmental Impact Statement (EIS) for the project. The EIS has been prepared to accompany the application for approval of the project, and addresses the environmental assessment requirements of the Planning Secretary of the Department of Planning and Environment ('the Secretary's environmental assessment requirements').

The purpose of this study is to provide a landscape and visual impact assessment of the project, including:

- An assessment of landscape character impacts during construction and operation
- An assessment of visual impacts during construction and operation, day and night
- A cumulative impact assessment, to consider the project in conjunction with other relevant projects
- Preparation of measures to manage the impact of the project, during construction and operation.

1.4 SEARs and Agency comments

Table 1-1 SEARs – Placemaking and Urban Design

SEARs	Where addressed in this report
7. Place Making and Urban Design	
3. The Proponent must assess the visual and landscape impacts of the proposal, including ancillary infrastructure on:	
(a) views and vistas;	Potential visual and landscape impacts to views and vistas are assessed in section 7 and section 8
(b) streetscapes, key sites and buildings;	Potential visual and landscape impacts to streetscapes, key sites and buildings are assessed in section 6, section 7 and section 8
(c) landscaping, green spaces, wetlands and existing trees and tree canopy, including an assessment of likely magnitude of impacts to trees and need for removal to be undertaken by an arborist, including the provision of measures to minimise and offset impacts;	Potential visual and landscape impacts to landscaping, green spaces, wetlands, existing trees and tree canopy are assessed in section 6, an Arborist report is found in Annexure A provides details of the magnitude of impact and the provision of mitigation measures. Arboricultural Assessment.
(d) heritage items including Aboriginal places, environmental heritage; and areas of heritage sensitivity; and	Potential visual and landscape impacts on the setting and views to and from heritage items and conservation areas are considered in section 6, section 7 and section 8. Potential impacts to heritage items are assessed in Appendix N (Statement of heritage impact).
(e) the local community.	Potential visual and landscape impacts to the local community are assessed in section 6 and section 7
4. The Proponent must provide visual representations of the proposal from key receiver locations to illustrate the proposal and its visual impacts.	Visual representations of the proposal from key receptor locations are provided in section 8

1.5 Structure of this report

This structure of this report is as follows:

- Policy and planning setting
- Landscape character impact assessment
- Visibility of the project
- Visual impact assessment
- Assessment of cumulative impacts
- Management of impacts
- Conclusion.

Annexure A provides an assessment of the proposed tree removal for the project. Annexure B provides an assessment of overshadowing.

2 The Project

2.1 Project features

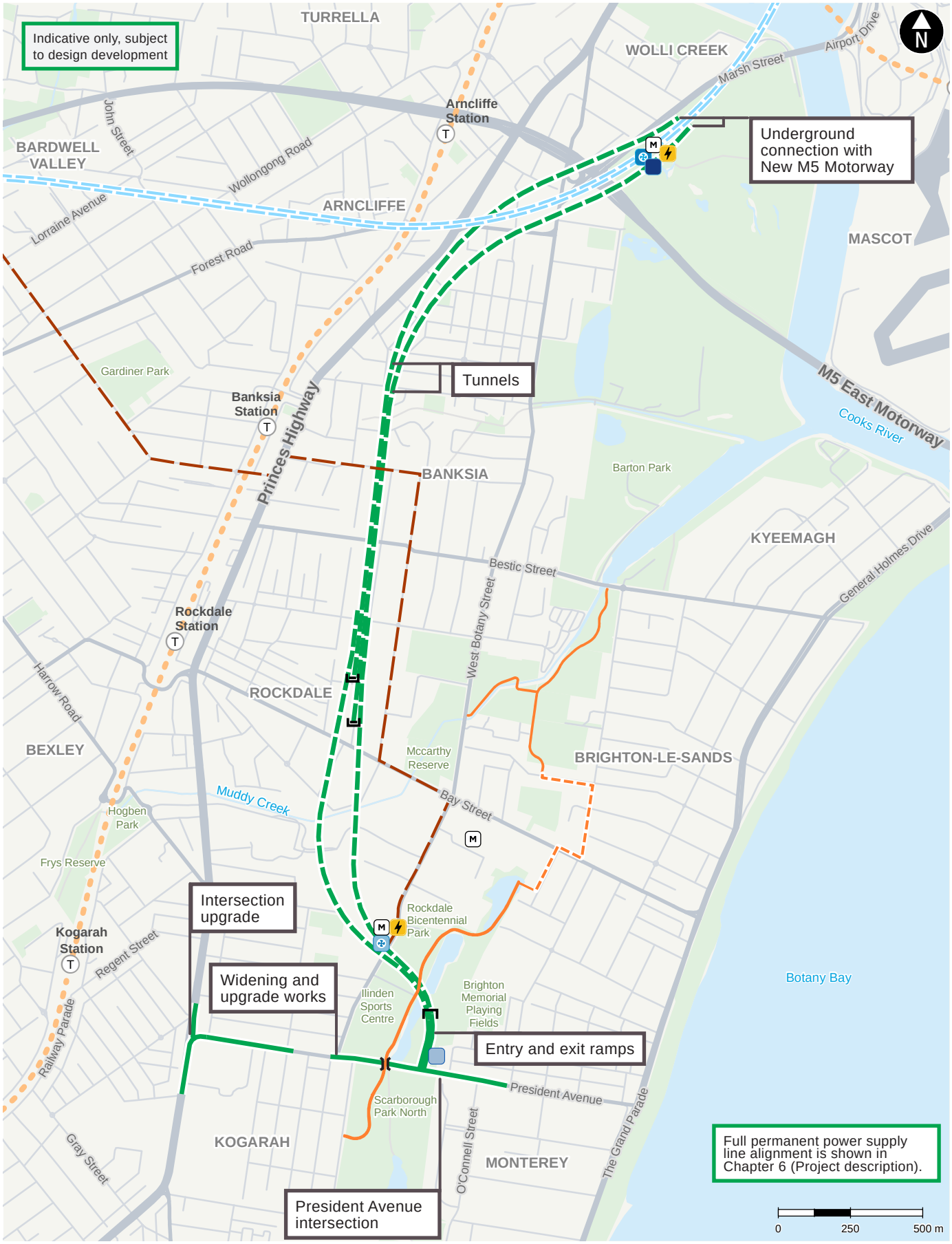
The project would comprise a new multi-lane underground road link between the New M5 Motorway and a surface intersection at President Avenue, Kogarah.

Key components of the project would include:

- Twin mainline tunnels. Each mainline tunnel would be around 2.5 kilometres in length, sized for three lanes of traffic, and line marked for two lanes as part of the project
- A tunnel-to-tunnel connection to the New M5 Motorway southern extension stub tunnels, including line marking of the New M5 Motorway tunnels from St Peters interchange to the New M5 Motorway stub-tunnels
- Entry and exit ramp tunnels about 1.5 kilometres long (making the tunnel four kilometres in length overall) and a tunnel portal connecting the mainline tunnels to the President Avenue intersection
- An intersection with President Avenue including entry and exit ramps and the widening and raising of President Avenue
- Upgrade of the President Avenue / Princes Highway intersection to improve intersection capacity
- Shared cycle and pedestrian pathways connecting Bestic Street, Brighton-Le-Sands to Civic Avenue, Kogarah (including an on-road cycleways)
- Three motorway operation complexes:
  - Arncliffe, including a water treatment plant, substation and fitout (mechanical and electrical) of a ventilation facility currently being constructed as part of the New M5 Motorway project
  - Rockdale (north), including a motorway control centre, deluge tanks, a workshop and an office
  - Rockdale (south), including a ventilation facility, substation and power supply.
- Reinstatement of Rockdale Bicentennial Park and recreational facilities
- In-tunnel ventilation systems including jet fans and ventilation ducts connecting to the ventilation facilities
- Drainage infrastructure to collect surface water and groundwater inflows for treatment
- Ancillary infrastructure for electronic tolling, traffic control and signage (both static and electronic signage)
- Emergency access and evacuation facilities (including pedestrian and vehicular cross and long passages); and fire and life safety systems
- New service utilities, and modifications and connections to existing service utilities
- A proposed permanent power supply connection from the Ausgrid Canterbury sub-transmission substation, to Rockdale Motorway Operations Complex south.

The project does not include ongoing motorway maintenance activities during operation or future upgrades to other intersections in the vicinity during operation. These works are permitted under separate existing approvals and are subject to separate assessment and approval in accordance with the EP&A Act.

The key features of the project are shown on **Figure 2-1**.



LEGEND

- The project in tunnel
- The project on surface
- On-road cycleway
- Shared cycle and pedestrian pathways
- President Avenue shared cycle and pedestrian bridge
- Tunnel stub
- Tunnel portal
- Water quality basin
- Water treatment facility
- Rockdale ventilation facility
- Motorway operations complex
- Substation
- Permanent power supply line
- New M5 Tunnel
- Arncliffe ventilation facility*
- * Under construction as part of the New M5 Motorway project
- Road
- Waterway
- Railway line
- Railway station
- Parks and recreation

Figure 2-1 Project features

2.2 Construction

2.2.1 Construction activities

The proposed construction activities for the project would include:

- Preparatory investigations
- Site establishment and enabling work
- Tunnelling
- Surface earthworks and structures
- Construction of motorway operations complexes
- Drainage and construction of operational water management infrastructure
- Construction of the permanent power supply connection
- Road pavement works
- Finishing works.

These activities would be undertaken within the construction boundary discussed in **section 2.2.2**, which includes the following six construction ancillary facilities:

- Arncliffe construction ancillary facility (C1) at Arncliffe, within the Kogarah Golf Course currently being used for the construction of the New M5 Motorway
- Rockdale construction ancillary facility (C2) at Rockdale, within a Roads and Maritime depot at West Botany Street
- President Avenue construction ancillary facility (C3) at Rockdale, north and south of President Avenue within Rockdale Bicentennial Park and part of Scarborough Park North, and a site west of West Botany Street
- Shared cycle and pedestrian pathways construction ancillary facilities (C4 and C5) at Brighton-le-Sands, within the recreation area between West Botany Street and Francis Avenue, near Muddy Creek
- Princes Highway construction ancillary facility (C6), on the north-east corner of the President Avenue and Princes Highway intersection.

2.2.2 Construction boundary

The area required for project construction is referred to as the ‘construction boundary’. This comprises the construction works area and construction ancillary facilities. In addition, utility works to support the project would occur within and outside the construction boundary. The construction boundary and locations of construction ancillary facilities are shown in **Figure 2-2**.

C1

- Tunnelling and spoil handling
- Construction of MOC1 (Water treatment plant, substation)
- Fitout, testing and commissioning of tunnels and MOC 1

C2

- Construction of the decline tunnel
- Tunnelling and spoil handling
- Pavement works for internal access road
- Construction of MOC2
- Reconfiguration of the site to enable ongoing/future use for maintenance activities

C3

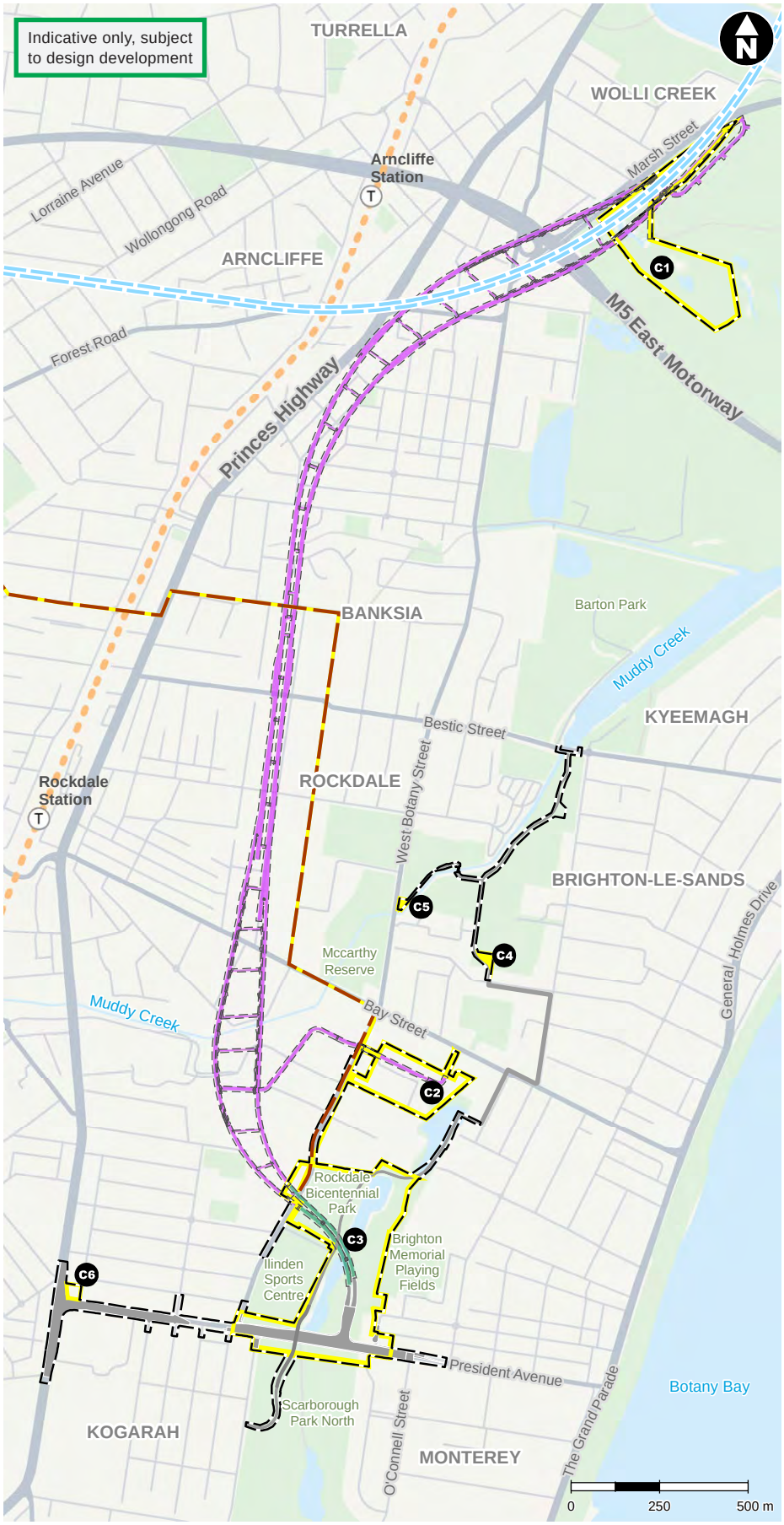
- Demolition of buildings and vegetation clearing and removal
- Relocation of utilities
- Temporary stockpiling of spoil and fill materials
- Management of any contaminated land, including acid sulphate soils
- Construction of cut-and-cover structures
- Construction of MOC3 (Rockdale ventilation facility and substation)
- President Avenue intersection upgrade works
- Construction of shared pedestrian and cyclist path and overpass

C4/C5

- Site establishment
- Vegetation clearing and removal, topsoil stripping areas and land-form shaping
- Temporary stockpiling of materials
- Construction of the shared pedestrian and cyclist path
- Finishing works including lighting, line marking and signage installation

C6

- Property adjustment and demolition
- Relocation of utilities, stormwater infrastructure, underground storage tanks and substation
- Laydown and parking of construction vehicles and equipment
- Reinstatement of site



LEGEND

- Surface works
- Construction boundary
- Cut-and-cover structures
- Underground construction
- Construction ancillary facility
- Permanent power supply line
- Permanent power supply construction route
- New M5 Tunnel
- Road
- Waterway
- Railway line
- Railway station
- Parks and recreation

Figure 2-2 Overview of construction boundary and ancillary features

2.3 Construction program

The project would be constructed over a period expected to be around four years, including commissioning which would occur concurrently with the final stages of construction (refer to **Figure 2-3**).

The project is expected to be completed towards the end of 2024.

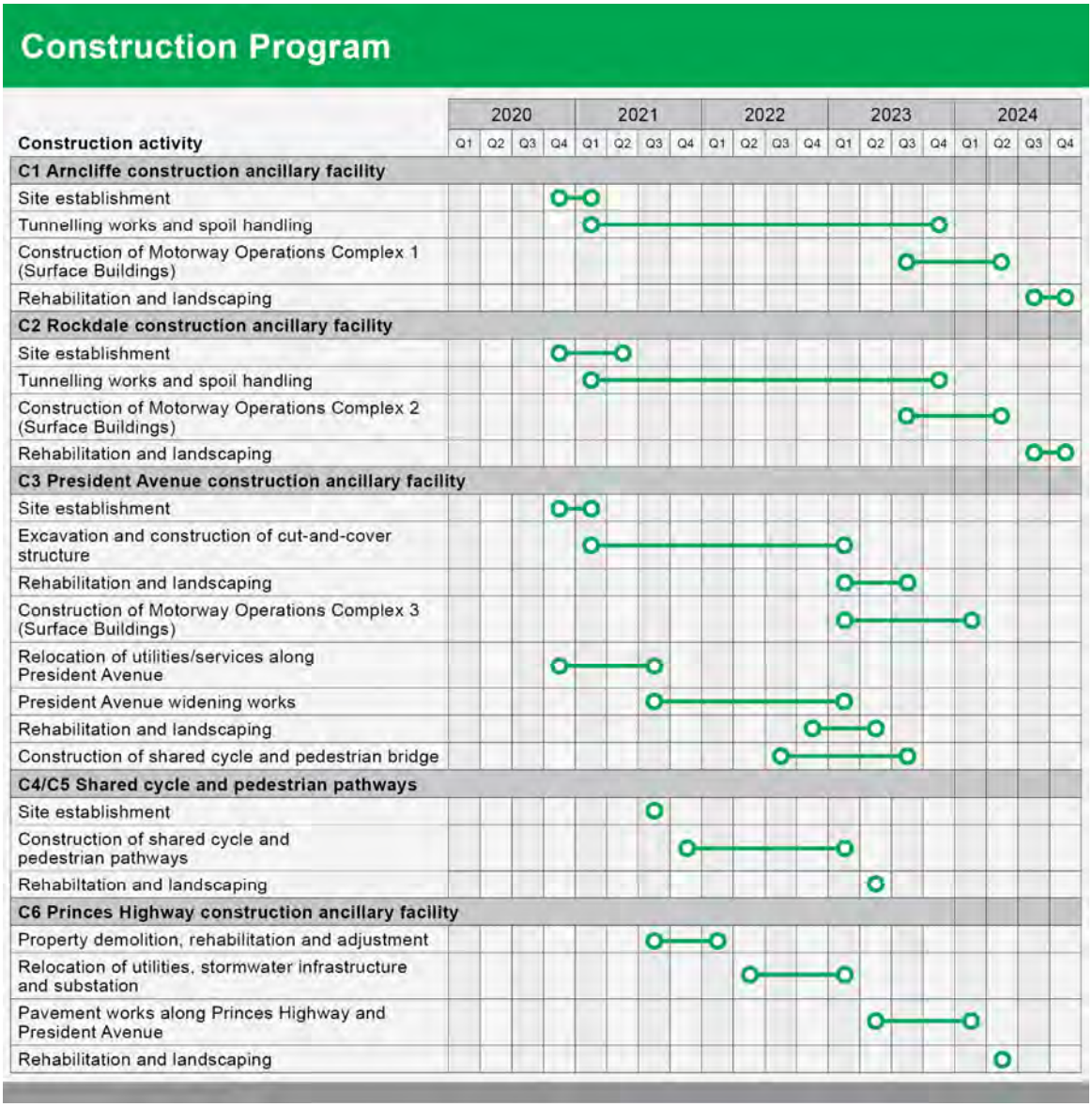


Figure 2-3 Indicative construction program

3 Urban Design

The Place Making and Urban Design Strategy (AECOM 2018), documents the urban design process, design principles and proposed design treatments for the project. The following section summarises the key features of the design, as identified within this report, including design principles for the project and the corridor, landscape and vent facility design.

3.1 Design objectives

The urban design objectives have been adopted from the '*WestConnex Urban Design Framework'* and modified to suit the contextual environment of the proposed F6 Extension Stage 1. To further strengthen this, '*Beyond the Pavement – Urban design policy, procedures and design principles*' (Roads and Maritime, 2014) underpins the urban design objectives for the project and is integral to the urban design outcome.

To ensure an integrated 'whole of corridor' response with the surrounding environment the following urban design objectives have been developed to govern the project outcomes:

- Leading edge environmental responsiveness
- Connectivity, accessibility and legibility
- Place making
- Urban renewal and liveability
- Memorable identity and a safe, enjoyable experience
- A new quality benchmark.

3.2 Project elements

The landscape and visual impact assessment considers issues relating to both the construction and operation of the project. Key project design elements include:

- Construction ancillary facilities
- President Avenue intersection
- Tunnel Portal, entry and exit ramps
- Rockdale Bicentennial Park
- Shared pedestrian and cycle pathways
- Princes Highway and President Avenue intersection
- The substation and water treatment plant to be constructed for the project at Arncliffe Motorway Operations Complex (MOC1)
- Rockdale ventilation facility (south) within Rockdale Motorway Operations Complex (south) (MOC3).

3.2.1 Construction worksite and ancillary facilities

Construction ancillary facilities would be established along the alignment, extending across the area required for the project elements and all enabling works. This would include services relocations and intersection reconfigurations. Work would progress in sections along roadways, and may require works to be split so that access can be maintained.

Elements seen at construction worksites would typically include:

- Traffic management
- Site perimeter hoardings or security fencing
- Demolition works including the removal of buildings and trees
- Equipment including cranes and excavators
- Ground and tunneling preparations
- Works to relocate services
- Road surfacing and realignment of kerbs and drainage
- Formation of entry and exit ramps, installation of tunnel portals, intersection fit-out including signage and signaling equipment.

Temporary construction ancillary facilities would be required to support the worksite activities, these would include:

- Site perimeter hoardings and / or security fencing
- Site office, amenities, workshops, and plant (such as water treatment, concrete and asphalt batching plants)
- Laydown, material and plant storage areas
- Cranes and heavy equipment
- Heavy vehicle access for deliveries and haulage.

3.2.2 President Avenue intersection

President Avenue is the primary access to the project from the south. The key urban design measures that would be integrated with the President Avenue intersection include:

- Re-establishment of a strong landscape character to provide an entry ‘gateway’ and visual hierarchy to the motorway entrance
- Raising the road on embankment for flood protection between West Botany Street and O’Connell Street
- Landscape treatment at the intersection and along President Avenue to integrate with adjacent open space, including turf verges, native grass and ground cover planting to the batters, and street tree planting to provide shade and amenity along the pathways and provide a tree-lined boulevard effect along President Avenue
- Improved pedestrian connectivity along both sides of President Avenue with a continuous pedestrian pathway on the north side and widened pedestrian pathway and signalised crossing on the south side.

3.2.3 Tunnel portal, entry and exit ramps

The project entry and exit ramps and portal would be the first experience of the project when approaching from the south. The urban design intent for the tunnel portal would be to provide a simple portal element that is integrated with the entry and exit ramps components. Given the landscape context is organic in its nature, the portal structure would also mimic this form as a ribbon extending from the entry and exit ramps components and into the landscape setting beyond, before folding back and returning on the other side.

To offset some of the vegetation to be removed at Rockdale Bicentennial Park, the area surrounding the tunnel portal and entry and exit ramps would be planted with a variety of low, mid and canopy vegetation reflective of the adjacent wetlands and recreational open space landscape plantings.

3.2.4 Rockdale Bicentennial Park

Upon completion of the project, the following features would be visible at Rockdale Bicentennial Park:

- Supplementary tree and shrub planting to screen the motorway entry and to integrate with adjacent interfaces
- A rebuilt section of the existing wetland within Rockdale Bicentennial Park (part of Rockdale Wetlands)
- Reinstatement of key active recreational facilities impacted by the works, including the playground and skate park, with similar (like for like) facilities
- Improved pedestrian circulation, connectivity and lighting associated with the playing fields
- Improved pedestrian circulation, including temporary and permanent bridging structure across the wetland within Rockdale Bicentennial Park
- Replacement of the playground and skate park at Rockdale Bicentennial Park North
- Provision for additional recreational and furniture amenity including seating, bin enclosures, bicycle racks, shelters and drinking fountains.

Refer to **Figure 3-1** for the landscape plan at Rockdale Bicentennial Park.

3.2.5 Shared pedestrian and cycle pathway

A shared pedestrian and cycle pathway would improve north to south connectivity between the existing cycleway north of Bestic Street and President Avenue. The link would provide a safe and direct connection across President Avenue and provide opportunity for east to west pedestrian and cycleway linkages between Rockdale and Kogarah train stations, and the Botany Bay foreshore.

Refer to **Figure 3-1** for the location of the shared pedestrian and cycle pathway in the southern surface works areas.

Figure 3-1 Indicative landscape concept master plan at Rockdale Bicentennial Park

3.2.6 Princes Highway and President Avenue intersection

To facilitate increased traffic volumes onto President Avenue from Princes Highway, this intersection would be widened, including an additional right-turn lane northbound on the Princes Highway and an additional left turn lane southbound. These works would require the full acquisition of a property (service station), the partial acquisition of four properties (St George TAFE and three multi-unit dwellings) as well as removal of existing vegetation along President Avenue.

The design of the President Avenue and Princes Highway intersection has included provision for reinstated pedestrian paths and replacement street trees.

3.2.7 Ventilation facility

The key operational elements required for the project would include the Rockdale ventilation facility and other infrastructure at West Botany Street, within MOC3. The Rockdale ventilation facility would be visually prominent within the landscape, particularly when viewed from Rockdale Bicentennial Park (west of the wetland) and along West Botany Street. The location of the ventilation outlet and associated facilities in the Rockdale industrial area should drive the materiality, colours and built form to ensure it is integrated with the surrounding context.

The key design principles for the Rockdale ventilation facility include:

- Articulation of the built form along West Botany Street to maximise opportunities for screen and buffer planting, and to break up the building mass
- Visual appearance and materiality of the ventilation outlet is to reflect built form elements of the surrounding urban character
- Coordination of all MOC structures including, associated buildings (substations and disaster recovery structures), parking facilities, site landscape works and response to urban setting
- Improved maintenance access into the compound from West Botany Street
- Community perception of the ventilation outlet within visual proximity to residential areas.

3.3 Landscape character and visual mitigation strategy

There are several mitigation measures which have been incorporated into the design in response to the landscape and visual conditions of the site.

Siting and layout:

- The F6 Extension Stage 1 tunnel has been located to avoid the Kings Wetland and Ilinden Sports Centre.
- The F6 Extension Stage 1 tunnel has been located to maximise the future functionality of the Brighton Memorial Playing Fields and remaining areas of the Rockdale Bicentennial Park.
- The President Avenue overpass has been located to maximise connectivity with the broader circulation network and to allow for extension during future stages of the project.

Landform considerations:

- All earthwork formations would be gently rounded out at both top and bottom of slopes, and at the end of each formation, in order to achieve a ‘natural’ transition into adjacent landforms.
- The earthworks to raise President Avenue would have maximum slopes of 1:4 to visually integrate this level change with the surrounding open space.

Structure design and treatment:

- The visual appearance and materiality of the ventilation facility would reflect built form elements of the surrounding urban character.
- The design of the President Avenue shared pedestrian and cycle bridge would be developed through collaboration between the engineer and urban designer from the outset, to ensure a coordinated and visually integrated outcome. The design would present smooth, clean lines with minimum structural depth consistent with their spans, and complement the surrounding built-form and natural environment. Urban design elements including throw screens, lighting and fencing shall all be considered as part of the overall composition and form, with a view to developing a

slender, symmetrical, visually uncluttered and well-ordered profile. Signage requirements should be kept to a minimum.

- The tunnel portal would be minimal in form and embellishment and would work in unison with the surrounding landscape setting.

Landscape treatments:

- Supplementary tree planting and screening would be provided along President Avenue to offset the tree removal and to re-establish a visual screen along the corridor
- The area surrounding the tunnel portal and entry and exit ramps would be planted with a variety of low, mid and canopy vegetation reflective of the adjacent wetlands and recreational open space species
- A section of the existing wetland within Rockdale Bicentennial Park (part Rockdale Wetlands) would be rebuilt at completion of the project works to restore this landscape
- Key active recreational facilities impacted by the works, in particular the sporting facilities, playground and skate park, would be reinstated to maintain the level of amenity.

4 Assessment methodology

4.1 Relevant guidelines and policies

The methodology used for this assessment is outlined below. This methodology is consistent with the *Roads and Maritime Services Guidance note EIA-N04 Guideline for Landscape Character and Visual Impact Assessment*, 2018.

In addition to this guide, the assessment draws upon the AILA Guidance Note for Landscape and Visual Assessment, prepared by the Australian Institute of Landscape Architects (2018); and the night time visual assessment draws upon guidance offered in the: Institution of Lighting Engineers (UK) and the *Guidance Notes for the reduction of obtrusive light* (2011), and *AS4282 Control of the obtrusive effects of outdoor lighting* (1997).

Figure 4-1 Environmental Impact Assessment Practice Note, Guideline for Landscape Character and Visual Impact Assessment (EIA-N04)

4.2 Key assumptions

The following key assumptions were made in the course of undertaking this study:

- The night-time assessment is based on assumptions from daytime field work. The extent of lighting was noted during daytime site visits and will enable adequate assumptions to be made to determine night time character.

4.3 Methodology

The landscape and visual impact assessment of the project includes:

- identification of the existing environmental conditions
- a review of the relevant policy and planning setting
- identification of landscape character zones and areas that experience views of the project
- an assessment of landscape character impact during construction and operation
- an assessment of the daytime visual impact during construction and operation
- an assessment of night-time visual impact during construction and operation
- identification of mitigation measures.

4.3.1 Policy and planning setting

The policy and planning setting for the study area has been outlined by identifying relevant clauses from applicable legislation that recognise the value of the landscape and visual conditions of the study area. This includes both state and local government planning guidance for the landscape and visual values of the study area. Additionally, where master plans and guidance documents identify the ambitions for the study area, the relevant clauses have been recorded and their relevance to this assessment explained.

4.3.2 Landscape character assessment

Landscape refers to '*all aspects of a tract of land, including landform, vegetation, buildings, villages, towns, cities and infrastructure*.' (Roads and Maritime 2018) Landscape character is the … '*combined quality of built, natural and cultural aspects that make up an area and provide its unique sense of place*' (Roads and Maritime 2018).

A range of landscape character zones could be directly or indirectly affected by the project. To address these impacts, an assessment was carried out by identifying the landscape character zones across the study area and correlating their sensitivity and the likely magnitude of change expected as a result of the project. This correlation provides an overall assessment of the level of landscape character impact.

Identification of landscape character zones

A Landscape Character Zone is … '*An area of landscape with similar properties or strongly defined spatial qualities, distinct from areas immediately nearby'*. (Roads and Maritime 2018) Landscape character zones have been identified for each surface works area.

The existing landscape character has been described in terms of the key landscape features of the study area. Site visits were undertaken and the existing character, landscape, public realm elements and views were recorded through observations and photographs.

Where relevant, the future character and conditions of the study area have been anticipated. In some cases, future projects are expected to redefine land use, development density and the character of the study area. This includes projects which are under construction and projects with development approval. The intent of master plans and precinct strategies for these projects has also been considered in the baseline condition, where there is a level of certainty that these plans will be implemented.

Landscape sensitivity

Landscape sensitivity is the capacity of a landscape *'to accommodate change without losing valued attributes'*. (AILA 2018) In relation to landscape character, it is the zone's *'capacity to absorb change.'* (Roads and Maritime 2018) The sensitivity of a landscape may reflect the frequency and volume of users in a location, but also reflects other characteristics such as tranquillity, diversity and rarity. The value of landscapes is often described in council and state government master plans and planning guidance documents, reflecting the importance of landscapes to the local, regional and state-wide community. **Table 4-1** lists the terminology that has been used to describe landscape sensitivity, these levels are based on the definitions in the Roads and Maritime Guidance note EIA-N04 Guideline for Landscape Character and Visual Impact Assessment, (2018).

Table 4-1 Landscape sensitivity levels

Landscape sensitivity	Description
High	Landscape zone protected with national or international legislation and / or Does not have the capacity to absorb change without detracting from its valued characteristics.
Moderate	Landscape zone that is heavily used and valued by residents of a major portion of a city or a non-metropolitan region and / or Has some capacity to absorb change without detracting from its valued characteristics. e.g. Rockdale Bicentennial Park and Scarborough Park.
Low	Landscape zone valued and experienced by residents and/or local recreational users and / or Has a moderate capacity to absorb change without detracting from its valued characteristics. e.g. High density residential areas, Kogarah Golf Course and main roads.
Negligible	Landscape zone not greatly valued for its landscape attributes e.g. industrial areas Has a high capacity to absorb change without detracting from its valued characteristics. e.g. industrials areas of Kogarah and Sydney Airport.

Magnitude of change

Magnitude is the '*measurement of the scale, form and character of a development proposal when compared to the existing condition*' (Roads and Maritime 2018). The magnitude of change expected in each landscape zone as a result of the project has been identified. This includes direct impacts such as the removal of trees or parkland, as well as indirect impacts, such as the change in character and functional change of an area of open space due to changing land use and access.

Table 4-2 lists the terminology used to describe the magnitude of change.

Table 4-2 Magnitude of landscape character change

Magnitude	Description
High	A substantial portion of the landscape zone is changed. This may include considerable alteration to the valued attributes of the landscape character zone.
Moderate	A moderate portion of the landscape zone is changed. This may include noticeable alteration to the valued attributes of the landscape character zone.
Low	A minor portion of the landscape zone is changed. This may include slight alteration to the valued attributes of the landscape character zone.
Negligible	Either the landscape zone is unchanged or if it is, it is largely mitigated by proposed character improvements. Does not alter or not noticeably alter the valued attributes of the landscape character zone.

4.3.3 Visual impact assessment

This assessment has addressed the potential impact on views by using a viewpoint assessment. This approach uses selected views to represent the range of views to the site. For each view, the sensitivity, and magnitude of change was identified. These factors were then correlated to arrive at an overall assessment of the level of visual impact.

Visibility of the project

The potential visibility of the project was identified by using aerial photography and topographic data combined with the likely height and area covered by the project. A visual envelope map was produced to illustrate the area identified. This envelope takes into consideration built form, but does not include the screening effect of vegetation. It is therefore used to inform field investigations and representative viewpoints were identified from within this area.

Identification of representative viewpoints

A number of viewpoints were selected to illustrate the potential views to the site. These represent publicly accessible viewpoints from a range of locations and viewing situations. Particular attention was paid to views from places where people are expected to congregate such as parks, recreation areas, public transport routes and commercial areas, as well as views to and from heritage places.

Visual sensitivity

Visual sensitivity is the capacity of a view *'to accommodate change without losing valued attributes'*. (AILA 2018) Roads and Maritime describe sensitivity as the … *'capacity to absorb change.'* (Roads and Maritime 2018). Visual absorption capacity is a concept which is used to describe the potential for a view to absorb a particular change without a noticeable loss of valued attributes'. (AILA 2018). The frequency, nature and duration of views influence the capacity for a view to accommodate change. Furthermore, views recognised by local, state or federal planning regulations would, by nature of their recognition in these documents, have an increased sensitivity. **Table 4-4** describes the visual sensitivity levels that were used in this assessment.

Table 4-3 Visual sensitivity levels

Visual sensitivity	Description
High	High quality or heavily experienced view to a feature or landscape that is iconic to a major portion of a city or region, or an important view from an area of regional open space.
Moderate	View of high quality or experienced by concentrations of residents and/or local recreational users. e.g. view along Eve Street cycleway, view to heritage-listed Kings Wetlands in Rockdale Bicentennial Park or Patmore Swamp in Scarborough Park.
Low	Views where visual amenity is important at a neighbourhood scale, such as views along suburban streets, views seen from local roads (e.g. President Avenue), briefly glimpsed views to landscape features, and views from small groups of residences.
Negligible	Views where visual amenity is not particularly valued by the wider community e.g. industrial areas of Kogarah.

Magnitude of visual change

Magnitude is the '*measurement of the scale, form and character of a development proposal when compared to the existing condition. In the case of visual assessment this also relates to how far the proposal is from the viewer*.' (Roads and Maritime 2018)

Magnitude of visual change describes the extent of change resulting from the project and the compatibility of these new elements with the surrounding landscape. There are some general principles which contribute to the magnitude of visual change which include elements relating to the existing view itself such as distance, landform, backdrop, enclosure and contrast. There are also characteristics of the project, such as scale, form, line and alignment.

In some circumstances, there may be a change to a view which does not alter the amenity of the view. This would be due to the visual absorption capacity of the surrounding landscape and/or the compatibility of the project with the surrounding visual context. **Table 4-4** lists the terminology used to describe the magnitude of visual change.

Table 4-4 Magnitude of visual change

Magnitude of visual change	Description
High	Substantial part of the view is altered. The project contrasts substantially with surrounding landscape.
Moderate	Alteration to the view is clearly visible. The project contrasts with surrounding landscape.
Low	Either there is a minor portion of the view changed and / or the project component visible is visually compatible with the existing setting or somewhat mitigated by proposed urban design improvements.
Negligible	Either the view is unchanged or if it is, the change in the view is generally unlikely to be perceived by viewers. The project does not contrast with the surrounding landscape.

4.3.4 Assessment of night time visual impact

The assessment of night-time visual impact has been carried out by applying a similar methodology to the daytime assessment. The night-time assessment does however draw upon the guidance of the Institution of Lighting Engineers (UK) and the *Guidance Notes for the reduction of obtrusive light* (2011), as well as *AS4282 Control of the obtrusive effects of outdoor lighting* (1997).

AS4282 identifies three potential effects of lighting, including:

- *"Changes to the amenity of an area due to the intrusion of spill light into otherwise dark areas, both outdoors and indoors, and to the direct view of bright luminaires.*
- *A reduction in the ability of transport system users to see essential details of the route ahead, including signalling systems, due to glare from bright luminaires.*
- *Changes to night-time viewing conditions due to a general luminous glow, i.e. sky glow, caused by the scattering of light in the atmosphere."*

This assessment addresses the first of these potential effects - changes to the amenity of an area, with a focus on the outdoors. AS4282 also notes the potential visual intrusion caused by the daytime appearance of outdoor lighting systems. This potential impact has also been addressed in the daytime assessment.

The guidance from the Institution of Lighting Engineers (ILE) identifies environmental zones, useful for the categorising of night-time landscape settings. These environmental zones range from E0: Dark landscapes, to E4: High district brightness areas. This broader approach to the assessment of obtrusive light is consistent with the detail available at a planning approval application stage of the project and is therefore the basis for the method applied to the night-time visual assessment contained within this report.

This guidance document defines the typical features of these environmental zones at night, including sky glow, glare and light trespass. The method for night-time visual assessment is outlined in the following sections.

Night time visual sensitivity

A night time sensitivity level has been allocated for the northern and southern surface works areas. The sensitivity of the night time setting reflects the predominant light levels of each area. The night time visual sensitivity levels have been developed from the *Guidance Notes for the Reduction of Obtrusive Light* (ILE 2011) and are described in **Table 4-5**.

Table 4-5 Visual sensitivity levels – night time

Visual sensitivity	Description
High	E0: Dark and E1: Intrinsically dark landscapes Very high sensitivity visual settings at night including UNESCO Starlight Reserves, National parks, State forests etc.
Moderate	E2: Low district brightness areas Highly sensitive visual settings at night including rural, small village, or relatively dark urban locations.
Low	E3: Medium district brightness areas Moderately sensitive visual settings at night including small town centres or urban locations.
Negligible	E4: High district brightness areas Low sensitivity visual settings at night including town/city centres with high levels of night time activity.

Magnitude of visual change at night

Following the sensitivity assessment, the magnitude of visual change that would be expected within the study area was then identified. These changes are described, as relevant, in terms of:

- *Sky glow – the brightening of the night sky.*
- *Glare – the uncomfortable brightness of a light source when viewed against a darker background.*
- *Light intrusion or 'trespass' – the spilling of light beyond the boundary of the property or area being lit.* (ILE 2011)

Table 4-6 lists the terminology used to describe the magnitude of visual change at night.

Table 4-6 Magnitude of visual change at night

Magnitude of visual change	Description
High	Substantial change to the level of sky glow, glare or light trespass would be expected. The lighting of the project contrasts substantially with surrounding landscape at night.
Moderate	Alteration to the level of sky glow, glare or light trespass would be clearly visible. The lighting of the project contrasts with surrounding landscape at night.
Low	Minor change to the level of sky glow, glare or light trespass. Minimal contrast with the surrounding landscape at night.
Negligible	Either the level of sky glow, glare and light trespass is unchanged or if it is altered, the change is generally unlikely to be perceived by viewers. The project does not contrast with the surrounding landscape at night.

4.3.5 Assigning impact levels

An assessment of landscape and visual impact has been made by combining the sensitivity and magnitude of change for the landscape character zone or viewpoint and assigning an impact level. **Table 4-7** shows the landscape and visual impact level matrix. This matrix has been drawn from the Roads and Maritime Guidance note EIA-N04 Guideline for Landscape Character and Visual Impact Assessment, (2018).

Table 4-7 Landscape and day time visual impact levels

	Sensitivity level			
Magnitude of change	**High**	**Moderate**	**Low**	**Negligible**
High	High	High-moderate	Moderate	Negligible
Moderate	High-moderate	Moderate	Moderate-low	Negligible
Low	Moderate	Moderate-low	Low	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible

Assessment of night time visual impact has been made by combining the visual sensitivity and magnitude of change to assign an impact level. **Table 4-8** shows the night time visual impact level matrix.

Table 4-8 Night time visual impact levels

	Sensitivity level			
Magnitude of change	**High**	**Moderate**	**Low**	**Negligible**
High	High	High-moderate	Moderate	Negligible
Moderate	High-moderate	Moderate	Moderate-low	Negligible
Low	Moderate	Moderate-low	Low	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible

4.3.6 Mitigation measures

Following the assessment of landscape and visual impact, specific measures to further eliminate, reduce and manage potential impacts were identified. These measures are in addition to the Landscape Character and Visual Mitigation Strategy which has been developed throughout the design of the project, and is detailed in **section 3.3** of this report, and further illustrated in the Place making and urban design strategy (Annexure A of **Appendix B** (Place making and urban design).

5 Policy and planning setting

The planning and policy setting for the project and its potential landscape and visual impacts is based on the regional and local planning documents discussed below.

5.1 State and regional planning context

5.1.1 Cooks Cove Precinct

The Cooks Cove Precinct has been considered for redevelopment for recreational, employment and residential uses since 2004. In August 2014, UrbanGrowth NSW began working with Bayside Council and the NSW Department of Planning and Environment (DPE) to determine a planning pathway for Cooks Cove. DPE has recently released a Land Use and Infrastructure Plan (LUIP) for Bayside West (Arncliffe, Banksia and Cooks Cove).

Located in Arncliffe, the Cooks Cove Precinct is a 135 hectare precinct of green space, bound by Marsh Street to the north and north west, Cooks River and Sydney Kingsford Smith Airport to the east, West Botany Street to the west, and Bestic Street to the south. The precinct is predominately characterised by open space, including Kogarah Golf Club, Barton Park and St George Stadium. There are four wetland areas within the precinct, which form part of the Rockdale Wetlands corridor.

The LUIP identifies the northern portion of the Cooks Cove Precinct (north of the M5 East Motorway), as suitable for up to 20 ha of mixed use and residential development (DPE 2016a, p.25). The remainder of the precinct would provide for open space, recreational uses and environmental protection areas, including the relocation of Kogarah Golf Club.

Until the LUIP is produced, a future planning proposal for land within the Cooks Cove Precinct would need to be consistent with the recommendations of the *Bayside West Precincts 2036 Plan – Arncliffe, Banksia and Cooks Cove* (DP&E 2018) and provisions of the *Sydney Regional Environment Plan No 33 – Cooks Cove* (SREP 33).

5.1.2 Greater Sydney Regional Plan: A Metropolis of Three Cities, 2018

This plan (Greater Sydney Commission, 2018b) sets a 40-year vision (to 2056) and establishes a 20-year plan to manage growth and change for Greater Sydney in the context of social, economic and environmental matters. It divides Greater Sydney into three regions, including the 'Western Parkland City' (including Penrith, Western Sydney Airport– Badgerys Creek Aerotropolis and Campbelltown – Macarthur), the 'Central River City' (including Greater Parramatta) and the 'Eastern Harbour City' centred around Sydney CBD (p.6).

The role of this plan is to co-ordinate a whole-of-government approach to provide the appropriate infrastructure in the right places to support the growth of three cities. The proposed F6 Extension project is located in the Eastern City district, within the Eastern Harbour City region. Kogarah is identified as a '*Health and Education Precinct*' (p.13), associated with the St George Hospital. Sydney Airport is a '*Trade Gateway*' (p.13), with land to the west and southwest of the airport (Bayside West Precinct) identified as an '*Urban Renewal Area*' (p.65).

The region's '*green infrastructure*' including '*urban tree canopy, green ground cover, bushland, waterways, parks and open spaces*' (p.6) are valued assets in Greater Sydney. A target has been set to '*increase tree canopy cover to 40 per cent, up from the current 23 per cent*' (Strategy 30.1, p.164). Strategy 25.1 aims to '*protect environmentally sensitive areas of waterways*' (p.151). such as the Rockdale Wetlands. The scenic value of landscape is also valued in the plan, including waterways, urban bushland; urban tree canopy and green ground cover; parks and open spaces, which '*create a sense of identity*' (p.159). Strategy 28.2 aims to '*enhance and protect views of scenic and cultural landscapes from the public realm*'. The region's '*Green Grid*' (p.6) including the network of walking and cycling links are also recognised as important, including President Avenue and the Rockdale Bicentennial and Scarborough Park corridor, which as identified as a Green Grid Opportunities (p.169) to help connect open spaces with communities.

5.1.3 Eastern City District Plan, 2018

Greater Sydney's three cities defined in the *Greater Sydney Regional Plan: A Metropolis of Three Cities* (Greater Sydney Commission, 2018b) reach across five districts: Western City District, Central City District, Eastern City District, North District and South District. This plan is focused on the Eastern City District, covering the CBD, eastern and inner-western suburbs, Sydney Airport and Bayside West, including proposed F6 Extension project. It is a 20-year plan to manage growth in the context of economic, social and environmental matters to achieve the 40-year vision for Greater Sydney. It contains the planning priorities and actions for implementing the Greater Sydney Region Plan, A Metropolis of Three Cities, at a district level and is a bridge between regional and local planning.

Port Botany and Sydney Airport are identified as a trade gateways. Opportunities provided by improved links to Port Botany and Sydney Airport and planning for the F6 Extension will improve motorway access and freight movements from the Eastern Harbour City across Greater Sydney and to Port Kembla/Illawarra, supporting the functions of these gateways. South of President Avenue, a corridor is identified as a '*Road Investigation 0–10 years*' (p.7).

In line with the *Great Sydney Regional Plan*, Kogarah is identified as a '*Health and Education Precinct*' (p.7) and land to the west and southwest of the airport (Bayside West Precinct) is identified as an '*Urban Renewal Area*' (p.7). The Eastern City District's coast and waterways '*shape its landscape and character*', including the Rockdale Wetlands corridor, recognised as a '*nationally important wetland*' (p.99). The Rockdale Bicentennial and Scarborough Park corridor is also identified as a '*Green Grid Priority Corridor*' (p.7), to support walking, cycling and greening the urban environment. New development and investment in infrastructure are identified as key opportunities to improve the quality and access to riparian corridors (p.101). In particular, the plan states that the F6 extension '*should be designed to retain and protect recreational open spaces and the ecological values of the corridor*' (p.110).

5.1.4 Sydney Regional Environmental Plan No. 33 – Cooks Cove

Kogarah Golf Course is zoned under the *Sydney Regional Environmental Plan No. 33 – Cooks Cove* for future infrastructure (special uses), employment (trade and technology) and open space uses. Although action has not yet been taken to give effect to these proposed future uses, the SREP requires that for any new development: '*The height, form and orientation of buildings are to take into account visual impact from both land and water, as well as solar access, ventilation, wind impact, the amenity and privacy of hotel occupants*' (Part 2, cl 10b).

Land currently occupied by Kogarah Golf Course is restricted to six storeys, except within 120 metres of the Cooks River where the building height limit is five storeys. The Cooks Cove SREP allows for one building within the Trade and Technology Zone to be up to 11 storeys provided it is not closer than 10 metres from the zone boundary. In addition to statutory environmental planning controls, development in this area will need to satisfy the requirements for safe operation of the Sydney Airport including restrictions on intrusion into regulated airspace.

5.2 Local planning context

Although the project is within the Bayside Council (including former Rockdale City Council) LGA, the northern part of the project is within the Cooks Cove Precinct (SREP 33). The following section describes the relevant local planning guidance for the project.

5.2.1 Rockdale Local Environmental Plan 2011

The Rockdale LEP 2011 (LEP) applies to land on which the southern surface works at President Avenue will be undertaken. Key relevant aims of this plan are to '*conserve the environmental heritage of Rockdale*' (cl 1.2.2b), '*maintain and improve residential amenity*'(cl 2.1.2c) and '*provide high quality open space*' (cl 1.2.2e).

Land use zones

The existing F6 reserved corridor is zoned Infrastructure, reflecting the desire for improving access and connectivity between Sydney and the Illawarra, whilst relieving pressure from the Princes Highway and Grand Parade at Brighton-Le-Sands. Other land use zones covering and in close proximity to the President Avenue surface works include Public Recreation, Light Industrial, and Low and Medium Density Residential. Relevant objectives of the land use zones include:

- Infrastructure (SP2): To provide for infrastructure and related uses' and 'To prevent development that is not compatible with or that may detract from the provision of infrastructure'
- Public Recreation (RE1): *'To protect and enhance the natural environment for recreational purposes'*
- Low and medium density residential (R2/R3): *'To ensure that land uses are carried out in a context and setting that minimises any impact on the character and amenity of the area'.*

Heights of Buildings

Adjacent parcels of land to the east, south and west of the Rockdale Wetlands and Recreation Corridor are permitted to reach maximum building heights of 8.5 metres, reflecting the desire to maintain the low density residential character either side of President Avenue. Further north, building heights are permitted to reach 14.5 metres within the light industrial precinct along West Botany Street, backing onto the Rockdale Wetlands. The Public Recreation zoned area is not subject to a building height restriction under the LEP.

Design

Although the LEP does not include specific guidance on road tunnel design, clause 5.6 permits '*variations to maximum building height standards for roof features of visual interest*' such as the proposed road tunnel ventilation system.

Heritage

Heritage items and heritage conservation areas in and around the project include:

- Western Outfall Main Sewer (Rockdale to Homebush) at Marsh Street, Arncliffe; a state listed heritage asset, part of the Southern and Western Suburbs Ocean Outfall Sewer
- Kings Wetland, a locally listed heritage landscape at Kings Road, Brighton- Le-Sands
- Patmore Swamp, a locally listed heritage landscape in the northern part of Scarborough Park: 'Aesthetically significant as a landscape of high visual amenity contrasting with surrounding suburbs' (NSW OEH 2010)
- School building at Brighton-Le- Sands Public School (1916), a locally listed heritage asset at 35 Crawford Road.

A key objective of the heritage conservation clause is '*to conserve the heritage significance of heritage items and heritage conservation areas, including associated fabric, settings and views*' (s.5.10).

5.2.2 Rockdale Development Control Plan, 2011

Rockdale Development Control Plan (DCP) provides detailed objectives, controls and performance standards for development, which supplement the provisions of the LEP.

The DCP recognises the importance of maintaining and enhancing views to significant landmarks, including the Cooks River area (cl 4.1.1). It also specifically requires the views to Botany Bay to be considered in site planning (see Figure 5-1).

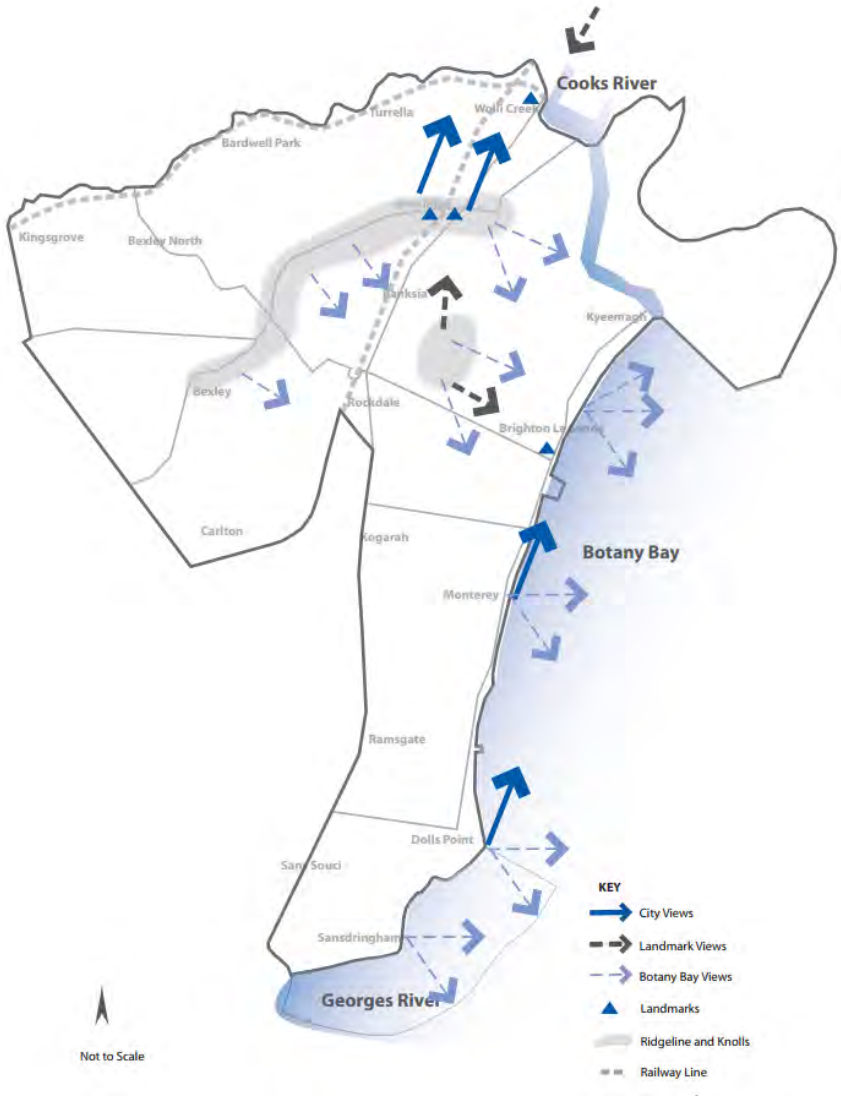


Figure 5-1 Significant views in the city (Rockdale city council 2011a, cl 4.1.1)

The DCP supports the conservation of significant buildings, landscape elements and special places within the LGA that contribute to its heritage significance such as the remnant bushland and wetlands. The DCP requires the following relevant controls for development of heritage Items:

Council recognises the aesthetic value of trees in creating a 'sense of place' and providing a distinctive character to an area whilst visually softening the built environment and screening undesirable sights. It requires that "*existing significant trees and vegetation are incorporated into proposed landscape treatment*" (cl 4.1.7) of new development.

The DCP also promotes quality landscape design solutions that respond to significant existing trees and natural features, relate to the building scale, and provide screening for visually obtrusive land uses or building elements (cl 4.3.1).

6 Landscape character impact assessment

For the purposes of the landscape and visual impact assessment the project has been divided into northern surface works at Arncliffe, and southern surface works in the vicinity of President Avenue, between Kogarah and Brighton-Le-Sands.

6.1 Northern Surface Works area (Arncliffe)

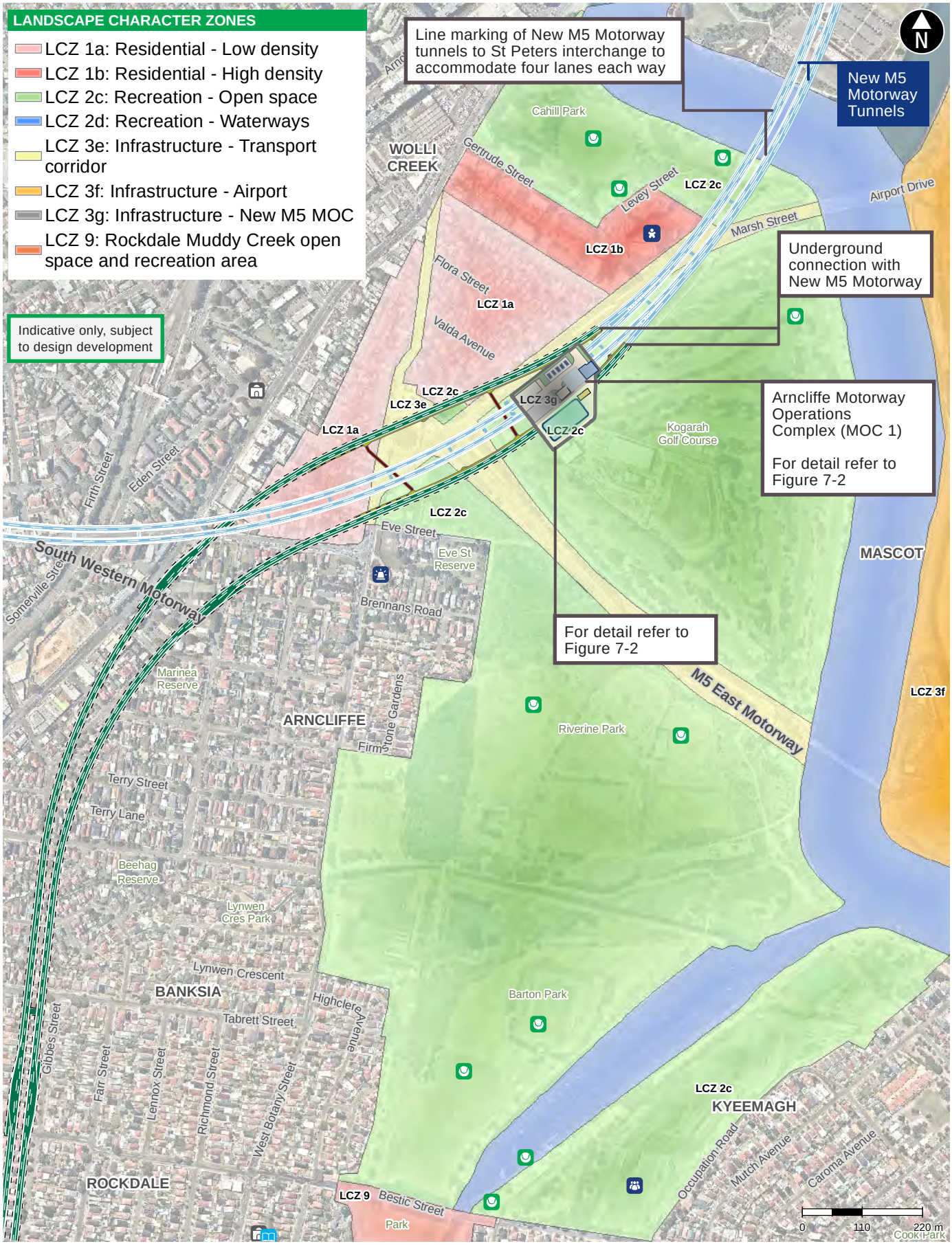
6.1.1 Identification of landscape character

The following landscape character zones (LCZs) were identified in the New M5 Motorway EIS, and have been used in this assessment for consistency. These were primarily determined by land use, which was considered to be the defining landscape character elements of the area. One additional LCZ was identified during this field investigation. There are three primary LCZs, with some sub character areas. These are:

- LCZ1 - Residential
  a) High density
  b) Low density
- LCZ2 - Recreation
  c) Open space
  d) Waterways
- LCZ3 - Infrastructure
  e) Transport corridor
  f) Airport
  g) New M5 Motorway operations complex

The location of these Landscape Character Zones (LCZ) is shown in **Figure 6-1**.

The following sections provide an updated description of these LCZs.



LEGEND

- The project in tunnel
- Cross passage
- Egress passage
- Substation
- Water treatment facility
- Motorway operations complex
- New M5 Tunnel
- Ventilation facility*
- * Under construction as part of the New M5 Motorway project
- Place of worship
- Community services
- Emergency services
- Child care centre
- Primary school
- Recreation and sporting facility

Figure 6-1 Landscape character zones, Northern surface works area (Arncliffe)

6.1.2 Assessment of landscape character impact

LCZ1a: Residential - Low density

Existing conditions

This zone includes the low density suburban area of Arncliffe located to the north and west of Marsh Street. The built form generally consists of single and double storey detached dwellings on individual lots. These homes include a mixture of architectural styles, ages and materials, including federation bungalows, fibro and brick cottages, and modern infill development. The residential streets are lined with street trees in some locations. This suburban area is dissected by several major transport corridors including the M5 East Motorway and West Botany Street. The topography is generally flat in close proximity to the Cooks River floodplain, east of West Botany Street, and slightly undulating elsewhere to the north of Marsh Street and west of West Botany Street. In some locations there are elevated easterly views across Arncliffe and to the airport (refer to **Figure 6-2**).

Figure 6-2 LCZ2a: Residential – Low density character images

Sensitivity

The landscape values of this zone are considered to be of low sensitivity as it is a suburban zone, experienced by small numbers of visitors and residents.

Impacts during construction

There would be no project elements introduced to the low density residential landscape character zone and no character change during construction. Therefore, the magnitude of change would be negligible to this landscape which is of low sensitivity, resulting in a **negligible landscape character impact**.

Impacts during operation

There would be no landscape character change experienced at the low density residential area as no project elements would be introduced to this landscape character zone during operation. Therefore, there would be negligible magnitude of change to a landscape of low sensitivity, resulting in a **negligible landscape character impact**.

LCZ1b: Residential - High density

Existing conditions

This zone includes the high density residential area of Wolli Creek located north of Innesdale Road, Marsh Street, Cahill Park and the Princes Highway. The built form and character of this zone consists of modern high rise residential apartments and airport transit hotels. Once an area of low density residential, this zone is undergoing renewal for mixed use and high density residential development, featuring buildings with a large footprint and rising up to fifteen storeys. The built form is varied, including older remaining detached houses and terraces amidst low, medium and high rise buildings. Architectural styles vary, with a broad selection of age and materials. Due to its proximity to the Cooks River, topography within this zone is flat and street level views are constrained by the building line. The upper levels of the east and southeast facing apartments and hotel rooms along Marsh Street would have expansive views across the Kogarah Golf Course to the Airport. (refer to **Figure 6-3**)

Figure 6-3 LCZ2b: Residential – High density character image

Sensitivity

The landscape values of this zone are considered to be of low sensitivity as it is a high density residential area. Whilst this area is occupied by high number of residents and visitors, there is an expectation of a built character and highly urban setting.

Impacts during construction

There would be no project elements introduced into the high density residential landscape character zone and no character change during construction. Therefore, the magnitude of change would be negligible to this landscape, which is of low sensitivity, resulting in a **negligible landscape character impact**.

Impacts during operation

There would be no landscape character change experienced within the high density residential area as no project elements would be introduced to this landscape character zone during operation. Therefore, there would be a negligible magnitude of change to a landscape of low sensitivity, resulting in a **negligible landscape character impact**.

LCZ2c: Recreation - Open space

Existing conditions

This zone includes the flat, low lying tracts of open space at the mouth of Muddy Creek, where it joins the Cooks River. Much of this open space is reclaimed wetland, converted into passive and active recreational uses including Kogarah Golf Course, Barton Park, Riverine Park and the Tempe Golf Driving Range. After completion of the New M5 Motorway project, more than half of the New M5 Motorway Arncliffe construction compound would be reinstated as open space.

The Landing Lights Wetland (also known as Riverine Park Wetlands) located at Spring Street, is a key feature of this zone. This wetland contains some of the last remaining saline wetlands on the Cooks River, making it '*one of Council's most environmentally significant natural areas*' (Rockdale City Council 2018). The Rockdale Market Gardens are a key historic and cultural landscape feature in this zone, located between West Botany Street and the Landing Lights Wetland, and to the west of Muddy Creek. The Southern and Western Suburbs Ocean Outfall Sewer (SWOOS), one of Sydney's oldest main sewers and a state heritage item, is visible on the southern side of Kogarah Golf Course.

The Eve Street and Bestic Street shared pedestrian and cycle pathways provide access through this zone. These pathways pass underneath the M5 East Motorway and allow views to the surrounding open space, providing visual relief from the surrounding urban areas, major arterial routes and Sydney Airport (refer to **Figure 6-4**).

Figure 6-4 LCZ2c: - Open Space character images

Sensitivity

The landscape values of this zone are considered to be of moderate sensitivity as it is an area of open space and used for recreational purposes.

Impacts during construction

A temporary construction compound would occupy a section of this character area. This would include the establishment of an acoustic shed, tunnelling works, stockpiling of excavated material and spoil haulage during tunnelling works, and then construction of a substation and single storey water treatment plant building. This work would be undertaken alongside the New M5 motorway operations complex, which will be constructed as part of the New M5 Motorway project, and occupy the northern part of the Arncliffe construction ancillary facility, alongside Marsh Street. The loss of access to this area of open space would continue to be experienced, however, the remaining Kogarah Golf Course would continue to function as a reduced size golf course. Overall, the magnitude of change would be low due to the loss of open space. As this is a landscape of moderate sensitivity, there would be a **moderate-low landscape character impact** during construction.

Impacts during operation

The eastern part of the construction site would be restored and returned to previous recreational uses. The northern part of the construction site, alongside Marsh Street, would become a Motorway Operations Centre with two additional buildings, a water treatment plant and substation. This area would expand the existing site of the New M5 Motorway Arncliffe MOC (still to be constructed). Whilst the additional buildings and small expansion of the MOC would be consistent with the adjacent landscape character area (LCZ3g New M5 motorway operations complex, refer to **section 6.1.2**)

This would result in a further small reduction in the area of open space in this zone. This would result in a low magnitude of change to the Open space landscape character zone, which has a moderate landscape sensitivity, resulting in a **moderate-low landscape character impact** during operations.

LCZ2d: Recreation – Waterways

Existing conditions

This zone includes a section of the Cooks River and Muddy Creek between Wolli Creek and Banksia. These waterways are used for active water-based recreation activities including sailing, boating, rowing, kayaking and fishing. The edges of these waterways are sparsely vegetated, allowing views to and from the water from adjacent open space areas and the airport.

Figure 6-5 LCZ2d: Recreation - Waterways Character image

Sensitivity

This zone considered to be of low sensitivity as although it is a recreational landscape it is surrounded by a largely modified landscape and would be able to absorb change.

Impacts during construction

There would be no landscape character change at the Cooks River during construction as works would not occur in the vicinity of this landscape character zone. Therefore, the magnitude of change would be negligible to this landscape of low sensitivity, resulting in a **negligible landscape character impact**.

Impacts during operation

There would be no landscape character change at the Cooks River during operation as no project elements would be introduced to this landscape character zone. Therefore, there would be negligible magnitude of change to a landscape of low sensitivity, resulting in a **negligible landscape character impact**.

LCZ3e: Infrastructure – Transport corridor

Existing conditions

This zone includes the M5 East Motorway and Marsh Street, both major arterial routes in Sydney's inner west. Noise walls and vegetation provides a visual buffer alongside the M5 East Motorway, screening views to and from the road corridor. Marsh Street is a six lane route extending east-west between Sydney Airport and West Botany Street, providing access to the M5 East Motorway and the New M5 Motorway Arncliffe construction compound. The road has been recently widened, leaving little room for landscape planting between the road and narrow (or zero) building setbacks. The variety in age, height, architectural style and materials of the built form along Marsh Street creates an eclectic streetscape character, including low density suburban houses juxtaposed with modern hotel and residential apartment buildings. Street level views are directed along the carriageway with views of adjacent recreational and residential uses mostly blocked by noise walls and fencing (refer to **Figure 6-6**).

Figure 6-6 LCZ3e: Infrastructure – Transport corridor character images

Sensitivity

This zone is considered to be of low sensitivity, as although it includes a busy arterial route and would be experienced by large numbers of people, it has the capacity to absorb change readily.

Impacts during construction

There would be no landscape character change to this zone during construction. Marsh Street and the M5 East Motorway would remain open and the project's construction works would occur below ground. As a result, the magnitude of change would be negligible to this landscape of low sensitivity, and a **negligible landscape character impact** during construction.

Impacts during operation

There would be no landscape character change to this zone as the project would be underground. Therefore, there would be negligible magnitude of change to a landscape of low sensitivity, resulting in a **negligible landscape character impact**.

LCZ3f: Infrastructure – Airport

Existing conditions

Sydney Airport is located to the east of the Cooks River and extends south to Botany Bay. As required by its function, it consists of a large, flat, open landscape and includes expansive areas of tarmac and turf, scattered low buildings, observation towers, multi-level car parks, hangars and sheds, and aircraft (on the ground, taking off and landing). It is bound by waterways and major arterial routes. The open character of this zone allows expansive views to and from this aviation-centric landscape.

Sensitivity

This landscape is functional rather than appreciated for its aesthetic qualities and is therefore considered to be of negligible sensitivity.

Impacts during construction

There would be no landscape character change to the airport as there would be no work undertaken in or near this landscape character zone during construction. Therefore, the magnitude of change would be negligible to a landscape of negligible sensitivity, resulting in a **negligible landscape character impact.**

Impacts during operation

There would be no change experienced in the landscape character of the airport as no project elements would be introduced to this landscape character zone. Therefore, there would be negligible magnitude of change to a landscape of negligible sensitivity, resulting in a **negligible landscape character impact**.

LCZ3g: Infrastructure – New M5 motorway operations complex

Existing conditions

This landscape character zone encompasses of the New M5 motorway operations complex, as approved for the M5 Motorway project. This site occupies part of the western side of Kogarah Golf Course and is currently a temporary construction compound. However, upon completion of the construction activity, the MOC would include several buildings including a ventilation facility (35 metres high), an air intake facility (10 metres high), distribution substation (around 5 metres high), water treatment facility, water treatment wetland and staff car park.

Sensitivity

This landscape would be functional and not particularly appreciated for its landscape qualities. It has considerable visual absorption capacity and is therefore considered to be of negligible sensitivity.

Impacts during construction

The New M5 motorway operations complex would remain largely unchanged with the project undertaking some internal fit out activities within the ventilation facility. This construction activity on the site would be somewhat absorbed into the character of the New M5 motorway operations complex. Overall, the project is expected to create a negligible magnitude of change to a landscape of negligible sensitivity, resulting in a **negligible landscape character impact** in this zone during construction.

Impacts during operation

Upon completion, the New M5 motorway operations complex would be a combined New M5 Motorway and F6 Extension Arncliffe Motorway Operation Complex, as described in the existing conditions section above. This would be a negligible magnitude of change to a landscape character zone which is of negligible sensitivity, resulting in a **negligible landscape character impact**.

6.2 Southern surface works area (President Avenue)

6.2.1 Identification of landscape character

The following landscape character zones have been identified in the vicinity of the President Avenue surface works area:

- LCZ4: Rockdale Bicentennial and Scarborough Parks
- LCZ5: Brighton-Le-Sands coastal residential area
- LCZ6: Kogarah residential and local centre
- LCZ7: Princes Highway commercial centre
- LCZ8: West Botany Street industrial and commercial area
- LCZ9: Muddy Creek open space

These Landscape Character Zones (LCZs) are described in the following sections. The location of these LCZs is shown in **Figure 6-7**.

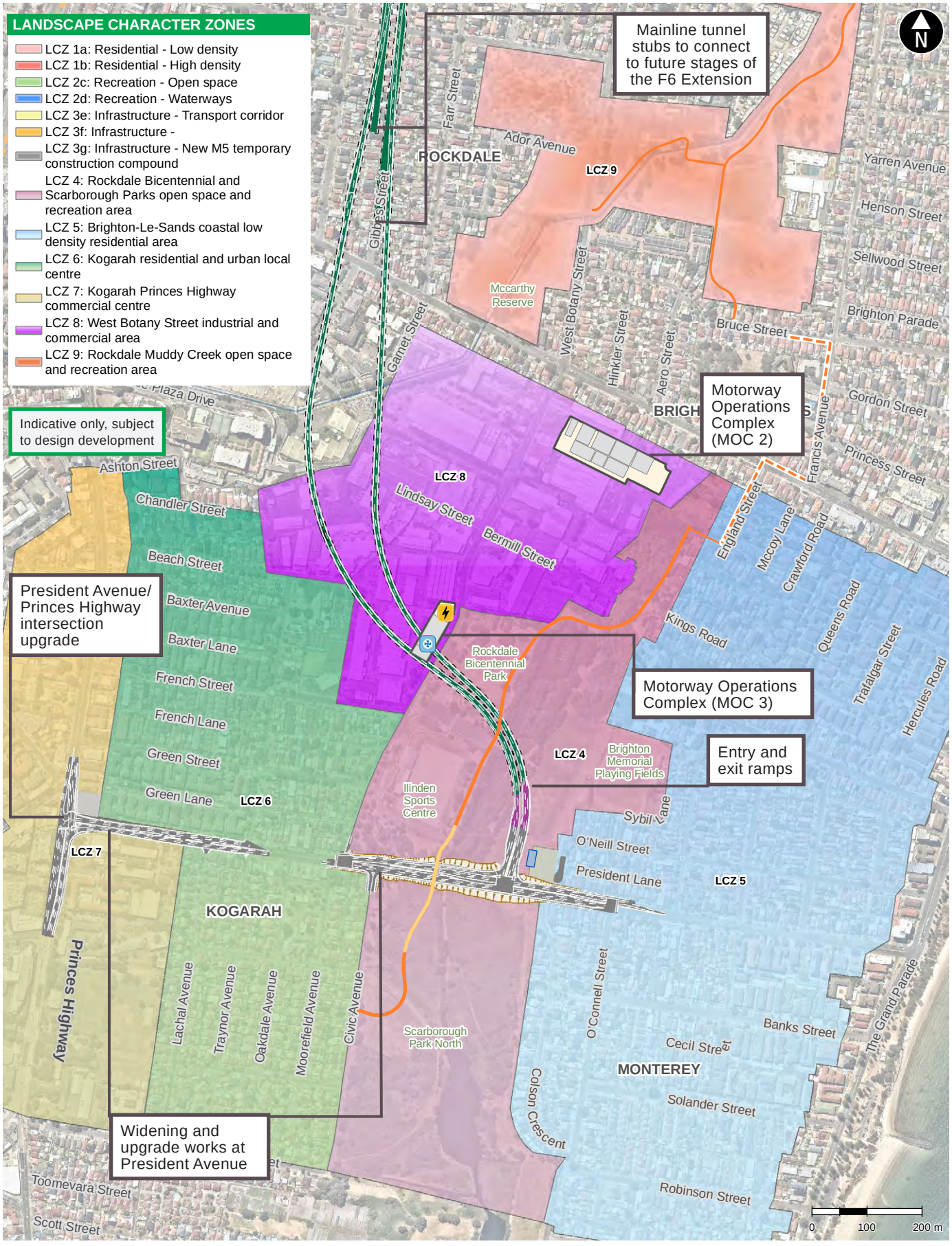


Figure 6-7 Landscape character zones, Southern surface works

6.2.2 Assessment of landscape character impact

LCZ4: Rockdale Bicentennial and Scarborough Parks

Existing conditions

Land within this zone is generally low lying and flat, associated with the wetland within Rockdale Bicentennial Park (part of Rockdale Wetlands). The wetlands form part of a system of tidal and freshwater swamps. Rockdale City Council considered the wetlands to be of '*high visual quality*', particularly appreciated when '*travelling along President Avenue*' (Rockdale City Council, 2016, p.41). The corridor meanders in a north-south direction through the centre of Rockdale, providing a landscape and visual buffer between industrial and commercial uses to the west and the residential areas to the east at Brighton-Le-Sands.

This zone includes several open spaces and a variety of opportunities for passive and active recreation. Key recreational assets in the corridor include Rockdale Bicentennial Park and Rockdale Wetlands, Ilinden Sports Centre and the Rockdale Bicentennial Park East adjacent to the historic Brighton-Le-Sands Public School. Ilinden Sports Centre is home to the Rockdale City Suns Football Club and includes a clubhouse, stadium seating for 1,000 patrons and a floodlit pitch, allowing it to host night training and games. To the west, the park includes the Rockdale Skate Park, a large car park, amenities block, playground and lawn area beside the wetlands. Dense vegetation encloses views to the wetlands, and east/west inter-visibility between the open spaces is limited. East-west pedestrian circulation is possible at two locations, between Kings Road and West Botany Street in the north, and a bridge crossing between Rockdale Bicentennial Park and the Rockdale Bicentennial Park East (refer to **Figure 6-8**).

Figure 6-8 LCZ4: Rockdale Bicentennial and Scarborough Parks character images

Sensitivity

This zone is considered to be of moderate sensitivity, as it is locally valued for its '*high visual quality*' and includes several community facilities and passive recreation areas, attracting visitors from within and outside the region.

Impacts during construction

A large part of Rockdale Bicentennial Park would be used for the President Avenue construction ancillary facility (C3). This would include excavation and construction of the cut-and-cover structures, President Avenue intersection, shared pedestrian and cycle pathway, and other general construction activity. To the west, the entire Bicentennial Park, including Rockdale Skate Park, playground, pathways and carpark would be closed and temporarily occupied for construction. There would be some vegetation protected within the wetlands, but a number of mature trees as well as buildings and structures within the construction ancillary facility area (C3) would be removed. West Botany Street would be temporarily diverted through the fringe of Rockdale Bicentennial Park during the construction of the cut and cover tunnel section. The Ilinden Sports Centre and adjacent carpark would not be directly affected.

To the east, the Rockdale Bicentennial Park East and parkland along President Avenue would be closed and a construction ancillary facility would be established in the southern part of the park. During construction of the cut-and-cover tunnels the southern section of the wetland within Rockdale Bicentennial Park (part of Rockdale Wetlands) would be temporarily dammed with water diverted around the construction site. This would require the removal of some wetland and adjacent parkland trees. The northern part of the park, including the heritage listed Kings Wetland, would be retained and protected during construction except for a corridor for constructing the shared pedestrian and cycle pathway. The club house and seating stand at the Brighton Memorial Playing Fields would also be retained.

The northern part of Scarborough Park would also be occupied during construction. This area would be used to support the widening President Avenue and installation of the shared pedestrian and cycle pathway, including a pedestrian bridge over President Avenue. The pathway and associated construction would extend south to the existing dog exercise area alongside Civic Avenue.

In summary, a substantial portion of this landscape zone would be affected, considerably altering the valued attributes of this landscape character zone during the construction period. This would include the removal of mature trees and wetland areas and the loss of access to some recreation facilities during construction. This would result in a high magnitude of change, to a landscape character area which is of moderate sensitivity, resulting in a **high-moderate landscape character impact** during construction.

Impacts during operation

During operation, areas of Rockdale Bicentennial Park not occupied by operational surface infrastructure, would be restored and returned to their previous recreational or open space use. This would include sporting fields, skate park, parkland, landscaping vegetation and areas of wetland not occupied by the cut-and-cover structures. Existing pedestrian and cyclist infrastructure would be reinstated and a new shared pedestrian and cycle pathway would connect Bestic Street in the north to Scarborough Park in the south including a bridge crossing at President Avenue. This overall reinstatement would restore and improve accessibility and connectivity within the park.

The character of President Avenue would be expanded and intensified as a major piece of road infrastructure. Visually prominent elements of the road within this LCZ would include the tunnel portal, entry and exit ramps and a signalised intersection. President Avenue would also be raised and widened in this location, extending into and above the adjacent Rockdale Bicentennial and Scarborough Parks landscapes.

All operational surface infrastructure would be appropriately landscaped with the aim of reinstating the existing character of the area. In some locations landscaping would be augmented to 'soften' the visually prominent project elements such as the tunnel portals and the President Avenue embankment extending into Scarborough Park north.

The proposed operational scenario for this area would result in a large section of the south eastern corner of the Rockdale Bicentennial Park being transformed into road infrastructure, and a permanent loss of access to this area of existing open space, reducing passive and active recreation opportunities locally. Overall, it is expected that there would be a high magnitude of change to the landscape character during operation, which is of moderate sensitivity, resulting in a **high-moderate landscape character impact**.

LCZ5: Brighton-Le-Sands coastal residential area

Existing conditions

This zone consists of low density suburban development, located between the Rockdale Wetlands and Brighton-Le-Sands coastal strip. This zone was extensively developed during the post war years in the late 1920s and again in the 1950s and 1960s. This development is still evident today in the concentration of federation bungalows and red brick cottages, set amongst modern infill development. The streets are generally wide, quiet and shaded by street trees. The predominant built form of single and double storey houses on individual lots with mature front gardens unifies this zone. Brighton-Le-Sands Public School is located adjacent to the wetlands at Crawford Street and consists of a Federation style complex of buildings set within flat low lying grounds containing mature trees. The distinctive Federation style building is on the local heritage register, and is noted for its contribution to the '*history and streetscape of the area*' (NSW OEH, 2005).

The topography of the zone is flat and low lying, typical of the coast wetland landscape. Street level views are generally enclosed by the built form and channelled along the gridded network of streets with glimpses to the ocean in the east. Properties on the western boundary of this character zone have a parkland setting provided by the adjacent Rockdale Bicentennial Park and Scarborough Park north (refer to **Figure 6-9**).

Figure 6-9 LCZ5: Brighton-Le-Sands coastal residential character images

Sensitivity

This is generally a quiet suburban zone, experienced by small numbers of visitors and residents. The landscape values of this zone are therefore to considered to be of low sensitivity.

Impacts during construction

The President Avenue construction ancillary facility (C3) would extend into the south western part of this landscape character zone, requiring the resumption and demolition of several residential properties on O'Neill Street and President Avenue. The land on which these properties are currently located would be converted into a site office and car park during construction. O'Neill Street would be closed and converted into a cul-de-sac. The ancillary facility would be enclosed by temporary noise attenuation measures, blocking views from nearby residences and community facilities, including Brighton-Le-Sands Public School and the adjacent Rockdale Bicentennial Park East. Construction traffic would pass through this zone via President Avenue, and large plant and equipment would be active within this zone. These elements would introduce a construction character to a small part of the LCZ which would contrast with the residential landscape character of this zone.

Overall, the influence of the project would be restricted to a small portion of this landscape zone during construction, resulting in a low magnitude of change to a landscape character area which is of low sensitivity. This would result in a **low landscape character impact**.

Impacts during operation

The main impact on this landscape would the replacement of several residential properties (nine in total) on O'Neill Street and President Avenue with open space, a widened road corridor and the President Avenue intersection. Part of Rockdale Bicentennial Park and the Rockdale Bicentennial Park East would be transformed, with new entry and exit ramp tunnels, altering the open parkland setting of the adjacent areas of this zone. The new President Avenue intersection and changes to the height and width of President Avenue as it passes through the Brighton-Le-Sands residential area would also reduce the residential character of some parts of this zone.

The majority of the quiet streets of this character zone would remain intact and unaffected. Pedestrian and cyclist connectivity would be improved with the introduction of a shared pedestrian and cycle pathway beginning in the LCZ at England Street in a vacant lot, linking through to Rockdale Bicentennial Park. The setting of Brighton-Le-Sands Public School would remain largely unaltered as the adjacent heritage listed wetland landscape and Brighton Memorial Playing Fields would be largely retained.

Overall, as the influence of the project would be restricted to a small portion of the landscape character zone, the proposed changes would result in a low magnitude of change. This is a landscape zone of low sensitivity, resulting in a **low landscape character impact**.

LCZ6: Kogarah residential and local centre

Existing conditions

This zone consists of a small low density residential precinct, located between the Rockdale Wetlands and the Princes Highway. Its character is influenced by a concentration of single storey red brick detached bungalows and cottages, typically built during 1950s and 1960s post war era of suburban development. The wide, quiet, tree-lined streets, with houses set well back from the road by front gardens is a typical visual feature throughout the zone. The topography is generally flat and low lying, even though this area is slightly elevated from the adjacent Rockdale and Scarborough Wetlands to the east. Properties located on West Botany Street, and particularly Civic Avenue, overlook the wetlands. President Avenue traverses this zone in an east-west direction, including a small cluster of retail buildings and a service station. In this precinct, President Avenue is a three lane wide, busy road corridor. Some mature small native street trees are located on the verges. To the northwest of the zone, there is a corridor of mature eucalypts located within the road reserve and on adjacent private properties, providing some shade and amenity to this section of the road (refer to **Figure 6-10**).

Figure 6-10 LCZ6: Kogarah residential and local centre character images

Sensitivity

The landscape values of this zone are considered to be of low sensitivity as it is a predominantly suburban zone, experienced by small numbers of visitors and residents. This landscape would have some absorption capacity along President Avenue.

Impacts during construction

A small area of this character zone would be altered by the widening works along President Avenue, which would introduce a construction character near to existing residences and retail properties. Street parking along President Avenue from the Princes Highway to O'Connell Street would be removed at the commencement of construction, footpaths would be temporarily closed (one side at a time) and/or pedestrians redirected during the construction. Although President Avenue would be widened to three lanes eastbound and westbound, there would be no property resumptions in this zone, maintaining the character of houses set well back from the road with wide front gardens. The northern end of Moorefield Avenue would be closed and converted into a cul-de-sac, slightly changing the circulation and character in this part of the zone. The small commercial area to the west of Moorefield Avenue would also remain.

In summary, a small portion of this landscape zone would be changed during construction, resulting in a low magnitude of change to a landscape character area which is of low sensitivity, resulting in a **low landscape character impact.**

Impacts during operation

President Avenue would be wider, influencing the character of a small area within this LCZ. The road corridor would include a right turning lane into Lachlan Avenue with central medians west of Cross Street. There would be new streetscape planting where space allows (in consultation with Council). These trees would restore the shade and visual filtering effect (between the road and adjacent properties) over time as this vegetation matures.

Overall, a minor portion of the landscape zone would be changed, in the vicinity of President Avenue. In this area the landscape qualities of this suburban zone would be slightly altered due it being a wider corridor with increased traffic. This would result in a low magnitude of change. This is a landscape zone of low sensitivity, resulting in a **low landscape character impact**.

LCZ7: Princes Highway commercial centre

Existing conditions

This zone is centred on the Princes Highway at the western end of President Avenue. The Princes Highway is a major north-south route between Sydney and Wollongong and is five to six lanes wide in this section. The road has narrow footpaths on either side, narrow or zero building setbacks and few street trees. The built form along the Princes Highway varies in age, height, architectural style and materials creating an eclectic streetscape character. This includes some isolated double storey Victorian shopfront terraces juxtaposed with modern office and residential apartment buildings. In particular, a contemporary mixed use tower stands prominently on the Princes Highway at the terminus of President Avenue. There are several health and educational facilities along the Princes Highway, including St George Private Hospital, TAFE NSW St. George College, James Cook Boys Technology High School and Moorefield Girls High School. These facilities include some open space and more generous setbacks, and include landscape planting, plazas and sporting fields, which provide visual relief in this intensely urban zone. The mature trees within the TAFE are a notable visual feature at the corner of President Avenue and the Princes Highway. Pedestrian circulation is generally along the footpaths beside the Princes Highway, with crossings at signalised intersections and an overpass between the hospital and TAFE. The topography rises and is slightly elevated from the adjacent wetland area at Rockdale Bicentennial and Scarborough Parks (LCZ1). Street level views are mainly directed north and south along the Princes Highway, and there are some slightly elevated easterly views towards Brighton-Le-Sands from the President Avenue intersection. The upper levels of east-facing apartments and office buildings would have elevated views along President Avenue, to the Rockdale Wetlands and beyond to Botany Bay (refer to **Figure 6-11**).

Figure 6-11 LCZ7: Princes Highway commercial centre character images

Sensitivity

This zone is a busy arterial route, attracting staff, students, patients and visitors from across the region. The zone has the capacity to absorb change due to its diverse built form and the dominating character of the Princes Highway. It is therefore considered to be of low sensitivity.

Impacts during construction

Construction works for the intersection upgrade would extend across the intersection of President Avenue and the Princes Highway. The service station on the north-eastern corner of the intersection would be fully acquired and there would be a partial acquisition of the front garden of three properties on the Princes Highway. A construction ancillary facility (C6) would be established on this corner and would include a laydown area, some offices, amenities and workshops, and parking for construction vehicles and equipment required for the construction of the President Avenue and Princes Highway intersection upgrade. Temporary hoarding and noise attenuation barriers would be installed along the construction site boundary where required. The mature street trees along the north side of President Avenue would be removed, as would the trees alongside the TAFE to the southeast corner of the intersection. A small part of the TAFE property fronting the Princes Highway would be acquired and the boundary fencing would be reconstructed at the new boundary. Footpaths around the intersection would be removed and realigned, with some temporary diversions required. The existing pedestrian bridge over the Princes Highway, south of the President Avenue intersection would be retained. Whilst there would be a construction character introduced to this area, this would be somewhat absorbed into the highly urban and mixed character of the zone.

Whilst a small portion of this landscape character zone would be changed during construction, as a consequence of the removal of mature trees, there would be a moderate magnitude of change to this area. This landscape character zone is of low sensitivity, resulting in a **moderate-low landscape character impact.**

Impacts during operation

The Princes Highway and President Avenue intersection would be the main location of change in this zone. The Princes Highway would be wider with three northbound turning lanes and a southbound slip lane into President Avenue. This would have narrowed the western frontage of properties between Green Street and President Avenue, and the southern frontages of properties from President Avenue to Cross Street. This would include front gardens, trees and fence lines. The TAFE would also be affected, with the brick property boundary wall being rebuilt and the loss of the amenity and shade from the mature trees along President Avenue and Princes Highway which would have been removed.

President Avenue would be wider with three lanes in each direction some central medians and turning lanes. The street streets along the northern side of President Avenue would be replaced by new streetscape planting, providing shade and a visual buffer between the road and adjacent properties. New footpaths would also be installed along both sides of President Avenue.

The changes to the intersection would affect only a small portion of the overall LCZ. Furthermore, the new operational scenario would be in keeping with the arterial road and eclectic urban development which are a key characteristic of this landscape character zone. Street trees would be reinstated during construction but would take time to mature, leading to a more open character of the intersection in the interim. The surrounding land uses would largely remain the same (with the exception of the service station) and important visual elements would be reinstated, such as the masonry wall in front of the TAFE, and trees. Overall, the proposed changes would result in a low magnitude of change. This is a landscape zone of low sensitivity, resulting in a **low landscape character impact**.

LCZ8: West Botany Street industrial and commercial area

Existing conditions

This zone includes a commercial and retail precinct focused on West Botany Street, between French and Bay Streets. It contains a mixture of commercial, retail and light industrial developments, including mechanical and manufacturing workshops, showrooms, offices and a shopping centre with double storey car park. The built form is hugely varied, with modern commercial and retail development generally located along the West Botany 'high street' and older brick saw-tooth roof industrial buildings in side streets such as Bermill Street. A Roads and Maritime maintenance depot is located in the eastern section of the zone, alongside the Rockdale Wetlands. This facility is set behind properties directly fronting West Botany Street and is accessed via two narrow driveways. Mature trees and a telecommunications tower can be seen rising above the surrounding buildings, however, the Roads and Maritime depot is largely concealed from the street. The topography is generally flat and low lying, with street level views contained by the built form (refer to **Figure 6-12**).

Figure 6-12 LCZ8: West Botany Street industrial and commercial area character images

Sensitivity

This zone is a busy local commercial precinct, attracting concentrations of residents, staff and visitors. Due to the variety and scale of the built form this landscape has the capacity to absorb change readily. Overall, it is considered to be of low sensitivity.

Impacts during construction

The Rockdale construction ancillary facility (C2) would be established in this zone at the existing Roads and Maritime maintenance depot. The facility would support the tunnelling works, including loading of spoil and spoil removal via West Botany Street. An acoustic shed would be constructed around the temporary access tunnel and associated aboveground spoil handling areas to manage noise and dust. A Motorway Control Centre would be constructed in this depot site, including office building, car park and deluge tanks. Several mature trees on this site would be removed. A water treatment plant and sediment pond would also be constructed on this site.

To the west of West Botany Street, a row of commercial buildings (seven properties in total) would be acquired and demolished to construct the Rockdale ventilation facility (approximately 35 metres tall), substation and power supply within C3. This section of West Botany Street would be temporarily diverted through Rockdale Bicentennial Park during construction of the relevant part of the cut and cover structure. Footpaths would also be closed and diverted during construction. Temporary hoarding and noise attenuation barriers would be installed along the construction site boundary. Although these elements would have a construction character, and views across the open space would be altered as Rockdale Bicentennial Park is also converted to a construction site, this work would not contrast substantially with the largely industrial character of this zone.

In summary, this activity during construction would result in a low magnitude of change to a landscape character zone which is of low sensitivity. This would result in a **low landscape character impact**.

Impacts during operation

A row of commercial properties in West Botany Street would have been replaced with the ventilation facility including a ventilation building, substation and car park. The majority of the Roads and Maritime maintenance depot site would also have been converted into an Operational Motorway Control Centre, including an office building, car park, maintenance facility, pump station and deluge tanks, storage yards and space for future facilities. The height, scale and form of the ventilation facility (including a ventilation tower of approximately 35 metres tall) and control centre (up to X metres tall) are considered to be generally consistent with the character and scale of the built form in this zone.

Overall, a minor portion of the landscape zone would be changed, and whilst the visibility of this site is limited by surrounding development, the proposed built form would be generally compatible with the existing landscape character. This would result in a low magnitude of change, to a landscape zone of low sensitivity, resulting in a **low landscape character impact.**

LCZ9: Muddy Creek open space

Existing conditions

This LCZ is characterised by relatively flat open space and recreational landscapes following Muddy Creek between Bestic and Bay Streets. These include the Whiteoak Reserve, the Rockdale Womens Sports Fields with asphalt netball courts (St George district netball association), C.A. Redmond Field, Greg Arkins Mini Field, Rockdale Park, Ador Reserve and McCarthy Reserve. These reserves include several buildings including the two to three storey PCYC between Ador and McCarthy Reserves and two clubhouses at the netball club. A playground is located in Whiteoak Reserve. Muddy Creek is a concrete channel through this area and there are two bridges across the creek, and paths and footworn tracks through the open space. Rockdale Park has a mature stand of trees. There are also mature trees scattered across Whiteoak Reserve, in some areas around the perimeter of the sporting reserves, and along the creek. The open space is surrounded by predominantly low density residential areas, with the exception being the Sheralee Tourist Caravan Park, a medium density residential development south of the netball courts, and the Cairnsfoot Special School (refer to **Figure 6-13**).

Figure 6-13 LCZ9: Muddy Creek open space character images

Sensitivity

This zone is considered to be of moderate sensitivity, as it includes many community facilities and active and passive recreation areas, attracting residents and visitors from across the region.

Impacts during construction

Works in this LOCZ would include construction of the shared pedestrian and cycle pathway extending from West Botany Street along the northern bank of Muddy Creek adjacent to the Rockdale Women's Sports Field. This pathway would cross the creek at the existing footbridge and follow the creek north on the southern bank. It would also extend from Bruce Street in the south to Bestic Street in the north through the Greg Arkins Mini Field and C.A. Redmond Field. Small construction compounds would be established on West Botany Street and Bruce Street. These would include fencing, a site office, car parking, laydown area and amenities. This work would temporarily restrict public access parts of the Rockdale Women's Sports Field, C.A. Redmond Field, and the Greg Arkins Mini Field and reduce the amenity and accessibility of these recreation areas. This work would be undertaken on existing areas of open space and existing trees would generally be retained.

During this time the character of this zone would be modified with the introduction of construction activities across several parcels of open space. This would result in a low magnitude of change, to a landscape character area which is of moderate sensitivity, resulting in a **moderate-low landscape character impact** during construction.

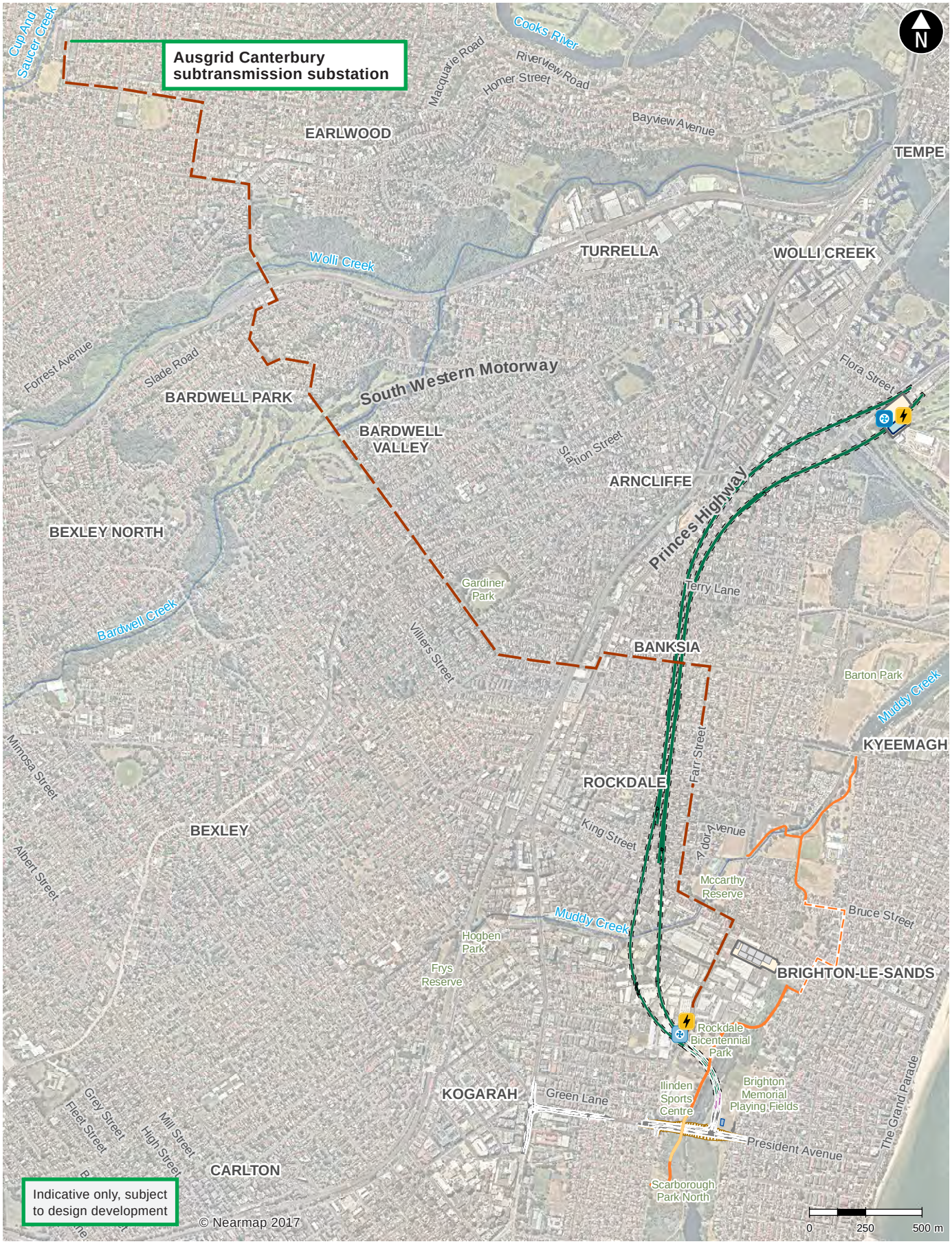
Impacts during operation

During operation the new shared pedestrian and cycle pathway and additional tree planting would be present within the LCZ. The character of this corridor would remain consistent with the surrounding open space and sporting fields. This would result in a low magnitude of change, to a landscape character area which is of moderate sensitivity, resulting in a **moderate-low landscape character impact** during construction.

6.3 Proposed permanent power supply

The landscape character impacts of the indicative power supply route has also been assessed, however, due to the small scale of the work separate LCZs have not been identified.

The proposed power supply route is shown in **Figure 6-14.**



LEGEND

- The project in tunnel
- The project on surface
- The project as an open slot
- On-road cycleway
- Shared cycle and pedestrian pathways
- President Avenue shared cycle and pedestrian bridge
- Permanent power supply line
- Substation
- Rockdale ventilation facility
- Arncliffe ventilation facility*
- Motorway operations complex

Figure 6-14 Permanent power supply route

Existing conditions

The proposed permanent power supply corridor extends south from the Ausgrid Canterbury sub-transmission substation, along Westfield Street which passes Hughes Park and a wide park-like road reserve. The corridor would be aligned generally east to west along predominantly residential streets of Earlwood, Bardwell Park, Bardwell Valley, Banksia and Rockdale. These residential streets are mostly two lanes wide with low to medium density residential properties and intermittent street trees, creating a leafy suburban character.

The corridor would pass along more densely urban streets to the southwest of the Earlwood village centre. The corridor also crosses the Eastern Suburbs and Illawarra railway line (T4) via an overbridge at Hartill-Law Avenue and passes the Bardwell Park railway station, entering another small commercial centre to the east of the station. It would also cross the Airport and South Line (T8) and the Princes Highway, to the south of Banksia station. These areas have fewer street trees and a more intensely urban and infrastructure character with a greater capacity to absorb the character of construction works and power transmission infrastructure.

On this route, the corridor would pass alongside or through several open spaces including Earlwood Oval, Girrahween Park, Charles Daly Reserve, Bardwell Valley Golf Club, Silver Jubilee Park, Gardiner Park, and McCarthy Reserve. These places include various types of open space including grassed fields, and rolling parkland with trees, and bushland areas.

Sensitivity

This corridor is mainly of low landscape sensitivity, with some areas of moderate landscape sensitivity in the areas of open space including Earlwood Oval, Girrahween Park, Charles Daly Reserve, Bardwell Valley Golf Course and Silver Jubilee Park.

Impacts during construction

The proposed permanent power supply would require temporary works within the road reserves and through open spaces. Works would include some road and footpath closures to accommodate temporary trenching works to install the connection underground. The works would include construction of surface level power lines, attached to existing infrastructure, at the Bardwell Valley Golf Club and Silver Jubilee Parks and to cross the T4 and T8 railway lines. Existing street trees within this corridor would be retained where possible.

Due to the works occurring in both local streets, through local centres and open spaces, it is expected that the project would result in a low magnitude of change. As this is a landscape of neighbourhood to local sensitivity, there would be a **negligible** to **low landscape character impact** during construction.

Impacts during operation

There would be no permanent aboveground project elements along this route during operation. This would result in no perceived reduction in the quality of this landscape, which is of local sensitivity, resulting in a **negligible landscape character impact**.

6.4 Summary of landscape character impacts

6.4.1 Northern surface works area (Arncliffe)

Table 6-1 summarises the impacts on the landscape character zones of the Northern surface works area (Arncliffe).

Table 6-1 Northern surface works area (Arncliffe) - summary of landscape character impacts

		Construction		Operation	
Landscape character zone	**Sensitivity**	**Magnitude of change**	**Impact level**	**Magnitude of change**	**Impact level**
LCZ1a: Residential - Low density	Low	Negligible	Negligible	Negligible	Negligible
LCZ1b: Residential - High density	Low	Negligible	Negligible	Negligible	Negligible
LCZ 2c: Recreation - Open space	Moderate	Low	Moderate-low	Low	Moderate-low
LCZ 2d: Recreation - Waterways	Low	Negligible	Negligible	Negligible	Negligible
LCZ 3e: Infrastructure - Transport corridor	Low	Negligible	Negligible	Negligible	Negligible
LCZ 3f: Infrastructure - Airport	Negligible	Negligible	Negligible	Negligible	Negligible
LCZ 3g: Infrastructure - New M5 motorway operations complex	Negligible	Negligible	Negligible	Negligible	Negligible

6.4.2 Southern surface works area (President Avenue)

Table 6-2 summarises the impacts on the landscape character zones of the southern surface works area (President Avenue).

Table 6-2 Southern surface works area (President Avenue) - summary of landscape character impacts

		Construction		Operation	
Landscape character zone	**Sensitivity**	**Magnitude of change**	**Impact level**	**Magnitude of change**	**Impact level**
LCZ4: Rockdale Bicentennial and Scarborough Parks	Moderate	High	High-moderate	High	High-moderate
LCZ5: Brighton-Le-Sands coastal residential area	Low	Low	Low	Low	Low
LCZ6: Kogarah residential and local centre	Low	Low	Low	Low	Low
LCZ7: Princes Highway commercial centre	Low	Moderate	Moderate-low	Low	Low
LCZ8: West Botany Street industrial and commercial area	Low	Low	Low	Low	Low
LCZ9: Muddy Creek open space	Moderate	Low	Moderate-low	Low	Moderate-low
Proposed permanent power supply	Low – moderate	Low	Moderate-low	Negligible	Negligible

7 Visibility of the project

7.1 Northern surface works area (Arncliffe)

7.1.1 Potential visibility of the project

Visual envelope

A Visual Envelope Map (VEM) has been used to illustrate the theoretical area from which the surface works may be visible. This is based on interpretation of aerial photography (refer **Figure 7-1**).

The potential visibility of the northern surface works site would be influenced by the landform and the surrounding built form. The site would be seen from Marsh Street which bounds the site to the north. To the northwest, areas of low density residential development are located on a landform which rises towards West Botany Street so that views towards the site may be possible. There are also areas of higher density residential development which would have views from upper windows and balconies, across the site. To the northeast and east of the site, there may be views from across the golf course and Cooks River as this landscape is relatively open and the landform is gently undulating. Views to the south may extend across open space to the M5 East Motorway which forms a visual barrier to views extending further south.

Selection of representative viewpoints

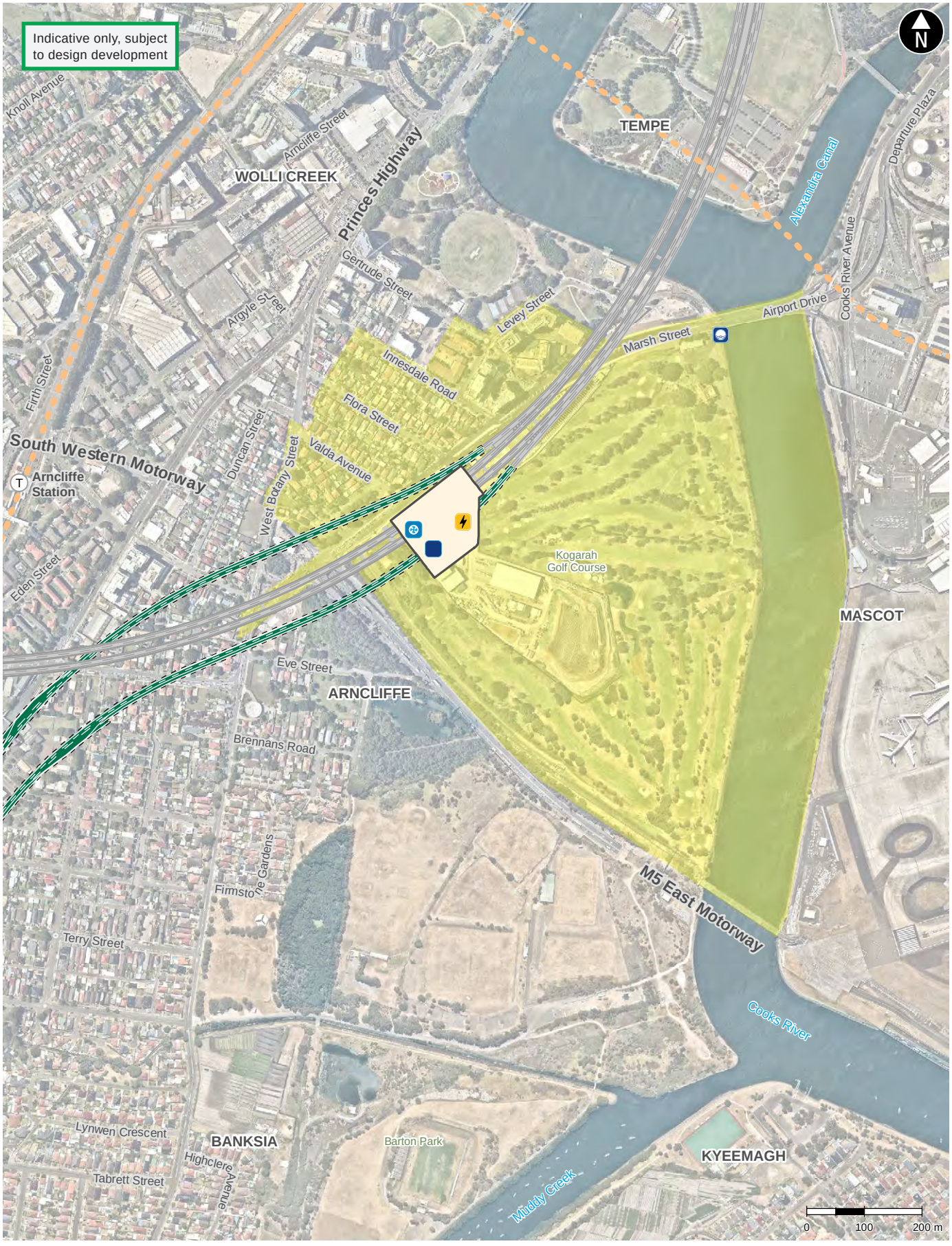
Three viewpoints were selected from within the visual catchment of the project as representative of range of potential views to the project. These views include views from residential areas, public open space and major roads.

Northern surface works area (Arncliffe)

The following views have been identified as representative of the views to the Northern surface works area (Arncliffe):

- VP1: View east from near Marsh Street pedestrian underpass
- VP2: View north from Eve Street cycleway
- VP3: View south from Marsh Street

The location of these viewpoints is shown in **Figure 7-2**.



LEGEND

- The project in tunnel
- Motorway operations complex
- Substation
- Water treatment facility
- Operational discharge location
- New M5 Tunnel
- Arncliffe ventilation facility*
- * Under construction as part of the New M5 Motorway project
- Visual Envelope Map
- Railway station
- Railway line
- Waterbody

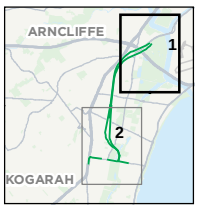


Figure 7-1 Visual Envelope Map - Road works

LEGEND

- The project in tunnel
- Cross passage
- Egress passage
- Substation
- Water treatment facility
- Motorway operations complex
- New M5 Tunnel
- Ventilation facility*
- (2) Viewpoint location
- Emergency services
- Child care centre
- Recreation and sporting facility

* Under construction as part of the New M5 Motorway project

Figure 7-2 Viewpoint locations, Northern surface works area (Arncliffe)

7.2 Southern surface works area (President Avenue)

7.2.1 Potential visibility of the project

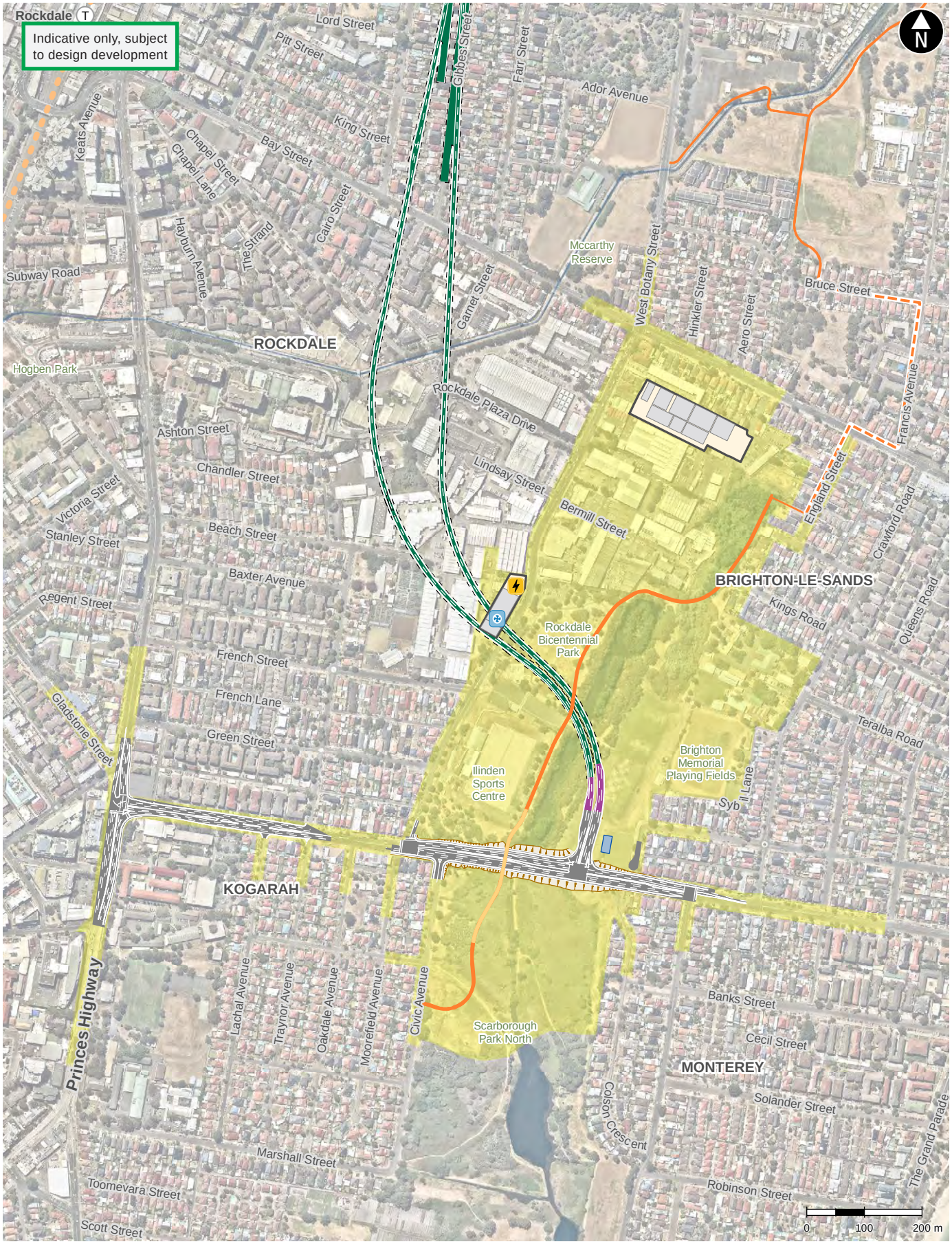
To assess the potential visibility of the southern works area (President Avenue) the project has been considered as three key visual components: the surface works (which refers to the surface roads, Motorway operations complex and street level areas of the ventilation facility), the Rockdale ventilation facility outlet (a structure which would rise above the surrounding built form), and the President Avenue shared pedestrian and cycle pathway bridge (which would also rise above the park and road corridor).

Surface works

The potential visibility of the surface works would be reduced by the dense surrounding built form and vegetation of the study area. A visual envelope map (VEM) has been used to establish the theoretical area from which the surface works may be visible. This is based on interpretation of aerial photography (refer **Figure 7-3** Visual envelope map – surface works).

It is expected that views to the President Avenue intersection and tunnel entry and exit ramps would be visible from the adjacent residential areas to the east. Views to the upgraded President Avenue would be seen from Scarborough Park, properties facing Presidents Avenue, and along intersecting streets.

Similarly the Rockdale MOC would be largely enclosed by surrounding built form and vegetation. This built form and vegetation would limit views to adjacent industrial, commercial and residential properties, West Botany and Bay Streets.



LEGEND

- The project in tunnel
- The project on surface
- The project as an open slot
- Motorway operations complex
- On-road cycleway
- Shared cycle and pedestrian pathways
- President Avenue shared cycle and pedestrian bridge
- Building
- Water quality basin
- Embankment
- Substation
- Rockdale ventilation facility
- Visual Envelope Map
- Railway station
- Railway line
- Waterbody

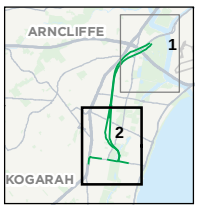


Figure 7-3 Visual envelope map - Surface works

Rockdale ventilation facility outlet

A Visual Envelope Map (VEM) has been used to establish the theoretical area from which the ventilation facility may be visible. This theoretical extent is based on LIDAR data (including built form and vegetation), with an assumed height of the outlet of 35 metres. The analysis uses a 3D model to identify the areas from which views to the site may be possible. This diagram shows the outlet as being visible from the streets and buildings surrounding the ventilation facility site, north and south along West Botany Street and extending east across the Rockdale Bicentennial Park, and beyond the Rockdale Wetlands to the Rockdale Bicentennial Park East. This theoretical area includes the rooftops of buildings in the surrounding industrial, commercial and residential areas to the very top of the outlet. This VEM formed the basis for field investigations to identify views to the proposed ventilation outlet (refer to **Figure 7-4**).

Figure 7-4 Visual envelope map – Rockdale ventilation facility outlet

Shared pedestrian and cycle bridge over President Avenue

A Visual Envelope Map (VEM) has also been used to establish the theoretical area from which the shared pedestrian and cycle bridge over Presidents Avenue may be visible. This theoretical extent is based on LIDAR data (including built form and vegetation) and an assumed height of the bridge of 5.5 metres above the roadway. The VEM shows the shared pedestrian and cycle bridge as being visible from east and west along Presidents Avenue and extending north into the Ilinden Sports Centre, and south across Scarborough Park North. This VEM formed the basis for field investigations to identify relevant viewpoints for this area. (refer to **Figure 7-5**).

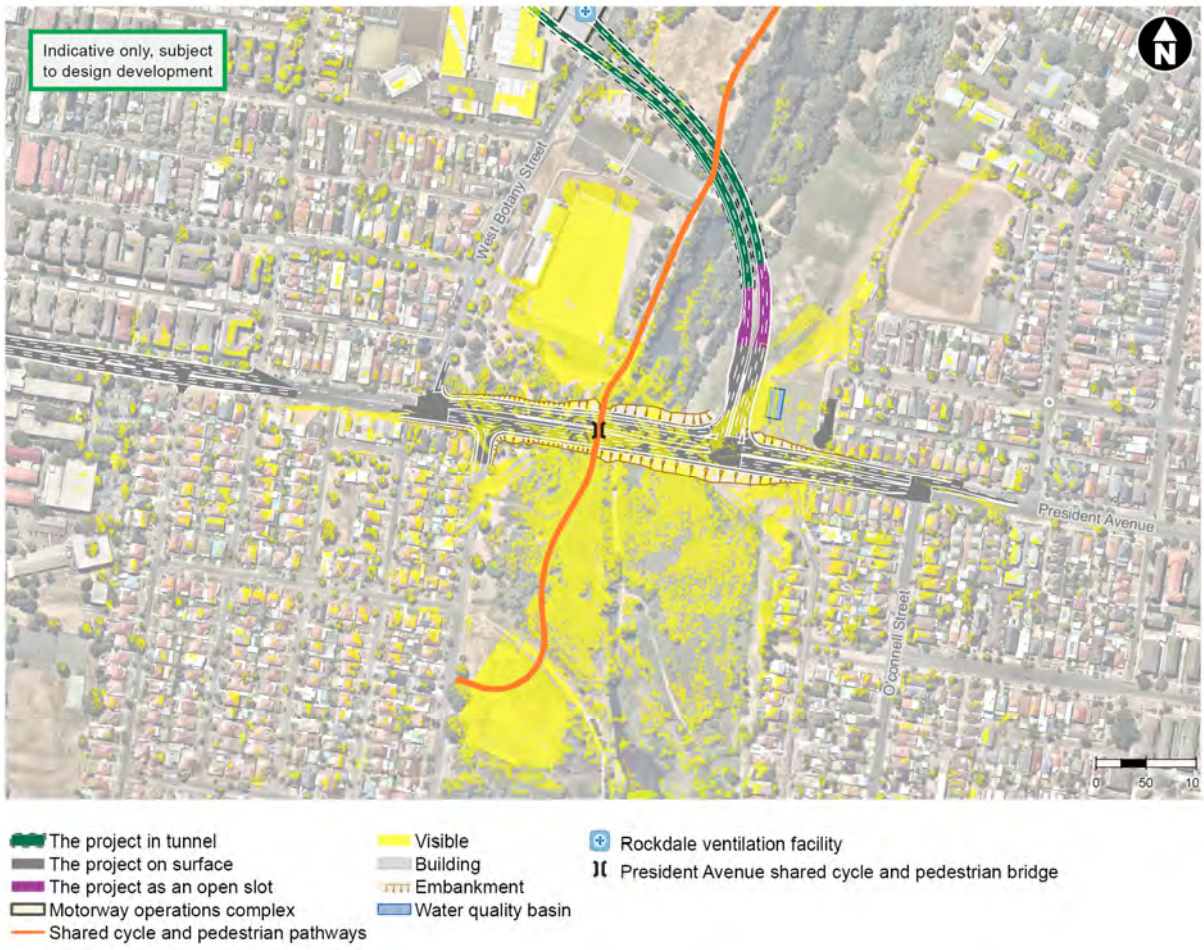


Figure 7-5 Visual envelope map – Shared pedestrian and cycle bridge

Selection of representative viewpoints

Fifteen viewpoints were selected from within the visual catchment of the project as representative of broad range of potential views to the project in the southern surface works area. These views include views to the roadworks, Rockdale ventilation facility and shared pedestrian and cycle pathway. These views include residential areas, schools, public open space, heritage places and local businesses.

The following views have been identified as representative of the views to the southern surface works area (President Avenue):

- Viewpoint 4: View north from the Ilinden Sports Centre
- Viewpoint 5: View south from Rockdale Bicentennial Park
- Viewpoint 6: View south from the Rockdale Bicentennial Park East
- Viewpoint 7: View south from Brighton-Le-Sands Public School
- Viewpoint 8: View north from Colson Crescent
- Viewpoint 9: View northeast from President Avenue
- Viewpoint 10: View east from Civic Avenue
- Viewpoint 11: View east from President Avenue retail area
- Viewpoint 12: View west along President Avenue at Lachal Avenue
- Viewpoint 13: View east along President Avenue from the Princes Highway
- Viewpoint 14: View south from West Botany Street
- Viewpoint 15: View east from West Botany Street to the Roads and Maritime maintenance depot.

The location of these viewpoints is shown in **Figure 7-6**.

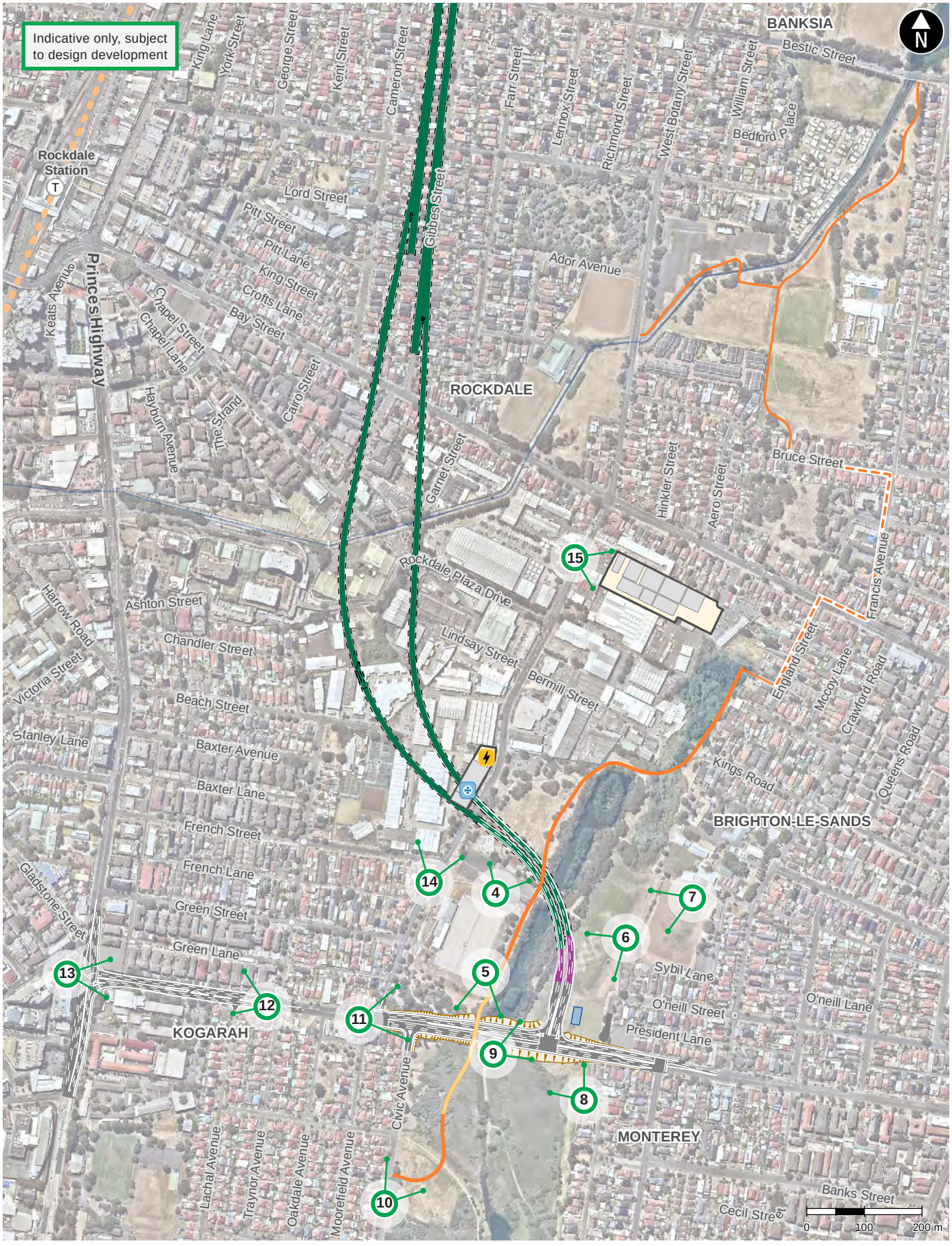


Figure 7-6 Viewpoint locations, Southern surface works

8 Visual impact assessment

8.1 Northern surface works area (Arncliffe)

8.1.1 Viewpoint assessment

The assessment of each representative viewpoint in the northern surface works area (Arncliffe) is detailed in the following tables.

Viewpoint 1: View east from near Marsh Street pedestrian underpass

Figure 8-1 Viewpoint 1 – View east from near Marsh Street pedestrian underpass

Table 8-1 Viewpoint 1 – Detailed impact assessment

	Daytime	Night time
Existing condition	This view is from a low-traffic residential street in Arncliffe and overlooks Marsh Street (a heavily trafficked six lane road) and the New M5 Motorway Arncliffe construction compound. A large gantry sign and street lights can be seen rising above the road. Vegetation along Marsh Street and the Eve Street cycleway partly obstruct views to the site, including views to the acoustic sheds and parts of the cranes. The parkland trees within Kogarah Golf Course are visible in the background. Upon completion of the New M5 Motorway project a substation and ventilation facility building, within the Arncliffe Motorway Operations Complex (MOC), would be seen beyond Marsh Street.	The middle ground of this view would be brightly lit due to street lighting and six lanes of traffic along Marsh Street. Lighting at the New M5 motorway operations complex would be visible in the centre of this view.
Sensitivity	Low – This is a view from a suburban street in Arncliffe.	Low – View located in a brightly lit suburban environment with a medium district brightness.
Construction – Magnitude	Negligible – There would be project construction works to the east of Marsh Street beyond and partially screened by the substation and ventilation buildings within the New M5 motorway operations complex.	Negligible – The project would require lighting in the compound areas, which would be see the New M5 Motorway substation and Ventilation building within the MOC. This would be across Marsh Street which has a high level of brightness and sky glow and would be largely absorbed into the background of this view
Impact level	Negligible visual impact	Negligible visual impact
Operation - Modification	Negligible – There may be glimpses to the single storey Water treatment facility building beyond the existing New M5 Motorway Substation and Motorway Ventilation facility.	Negligible – There may be some lighting associated with the new single storey Water treatment facility, however, this would be seen beyond the lighting of the New M5 motorway operations complex.
Impact level	Negligible visual impact	Negligible visual impact

Viewpoint 2: View north from Eve Street cycleway

Figure 8-2 Viewpoint 2 – View north from Eve Street cycleway

Table 8-2 Viewpoint 2 – Detailed impact assessment

	Daytime	Night time
Existing condition	A dense corridor of vegetation along the eastern side of the cycle path screens the New M5 Motorway Arncliffe construction compound. The large acoustic sheds and cranes on this site would be removed and the eastern (middle ground) areas of the site would be returned to open space following the New M5 Motorway construction. There would be a New M5 Motorway ventilation facility, supply ventilation station and water treatment facility in the background. Beyond the site, the upper storeys of the high rise apartment blocks and hotels north of Marsh Street are visible.	The middle and background of this view would be brightly lit, due to the New M5 Motorway Arncliffe construction compound, street lighting along Marsh Street and high rise residential development north of Marsh Street. The foreground is predominantly dark.
Sensitivity	Moderate – Eve Street cycleway is a regional cycle route to the CBD via the Cooks River Cycleway. It attracts users from across the district and is frequently used for recreation and commuting.	Low – This cycleway is not lit and would not be used frequently at night. Cycleway is located in a medium district brightness area with light spill from adjacent infrastructure (i.e. Marsh Street, Sydney airport).
Construction - Magnitude	Moderate – The Arncliffe construction ancillary facility (C1) would occupy the same area as the New M5 Motorway Arncliffe construction compound in this view. An acoustic shed would be constructed over the tunnelling works and the and upper parts of plant/machinery would be seen above the site. These elements would replace the open space (which would have been reinstated after the New M5 Motorway construction) These would contrast with the adjacent open space character. However, this work would be seen in the context of the New M5 Motorway MOC buildings and the built form in the background, reducing the level of visual contrast somewhat.	Negligible – There would be construction activity at night, including task and security lighting. Acoustic enclosures would reduce the level amount of light sources visible and the skyglow over the site. This work would be seen in the context of a brightly lit backdrop to the north, including the New M5 motorway operations complex and urban high density areas of Arncliffe, and would be largely absorbed into this context. It would, however contrast with the predominantly dark open space areas to the east.
Impact level	Moderate visual impact	Negligible visual impact
Operation - Magnitude	Low – There would be an additional single story water treatment facility building and substation located to the southeast of the existing New M5 motorway operations complex. These structures would be closer to the viewer, and partially screened by existing vegetation within the park. The area south of the New M5 Motorway Arncliffe MOC (centre of view) would be restored and returned to recreational use.	Negligible – The landscape in the centre of view would be restored into open space, returning it to a dark landscape. The new water treatment facility and substation would have some lighting at night, consistent in character with the New M5 motorway operations complex, but bringing light closer to the viewer. This lighting would be generally absorbed into the brightly background of the New M5 motorway operations complex and high density residential area in beyond.
Impact level	Moderate-low visual impact	Negligible visual impact

Viewpoint 3: View south from Marsh Street

Figure 8-3 Viewpoint 3 – view south from Marsh Street

Table 8-3 Viewpoint 3 – Detailed impact assessment

	Daytime	Night time
Existing condition	Upon completion of the M5 works areas of the compound in the middle ground of the view would be returned to recreational uses. The New M5 motorway operations complex would be visible in the background adjacent to Marsh Street. This would include several buildings including a ventilation facility, supply vent station and water treatment facility.	The north of this view (right) is brightly lit with moving headlights from vehicles and street lighting along Marsh Street, and the high rise residential development. The New M5 Motorway MOC would be lit in the background of this view. The Kogarah Golf Course to the south (left) would be predominantly dark at night.
Sensitivity	Low – This is an infrequently used footpath, but also represents road users along Marsh Street, a major arterial route.	Low – view located in a brightly lit urban environment, with a medium district brightness.
Construction – Magnitude	Low –The Arncliffe construction ancillary facility (C1) would be visible to the east of the New M5 Motorway MOC, in the background of the view. This area would be substantially smaller than the footprint of the current New M5 Motorway construction compound. This work would be seen alongside the New M5 Motorway and across open space in the middle ground of this view.	Negligible – There would be light from construction activity, security and vehicles within the project construction compound, visible in the background of the view. This additional lighting would be absorbed into the view as it would be seen adjacent to the within the MOC which would include some lighting, and the brightly lit Marsh Street.(with moving headlights from traffic) and high density residential buildings to the east.
Impact level	Low visual impact	Negligible visual impact
Operation – Magnitude	Low – The New M5 Motorway MOC would be used for some operational components of the project, including the Arncliffe ventilation facility. There would be a new F6 Extension Stage 1 water treatment facility building and substation to the east of the New M5 Motorway MOC. Areas not occupied by permanent operational infrastructure would be restored and returned to recreational uses.	Negligible – There would be additional light sources visible including security lighting at the F6 Extension Stage 1 water treatment plant and substation. This would be consistent in character with the adjacent New M5 motorway operations complex and be largely absorbed into the view.
Impact level	Low visual impact	Negligible visual impact

8.1.2 Summary of visual impact

Impacts during construction and operation

Views from residential areas in the northwest

During construction the New M5 motorway operations complex would mostly screen views to the Arncliffe construction ancillary facility (C1) from residential areas in the northwest. Some elevated, south facing properties would have glimpses to the upper parts of plant and machinery in the background, rising above the New M5 motorway operations complex. These elements would be consistent in character and somewhat absorbed into the character of views from these areas (refer to Viewpoint 1: View east from near Marsh Street pedestrian underpass). Overall, a negligible magnitude of change is expected in views from the high and low density residential areas of Arncliffe, which are of low sensitivity, resulting in a **negligible visual impact** during construction.

During operation, the new F6 Extension Stage 1 water treatment facility and substation would be mostly screened by the New M5 motorway operations complex in views from residential areas in the northwest. This would include the upper levels of south facing apartments and hotel rooms in the high density residential zone and elevated south facing properties in the low density residential zone. Whilst the MOC would be larger in size and include an additional single storey water treatment facility building and substation, this would be a small change in the view and be consistent with the character of the adjacent New M5 motorway operations complex (refer to Viewpoint 1: View east from near Marsh Street pedestrian underpass). Overall, this would result in a negligible magnitude of change to this landscape zone which is of low sensitivity, and in a **negligible visual impact** during operation.

Views from open space areas to the south and southeast

From open space areas to the south and southeast of the site, views to the Arncliffe construction ancillary facility (C1) would be limited due to the flat landform and intervening vegetation. The construction site would be visible from areas north of the M5 East Motorway, on the Eve Street cycleway and parts of the Kogarah Golf Course. Where views are available, the Arncliffe construction ancillary facility (C1) would include acoustic sheds and stockpiles rising above site security fencing (refer to Viewpoint 2: View north from Eve Street cycleway). A moderate magnitude of change is expected, to views from adjacent open space areas, which are of moderate sensitivity, resulting in a **moderate visual impact** during construction.

Due to landform, intervening vegetation and built form, views to the Arncliffe MOC would be limited to accessible areas north of the M5 East Motorway, including Kogarah Golf Course and the Eve Street cycleway. The Arncliffe construction ancillary facility would have been restored and returned to recreational use, restoring the visual quality of these views (refer to Viewpoint 2: View north from Eve Street cycleway). This would result in a low magnitude of change to views of moderate sensitivity, and a **moderate-low visual impact** during operation.

Views from Marsh Street in the northeast

In views from Marsh Street, the Arncliffe construction facility (C1) would be seen to the southeast of the New M5 motorway operations complex. Whilst these works would expand the footprint of built seen within the Kogarah Golf Course, they would be in the background of this view and of a similar scale and built form character to the adjacent MOC (refer to Viewpoint 3: View south from Marsh Street). Overall, a low magnitude of change is expected in views from Marsh Street, which are of low sensitivity, resulting in a **low visual impact** during construction.

During operation, the F6 Extension Stage 1 water treatment facility and substation would be seen alongside the New M5 motorway operations complex. This would be a small area of additional development within the open space and consistent in character with the adjacent MOC. (refer to Viewpoint 3: View south from Marsh Street). This would result in a **low** magnitude of change to views in this location, which are of low sensitivity, resulting in a **low visual impact** during operation.

Views at night

Impacts during construction

It is expected that there would be night works undertaken at the Arncliffe construction ancillary facility (C1). The site would include some lighting during these times from vehicles, offices, and floodlighting of construction support activities. Lighting from any tunnelling activity, however, would be contained by acoustic sheds. This lighting would be generally consistent in character with the lighting from the future New M5 motorway operations complex and brightly lit adjacent areas of Marsh Street and the high density residential areas to the north. Overall, the project would result in a negligible magnitude of change, within views of low sensitivity, and a **negligible visual impact**.

Impacts during operation

During operation there would be additional lighting for the F6 Extension Stage 1 water treatment plant and substation. This lighting would be seen in the context of the brightly lit Marsh Street corridor and adjacent New M5 motorway operations complex. The lighting would be largely absorbed into the view, resulting in a negligible magnitude of change, within views of low sensitivity, and a **negligible visual impact**.

8.1.2.1 Summary tables

Table 8-4 summarises the viewpoint assessment for the northern surface works area (Arncliffe).

Table 8-4 Northern surface works area (Arncliffe) - summary of viewpoint assessment

		Construction		Operation	
Viewpoint	**Sensitivity**	**Magnitude of change**	**Impact level**	**Magnitude of change**	**Impact level**
Daytime views					
VP1: View east from near Marsh Street pedestrian underpass	Low	Negligible	Negligible	Negligible	Negligible
VP2: View north from Eve Street cycleway	Moderate	Moderate	Moderate	Low	Moderate-low
VP3: View south from Marsh Street	Low	Low	Low	Low	Low
Night views					
VP1: View east from near Marsh Street pedestrian underpass	Low	Negligible	Negligible	Negligible	Negligible
VP2: View north from Eve Street cycleway	Low	Negligible	Negligible	Negligible	Negligible
VP3: View south from Marsh Street	Low	Negligible	Negligible	Negligible	Negligible

8.2 Southern surface works area (President Avenue)

8.2.1 Viewpoint assessment

The assessment of each representative viewpoint in the southern surface works area (President Avenue) is detailed in the following pages.

Viewpoint 4: View north from the Ilinden Sports Centre

Figure 8-4 Viewpoint 4 – View north from the Ilinden Sports Centre

Table 8-5 Viewpoint 4 – Detailed impact assessment

	Daytime	Night time
Existing condition	This view in Rockdale Bicentennial Park includes a large public car park in the foreground, a skate park and playground in the middle ground. The view is enclosed to the north and east by vegetation.	The main light sources in this view are the lights in the car park and flood lights at the Ilinden Sports Centre (behind the viewer). There is some sky glow from lighting on West Botany Street and the industrial areas to the north (centre) and west (left).
Sensitivity	Moderate – This view is experienced by concentrations of residents and local recreational users. This park attracts visitor from across the district.	Low – Medium district brightness area with light spill and skyglow from adjacent infrastructure and facilities.
Construction - Magnitude	High – The President Avenue construction ancillary facility and construction of the cut-and-cover structures would extend across the middle ground of this view. The playground (centre of view) would be demolished and converted into a site car park. All trees to the north (centre) and east (right) of the park would be removed, opening up views to the existing industrial development in the background. The car park in the foreground of view would remain.	Moderate – Security lighting and night works at the President Avenue construction ancillary facility would increase the intensity of lighting in this view. Although this lighting would contrast to the adjacent dark parkland setting, it would be seen in context of the brightly lit industrial and commercial areas on West Botany Street, and the Ilinden Sports Centre (behind viewer).
Impact level	High-moderate visual impact	Moderate-low visual impact
Operation - Magnitude	Low – The tunnel would be underground and out of view. The park would be reinstated and new vegetation would be seen, including trees around the perimeter of the park, which would mature over time and further screen views to the adjacent developed areas. The new shared pedestrian and cycle pathway would also be visible, to the right of the view, and slightly raised on an embankment.	Low – The parkland would be reinstated, including low level security lighting. Lighting along the Shared pedestrian and cycle pathway would be a new source of light in this view, adding new light sources and some sky glow.
Impact level	Moderate-low visual impact	Low visual impact

Viewpoint 5: View south from Rockdale Bicentennial Park

Figure 8-5 Viewpoint 5 – View south from Rockdale Bicentennial Park

Table 8-6 Viewpoint 5 – Detailed impact assessment

	Daytime	Night time
Existing condition	This view to the wetlands includes mature trees, scenic lagoons and islands. The landform rises to the west (right) to the Ilinden Sports Centre (out of view). The traffic on President Avenue is screened by the vegetation within the parkland and along banks of the wetland.	This part of Rockdale Bicentennial Park is not lit at night, however, the light from adjacent floodlights at Ilinden Sports Centre as well as the street lights and lights of vehicles travelling along President Avenue illuminate this view. The light spill and sky glow is contained somewhat by vegetation within the parkland and wetland.
Sensitivity	Moderate – This view is experienced by concentrations of residents and local recreational users. This park attracts visitor from across the district.	Low – Medium district brightness area with light spill and skyglow from adjacent infrastructure and facilities.
Construction - Magnitude	High – Work to construct the shared pedestrian and cycle pathway would extend across this view and would include the removal of the vegetation along the western edge of the wetland (left) and along President Avenue (centre of view). This would open up views to the President Avenue widening works in the background. Cranes, large plant and major earthworks to create embankments for the pedestrian and cycle pathway would be seen as the bridge structure over President Avenue is constructed. East of the view (left) the wetland would be temporarily diverted and the President Avenue construction ancillary facility would be visible in the background.	High – Security lighting at the President Avenue construction ancillary facility, and works to construct the Shared pedestrian and cycle pathway would introduce new light sources into this view, contrasting with the adjacent dark parkland setting. This additional lighting would alter the level of sky glow and light would trespass in this view.
Impact level	High-moderate visual impact	Moderate visual impact
Operation – Magnitude	Moderate – The shared pedestrian and cycle pathway would be in the centre of this view, raised on embankment and linking to a bridge structure over President Avenue. President Avenue would have been widened and raised by approximately three metres on an embankment, with culverts at the wetland crossing. The wetlands would be reinstated, however, the area of vegetation would be reduced and the trees would be less mature, so that open views to the President Avenue intersection and the new road structures would be possible, and filtered through trees over time.	Moderate – The shared pedestrian and cycle pathway would be lit, a new source of light in this view, contrasting with the adjacent dark parkland setting. Lighting from President Avenue, the President Avenue intersection, and the tunnel entry and exit ramps would introduce both direct light sources and increase the sky glow. This lighting would be filtered by streetscape, wetland and parkland vegetation, an effect that would increase as this vegetation matures.
Impact level	Moderate visual impact	Moderate-low visual impact

Viewpoint 6: View south from the Rockdale Bicentennial Park East

Figure 8-6 Viewpoint 6 – View south from the Rockdale Bicentennial Park East

Table 8-7 Viewpoint 6 – Detailed impact assessment

	Daytime	Night time
Existing conditions	View south from the Rockdale Bicentennial Park East towards President Avenue across a flat area of open space. Traffic travelling east/west along the dual lanes of President Avenue is visible in the centre of view, beyond the fields. To the left of view, there are views filtered through vegetation, to a group of six detached dwellings. The heritage listed Patmore Swamp within Scarborough Park can be seen south of President Avenue, in the background of the view.	Low - The street lights and lights of vehicles travelling along President Avenue are the main light source in an otherwise dark recreational landscape. Views of light from adjacent residential areas of Brighton-Le-Sands and Kogarah is reduced by mature garden vegetation and trees within the adjacent parkland.
Sensitivity	Moderate - This view is experienced by concentrations of residents and local recreational users. This park attracts visitor from across the district.	Low - Medium district brightness area with light spill and skyglow from adjacent infrastructure and facilities.
Construction - Magnitude	High – Establishment of the President Avenue construction ancillary facility and construction of the President Avenue intersection would be the focus of this view. The row of houses west of O'Neill Street and adjacent vegetation (left of view) would be removed to widen President Avenue and install a temporary site office and car park. Rockdale Bicentennial Park East in the foreground of view would be converted into a worksite for construction of the President Avenue intersection surface works, tunnel entry, exit ramps and portal. All trees within the Rockdale Bicentennial Park seen in this view, would be removed. Construction of a temporary water treatment facility and temporary stockpiling of spoil and fill materials would be visible.	High – Security lighting at the President Avenue construction ancillary facility would be a new source of light in this view, contrasting with the adjacent dark parkland setting. Lighting would be directed away from adjacent properties, however there would be new light sources seen within this view, altering the level of sky glow in this view.
Impact level	High-moderate visual impact	Moderate visual impact
Operation - Magnitude	Low – The President Avenue intersection would be the focus of this view. It would be raised on embankment and include a new signalised intersection. The tunnel entry and exit lanes, ramps and portal would be oriented away from the view, and concealed by vegetation. Open space in the foreground would be reinstated for recreational use. Vegetation would be established along the north and eastern edge of the intersection to screen views. This screening effect would increase as this vegetation matures.	Moderate – Lighting at the President Avenue intersection, and tunnel entry and exit ramps would be new sources of light in this view, and adding to the sky glow visible. This light would be somewhat screened by intervening vegetation, an effect that would increase as this vegetation matures.
Impact level	Moderate-low visual impact	Moderate-low visual impact

Viewpoint 7: View south from Brighton-Le-Sands Public School

Figure 8-7 Viewpoint 7 – View south from Brighton-Le-Sands Public School

Table 8-8 Viewpoint 7 – Detailed impact assessment

	Daytime	Night time
Description of view	View to flat open space and sports fields with water tanks, fencing and field lighting. A dense corridor of vegetation can be seen in the centre of view, obstructing views to the clubhouse, spectator seating stand and President Avenue. To the east (left) several detached dwellings on O-Neil Street are visible. In the background a further corridor of dense vegetation obstructs westerly views to the Rockdale Wetlands and parkland beyond.	The main light sources in this view are the floodlights at the Brighton Memorial Playing Fields and Ilinden Sports Centre football field, as well as adjacent residential areas of Brighton-Le-Sands. Sky glow from the commercial areas of Kogarah, including St George Private Hospital, are visible in the background of view, contributing to a general sky glow.
Sensitivity	Moderate - This view is experienced by concentrations of residents and local recreational users. This park attracts visitor from across the district and the school is heritage listed.	Low - Medium district brightness area with light spill and skyglow from adjacent infrastructure and facilities.
Construction - Magnitude	Moderate – Rockdale Bicentennial Park East, the clubhouse building, rainwater tanks and perimeter vegetation, seen in the fore and middle ground of this view would be retained. Beyond these structures, the President Avenue construction ancillary facility would be established. This would include the clearing of vegetation within Rockdale Bicentennial Park, to the south (centre and left of view). Major earthworks, cut-and-cover excavation, tunnelling support, and roadworks would be located in the middle to background of the view. Temporary stockpiling of spoil and fill materials may also be seen at Rockdale Bicentennial Park East.	Moderate – Security lighting at the President Avenue construction ancillary facility would be a new source of light in this view, contrasting with the adjacent dark parkland setting. Although the site fencing and hoarding would help reduce the spill into the adjacent parkland and residences, the additional lighting would alter the level of sky glow and light trespass in this view.
Impact level	Moderate visual impact	Moderate-low visual impact
Operation - Magnitude	Low – The new tunnel portal would be oriented away from the view, and located beyond the rain water tanks. Intervening existing and new vegetation would screen the entry and exit ramps extending towards the President Avenue intersection, New vegetation would be planted, visually integrating and softening the appearance of any visible new road structures over time as this vegetation matures.	Low – Flood lights over the Brighton Memorial Playing Fields would be reinstated. Lighting at the tunnel portal and entry/exit ramps would be new sources of light in this view, adding to the sky glow. This lighting would be filtered through intervening vegetation, which would screen views over time as it matures.
Impact level	Moderate-low visual impact	Low visual impact

Viewpoint 8: View north from Colson Crescent

Figure 8-8 Viewpoint 8 – View north from Colson Crescent

Table 8-9 Viewpoint 8 – Detailed impact assessment

	Daytime	Night time
Existing condition	The topography is low lying and flat allowing views across a President Avenue and towards Rockdale Bicentennial Park. Traffic travelling east to west along the dual lanes of President Avenue are visible in the centre of view, filtered through street trees and vegetation within the parkland and wetlands. There are filtered views to a group of houses located on President Avenue (right). The heritage listed Patmore Swamp can be seen to the west (left).	The street lights and lights of vehicles travelling along President Avenue are the main light sources in this view. In the background there is skyglow from the distant commercial area and flood lights from the sporting fields. The light from the adjacent residential areas of Brighton-Le-Sands and Kogarah also adds light to this view.
Sensitivity	Low - This view is experienced by a small number of residential properties and local recreational users.	Low - Medium district brightness area with light spill and skyglow from adjacent residential areas, roads and recreational facilities.
Construction - Magnitude	High – The President Avenue construction ancillary facility and President Avenue upgrade works would extend across a large part of this view. Visible elements would include activity to widen President Avenue, demolition of the houses along the northern side of the road (right of view), establishment of the site office, construction of the temporary water treatment plant and car park, removal of street and parkland trees, major earthworks and road construction activities. Temporary stockpiling of spoil and fill materials may also be seen to the north of President Avenue, as would construction vehicles entering and exiting the site. Construction of the shared pedestrian and cycle bridge would also be visible across President Avenue, including ramped approaches.	Moderate – Security lighting at the President Avenue construction ancillary facility would be a new source of light in this view, contrasting with the adjacent dark parkland setting. Although lighting would be directed to avoid direct light spill on adjacent parkland and residences, the additional lighting would alter the level of sky glow and new visible light sources in this view.
Impact level	Moderate visual impact	Moderate-low visual impact
Operation - Magnitude	Moderate – The President Avenue intersection would be prominent in this view, raised on embankment by approximately three metres and including a new signalised intersection and gantry signage. President Avenue would also be widened to three lanes in each direction, with additional turning lanes. The shared pedestrian and cycle bridge would also be a new feature in this view, west of the intersection. New planting would aim to visually integrate the works into the surrounding open space.	Moderate – The President Avenue intersection would be a new source of light in this view, particularly the new signalised intersection and lighting along the entry and exit ramps extending from the tunnel portal. The shared pedestrian and cycle bridge and its approached would also be lit. This additional lighting would alter the level of sky glow and light trespass in this view.
Impact level	Moderate-low visual impact	Moderate-low visual impact

Viewpoint 9: View northeast from President Avenue

Figure 8-9 Viewpoint 9 – View northeast from President Avenue

Table 8-10 Viewpoint 9 – Detailed impact assessment

	Daytime	Night time
Existing condition	View across four lanes wide road to the Rockdale Wetlands. Views into the parkland are enclosed by dense vegetation. Residential properties with intermittent street trees and overhead powerlines can be seen in the background.	The street lights and lights of vehicles travelling along President Avenue are the main light source in this view. The light from adjacent residential areas of Brighton-Le-Sands are also be visible. Sky glow from the flood lights of the Brighton Memorial Playing Fields can be seen beyond the trees.
Sensitivity	Moderate - This view is experienced by a large number of road users, and includes views to open space to the north and south of the road which is a local visual feature.	Low - Medium district brightness area with light spill and skyglow from the roadway, adjacent and recreational facilities.
Construction - Magnitude	High – The removal of the mature vegetation within the park and demolition of residential properties on President Avenue would be seen in the middle ground of this view. The President Avenue construction ancillary facility (C3) would be established on this site. It would contain a water treatment plant, car parking area and the cut-and-cover tunnelling works. Construction traffic and activity along President Avenue and the intersection would also be visible including vegetation clearing and removal of street trees, installation of culverts, and earthworks to raise the road corridor (3 metres). The entire fore and middle ground of this view would be affected.	Moderate – Night work within the construction ancillary facility would be lit at night including lighting of the carpark, laydown areas and cut- and -cover works area. This lighting would be cut off to reduce direct light spill on adjacent residential properties. These works would be seen in the context of lighting on the fields beyond, and to the west at the Ilinden Sports Centre. Lighting at the President Avenue construction ancillary facility would also add to the sky glow.
Impact level	High-moderate visual impact	Moderate-low visual impact
Operation - Magnitude	High –The President Avenue intersection would be visible in the centre of the view, including additional lanes, entry and exit ramps, and the tunnel portal. There would be new lighting, traffic signals and gantry signage. New street and parkland vegetation would assist in visually integrating this infrastructure into the open space setting as it matures over time.	Moderate – The signalised intersection at the President Avenue intersection and additional lighting along President Avenue would increase the direct light sources across the view, and create a general sky glow. Sports field lighting would be reinstated to the background of the view. Street trees surrounding the intersection would filter views to this light, with this effect increasing over time as the trees mature.
Impact level	High-moderate visual impact	Moderate-low visual impact

Viewpoint 10: View east from Civic Avenue

Figure 8-10 Viewpoint 10 – View east from Civic Avenue

Table 8-11 Viewpoint 10 - Impact assessment table

	Daytime	Night time
Existing condition	The topography is low lying and flat, allowing expansive views across the Rockdale and Scarborough Wetlands. This view includes the heritage listed Patmore Swamp in the foreground. Traffic travelling along President Avenue are glimpsed through street trees and vegetation within the parkland and wetlands, leaving only the upper parts of the street lights visible. Vegetation in the distant background of view within the of Rockdale Bicentennial Park and Rockdale Bicentennial Park East can also be seen.	The street lights and lights of vehicles travelling along President Avenue and Civic Avenue is the main light source in this view. The light from adjacent residential areas of Kogarah is also visible. The flood lights of the Brighton Memorial Playing Fields create a sky glow in the distance, above the vegetation within the parkland.
Sensitivity	Low - This view is experienced by a small number of residential properties and local recreational users.	Low - Medium district brightness area with light spill and skyglow from adjacent residential areas and roads.
Construction - Magnitude	Moderate – Construction of the shared pedestrian and cycle pathway through Scarborough Park would be visually prominent, extending south on a viaduct structure from the President Avenue bridge to Civic Avenue. The mature street trees along Civic Avenue would be unaffected. Construction activity along President Avenue, including the intersection, would also be visible in the distant background.	Moderate – There would be at construction sites along the shared pedestrian and cycle pathway. The President Avenue construction ancillary facility would also add to the sky glow in the background. This would contrast with the darker parkland setting.
Impact level	Moderate-low visual impact	Moderate-low visual impact
Operation - Magnitude	Low – The shared pedestrian and cycle pathway would be a new feature in this view. The viaduct structure would be visually integrated into the open space setting with new plantings. The President Avenue intersection would be visible beyond the corridor, including on the road on a raised embankment.	Low – Security lighting along the shared pedestrian and cycle pathway would be a new source of light in this view, contrasting with the dark parkland setting. The signalised intersection at the President Avenue intersection would also be seen in the background of this view. Street trees and vegetation along President Avenue and within the park would filter views to the lighting over time as it matures. However, there would be an overall increase in the lighting seen in this view.
Impact level	Low visual impact	Low visual impact

Viewpoint 11: View east from President Avenue retail area

Figure 8-11 Viewpoint 11 – View east from President Avenue retail area

Table 8-12 Viewpoint 11 - Impact assessment table

	Daytime	Night time
Existing condition	View east along a President Avenue from local shops. President Avenue is six lanes wide, including turning lanes and street parking. The signalised intersection at West Botany Street is visible in the centre of view. Rockdale Bicentennial Park can be seen beyond the intersection, including mature parkland trees, screening views to the Rockdale Wetlands. The avenue is lined by street trees, softening this busy road and providing a visual screen to adjacent residential areas. A high rise residential tower at Grand Parade along the Brighton-Le-Sands foreshore visible in the distant background, rising seven storeys.	This section of Rockdale Bicentennial Park is a dark landscape at night. Elsewhere, the view would be brightly lit, due to the street lighting, six lanes of traffic along President Avenue, retail area and adjacent residential development to the south. Street lights and high rise residential development along the Brighton-Le-Sands foreshore also add to the sky glow in this view.
Sensitivity	Low - This view is experienced by a moderate number of road users and is an important local route.	Low - Medium district brightness area with light spill and skyglow from adjacent busy road, commercial and residential areas.
Construction - Magnitude	Moderate - Construction activity would extend across President Avenue as it is widened and raised, requiring temporary lane diversions and closure or diversion of pedestrian pathways. The shops (right of view) would remain. The President Avenue construction ancillary facility would be located on Rockdale Bicentennial Park, beyond the West Botany Street intersection, replacing the mature trees (left of view). Construction of the shared pedestrian and cycle bridge over President Avenue would be seen in the middle ground of view.	Low – Night works for the widening of President Avenue would increase direct light sources and sky glow in this view. The removal of trees at the West Botany Street intersection would also increase light open up views through the Rockdale Bicentennial Park, to the President Avenue construction ancillary facility (C3).
Impact level	Moderate-low visual impact	Low visual impact
Operation - Magnitude	Low – President Avenue would be raised and widened to have to three lanes in each direction with central median, footpaths, and a new signalised intersection at West Botany Street. The new President Avenue intersection with the F6 Extension Stage 1 entry and exit ramps would be signalised and seen in the middle ground of the view. Subject to consultation with Council streetscape planting would be provided, improving streetscape amenity over time. The shared pedestrian and cycle bridge over President Avenue would be seen in the centre of view.	Low – The level of street lighting along President Avenue would be similar to the existing streetscape. The shared pedestrian and cycle bridge would be a newly lit feature, adding light sources and sky glow to the view.
Impact level	Low visual impact	Low visual impact

Viewpoint 12: View west along President Avenue at Lachal Avenue

Figure 8-12 Viewpoint 12 – View west along President Avenue at Lachal Avenue

Table 8-13 Viewpoint 12 – Detailed impact assessment

	Daytime	Night time
Existing condition	View west along President Avenue adjacent to residential properties in Kogarah. The view includes mid-century single storey red brick detached bungalows and cottages, with houses set well back from the road by open front gardens and low brick walls along property boundaries and open front gardens, are visible to the south (left of view). Several low rise apartment buildings (up to three storeys) can be seen through the street trees to the north (right of view). President Avenue is six lanes, with street parking in this section. A signalised intersection at the Princes Highway is visible in the centre background of view. Existing street trees, particularly along the northern side of the road, soften this busy road and filter views from adjacent residences.	President Avenue is brightly lit, due to the street lighting, six lanes of traffic and adjacent residential development. Street lights and high rise residential development along the Princes Highway also add to the sky glow in this view.
Sensitivity	Low - This view is experienced by a moderate number of road users and is an important local route.	Low - Medium district brightness area with light spill and skyglow from adjacent busy road, commercial and residential areas.
Construction - Magnitude	Moderate – Works to widen President Avenue would be prominent in this view, including temporary lane diversions, closure or diversion of pedestrian pathways and removal of several mature street trees. This vegetation removal would open up views to the works at the President Avenue and Princes Highway intersection. Construction activity would be seen along the entire length of President Avenue including the Princes Highway intersection.	Moderate – Night works to widen President Avenue would increase the level of lighting and skyglow in this view. Removal of street trees would also increase light trespass onto adjacent properties.
Impact level	Moderate-low visual impact	Moderate-low visual impact
Operation - Magnitude	Low – President Avenue would be widened, to include three lanes in each direction and a central median for turning lanes. There would be a reduced verge width and new street trees located where space allows on President Avenue (subject to consultation with Council). The new street trees would provide some filtering and softening of views increasing as they mature over time.	Low – Although the level of street lighting would be similar to the existing streetscape, the widening of President Avenue corridor would reduce the width of the verge, bringing the lighting of traffic and street lights closer to adjacent properties. Street trees would be installed (subject to consultation with Council), providing a visual buffer to adjacent properties over time.
Impact level	Low visual impact	Low visual impact

Viewpoint 13: View east along President Avenue from the Princes Highway

Figure 8-13 Viewpoint 13 – View east along President Avenue from the Princes Highway

Table 8-14 Viewpoint 13 – Detailed impact assessment

	Daytime	Night time
Existing condition	View west along a President Avenue from the Princes Highway signalised intersection. The topography is generally flat, dropping slightly at the Rockdale and Scarborough Wetlands, seen in the background. President Avenue is five to six lanes at this point, with turning lanes and on-street parking. TAFE NSW St George College is visible to the south (right of view), with a service station to the north (left). A three storey residential building can be seen adjacent to the service station. Beyond this, street and garden trees screen views to the buildings either side of the road, softening this intense urban environment. The Brighton-Le-Sands foreshore can be seen in the distance, in the centre of the view.	The Princes Highway and President Avenue is brightly lit, due to the street lighting, traffic and adjacent commercial, educational and residential development. Street lights and high rise residential development along the Brighton-Le-Sands foreshore in the background, also add to the sky glow in this view.
Sensitivity	Low - This view is experienced by a moderate number of road users and is an important local route.	Low - Medium district brightness area with light spill and skyglow from adjacent busy roads, commercial area and institutions.
Construction - Magnitude	**High** – The President Avenue and Princes Highway intersection upgrade works would be prominent in this view, including the Princes Highway construction ancillary facility (C6) in place of the service station and diversion of vehicular and pedestrian traffic to widen the intersection. Several mature street trees on the northern side of President Avenue (left of view) would be removed for the widening of the road. The TAFE, including mature trees (right of view), would also be removed. Construction activity would be seen along the entire stretch of President Avenue up to the construction ancillary facility, located at Rockdale Bicentennial Park.	Moderate – The President Avenue and Princes Highway intersection, and along President Avenue to the construction ancillary facility at Rockdale Bicentennial Park, would be lit at night for construction and traffic safety. The removal of street trees would open up views to the lights at adjacent institutions, residential and commercial properties.
Impact level	Moderate visual impact	Moderate-low visual impact
Operation - Magnitude	Low – The President Avenue and Princes Highway intersection would include additional turning lanes. President Avenue would be widened, to include three lanes in each direction with central median. Street streets along the northern side of President Avenue would have been removed and not replaced (in consultation with Council). The shared pedestrian and cycle bridge over President Avenue would also be seen in the middle ground, between Rockdale Bicentennial and Scarborough Parks, adding to the built character of this view.	Low – Although President Avenue and the Princes Highway would be widened, the level of lighting would be very similar to the existing streetscapes. Street trees would also be installed [in consultation with Council], providing a visual buffer to adjacent properties over time.
Impact level	Low visual impact	Low visual impact

Viewpoint 14: View north from West Botany Street

Figure 8-14 Viewpoint 14 – View north from West Botany Street

Table 8-15 Viewpoint 14 – Detailed impact assessment

	Daytime	Night time
Existing condition	View north along West Botany Street towards President Avenue. To the west (left of view), the built form consists of single and double storey light industrial and retail buildings. A group of three mature Hoop Pine trees near the corner of French Street (centre of view) provide a visual feature in views along this street. Rockdale Bicentennial Park can be seen to the east (right of view), street trees and lawn area rising to a public car park, skate park and playground.	The main light sources in this view are the street lights and traffic along West Botany Street and security lighting from the adjacent industrial precinct. Lighting at the skate park and the flood lights at Ilinden Sports Centre are also be major light sources, when used at night time for matches and training.
Sensitivity	Low - This view is experienced by a moderate number of road users and is an important local route.	Low - Medium district brightness area with light spill and skyglow from adjacent busy road, commercial area and sports facility.
Construction - Magnitude	High – A row of commercial buildings on west side of West Botany Street (centre, background of view) would be demolished to construct the ventilation facility. The mature Hoop Pine trees would be retained. The President Avenue construction ancillary facility would be established at the Rockdale Bicentennial Park (right of view). West Botany Street would be temporarily diverted through the park. The clearing and removal of parkland vegetation, establishment of a worksite car park and construction of the cut-and-cover structures would also be visible. Movement of vehicles carrying spoil from the site along West Botany Street would be prominent in this view.	Moderate - There would be several new sources of light in this view. There would be security lighting at the construction ancillary facility and ventilation facility site, and at the temporary traffic diversion of West Botany Street through Rockdale Bicentennial Park. This additional lighting would alter the level of sky glow and light trespass in this view.
Impact level	Moderate visual impact	Moderate-low visual impact
Operation - Magnitude	Low - The park (right) would be restored to open space. West Botany Street would be reinstated to its current alignment. The built form and massing of the ventilation facility would be substantially larger than the existing built form. An outlet would rise 35 metres above the road level. The outlet would be set back from the road, reducing its scale somewhat. The outlet would be compatible and visually absorbed into the surrounding commercial and light industrial precinct.	Negligible - Additional light sources would include security lighting for the ventilation facility and adjacent car park. Security lighting through Rockdale Bicentennial Park would also be reinstated, resulting very little change to the level of sky glow, glare or light trespass.
Impact level	Low visual impact	Negligible visual impact

Viewpoint 15: View east from West Botany Street to Roads and Maritime depot

Figure 8-15 Viewpoint 15 – View east from West Botany Street to Roads and Maritime depot

Table 8-16 Viewpoint 15 – Detailed impact assessment

	Daytime	Night time
Existing condition	Existing residential, commercial and retail properties along Bay Street and West Botany Street, partially enclose the view, concealing the depot from the street. The depot visible in the background of this view and includes vehicle parking. There are several mature trees along the depot site perimeter, including a large Hoop Pine tree (left of view) along the western property boundary.	The main light sources in this view is the depot security lighting, and skyglow from the street lights and vehicular traffic lights along West Botany Street behind the viewer. Lighting within the adjacent residential, commercial and retail properties are also visible.
Sensitivity	Low – private access road used by Roads and Maritime vehicles only, within an industrial area.	Low – Medium district brightness area with light spill and skyglow from adjacent busy road, commercial and residential areas.
Construction - Magnitude	Low – The Rockdale construction ancillary facility (C2) would be established in the background of this view. All vegetation within the depot would be removed, and construction vehicles would be seen entering/exiting the site via the depot entrance road at West Botany Street (centre of view).	Negligible – Additional light sources would include security lighting for the construction ancillary facility, resulting very little change to the level of sky glow, glare or light trespass.
Impact level	Low visual impact	Negligible
Operation - Magnitude	Low – Facilities within the operational motorway control centre would be seen in the background of this view. These would include a control centre building and adjacent staff car park, pump station and deluge tanks, maintenance facility, storage building and yard. The built form and scale of these elements would be visually compatible with its commercial and light industrial setting. The loss of mature tree cover would reduce the amenity of this view.	Negligible - Additional light sources would include security lighting for the operational motorway control centre and entrance road, resulting very little change to the level of sky glow, glare or light trespass.
Impact level	Low visual impact	Negligible visual impact

8.2.2 Summary of visual impacts

Views to the Rockdale Bicentennial and Scarborough Parks

Impacts during construction

During construction, a large part of Rockdale Bicentennial Park would be used for the President Avenue construction ancillary facility (C3), substantially altering views to and from the park (refer to **Figure 8-16**).

From the Ilinden Sports Centre there would be elevated, northerly views to the President Avenue construction ancillary facility (C3). These views would include major excavation for the cut-and-cover tunnel (refer viewpoint 4 as shown in **Figure 8-4**). This would be a high magnitude of change to a low sensitivity, resulting in **high-moderate** visual impact.

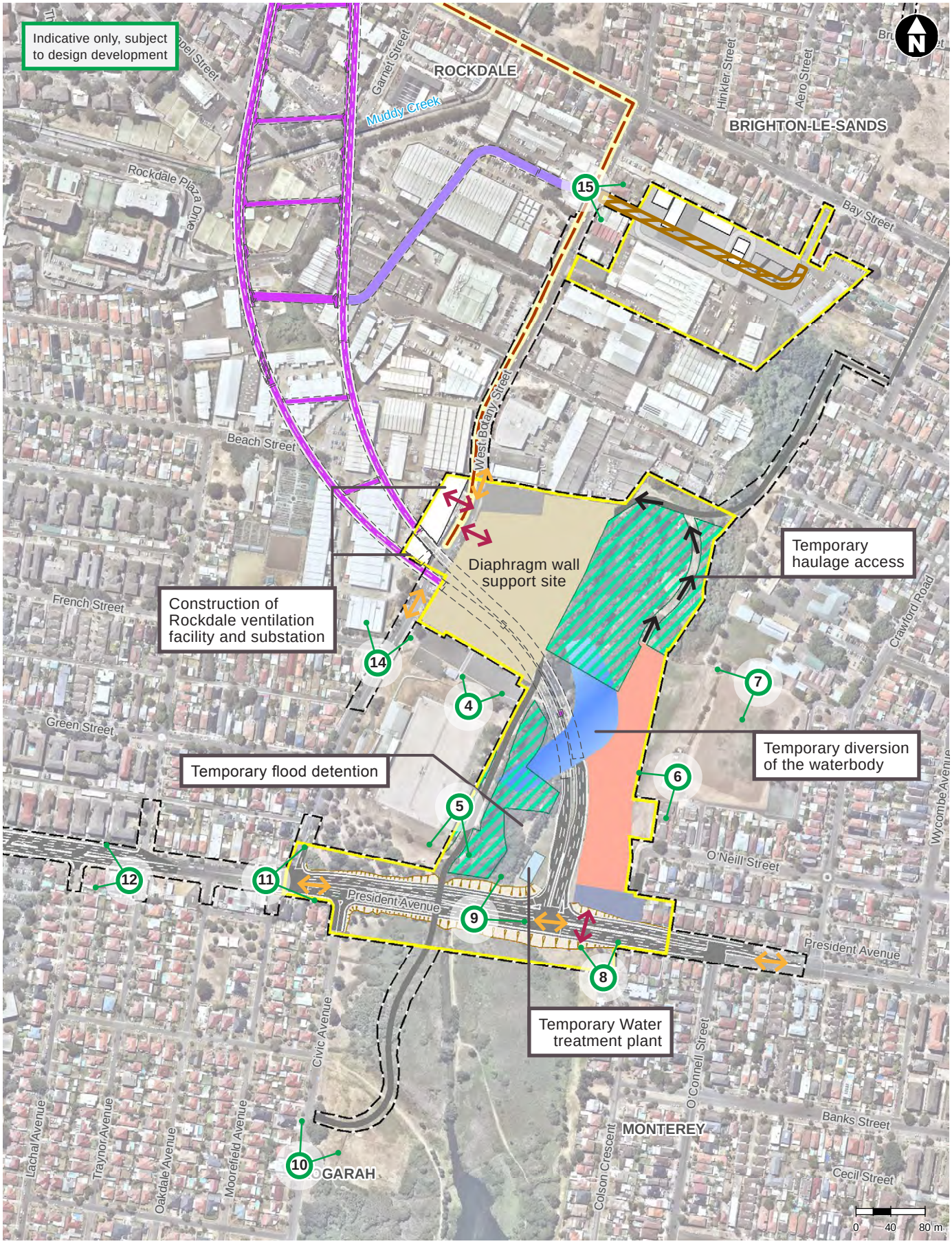
There would also be views southeast from the Illinden Sports Centre towards the site (refer Viewpoint 5 as shown in **Figure 8-5**). This view would include substantial earthworks, large plant and equipment for construction of the shared pedestrian and cycle bridge, the entry and exit ramp tunnels, President Avenue intersection, drainage works and road widening works on President Avenue. This view would experience a high magnitude of change, and is of moderate sensitivity, resulting in a **high-moderate** visual impact during construction.

There would be views to the construction ancillary facility (C3) from Rockdale Bicentennial Park East and nearby residences on O'Neill Street, Sybil Lane and Colson Crescent. (refer Viewpoint 6 as shown **in Figure 8-6**) The demolition of several houses on O'Neill Street and President Avenue would be seen in this view, and open-up views to the removal of vegetation, establishment of the ancillary facility, and the construction of the President Avenue intersection, tunnel entry and exit ramps within the construction ancillary facility. Construction of the shared pedestrian and cycle bridge over President Avenue would also be seen, rising above the site in the background of these views. This view is of moderate sensitivity and would experience a high magnitude of change, resulting in **high-moderate** visual impact.

Views southwest from Rockdale Bicentennial Park East, adjacent to the Brighton-Le-Sands Public School, would include the construction ancillary facility (C3) in the background (refer to Viewpoint 7 as shown in **Figure 8-7**). The construction site would be partly screened by intervening vegetation, including existing vegetation along Rockdale Bicentennial Park East. Some existing vegetation along the wetlands to the west (right) would also be retained. This vegetation would obstruct views to construction works in the Rockdale Bicentennial Park and the Rockdale ventilation facility on West Botany Street. This would result in a moderate magnitude of change to views which are of moderate sensitivity and a **moderate** visual impact.

Views from within Scarborough Park North, and adjacent residential areas such as Colson Crescent, to the east in Brighton-Le-Sands, would have close proximity views to construction activity (refer Viewpoint 8 as shown in **Figure 8-8**). This would include works to widen President Avenue, construct the shared pedestrian and cycle bridge and President Avenue intersection in the fore and middle ground of views. In the background of this view, works at the construction ancillary facility (C3) within the Rockdale Bicentennial Park would also be seen. This work would extend across much of the view, resulting in a high magnitude of change, to the view from Colson Crescent, which is of low sensitivity and a **moderate** visual impact.

Views north and east from Civic Avenue, to Scarborough Park North, would include works to construct the shared pedestrian and cycle bridge and widen President Avenue. (refer Viewpoint 10 as shown in **Figure 8-10**). This would include earthworks to raise and widen President Avenue, and build the bridge viaduct structure and approaches. Works to construct the President Avenue intersection and Rockdale construction ancillary facility (C3) would be visible beyond the bridge. These changes would result in a moderate magnitude of change to this view, which is of low sensitivity, and a **moderate-low visual impact** during construction.



LEGEND

- Surface works
- Construction boundary
- Cut-and-cover structures
- Underground construction
- Construction ancillary facility
- Permanent power supply line
- Permanent power supply construction boundary
- Underground construction - Temporary access tunnel
- Carpark
- Spoil shed
- Access route
- Sediment basin
- Soil treatment area
- Carpark and facilities
- Waterbody diversion
- Diaphragm wall support site
- Vehicle access
- View point location
- Vegetation exclusion zone
- Through traffic maintained during construction

Figure 8-16 Rockdale (C2) and President Avenue construction ancillary facility layout (C3) – Viewpoints

Impacts during operation

In views north from Ilinden Sports Centre, the open space of Rockdale Bicentennial Park would have been reinstated to its former use as open space (refer Viewpoint 4 as shown in **Figure 8-4**). Located to the west of West Botany Street, the Rockdale ventilation facility would be visible from this part of the Rockdale Bicentennial Park. Trees along the park edge and along the street would filter views to the facility. Furthermore, the light industrial character and scale of the facility would be visually consistent with the surrounding area of mixed light industrial built form. The ventilation outlet would rise above the surrounding built form, and may be seen rising above the vegetation in views from the western areas of the park. Overall, there would be a low magnitude of change to a moderate sensitivity view, resulting in **moderate-low** visual impact.

In views south from the Rockdale Bicentennial Park in the vicinity of the Ilinden Sports Centre, the new shared pedestrian and cycle bridge over President Avenue would be seen prominently in the fore and middle ground (refer Viewpoint 5 as shown in **Figure 8-5**). In the middle to background, President Avenue would be seen, raised with culverts and widened to include turning lanes into the tunnel. This view would be softened somewhat by wetland planting at the stream crossing. Streetscape planting would be reinstated along this section of President Avenue including street trees and landform modifications and planting to visually integrate the embankments as they mature over time. This would result in a moderate magnitude of change to a moderate sensitivity view, resulting in **moderate** visual impact.

During operation, there would be views to the project from Rockdale Bicentennial Park East (refer Viewpoint 6 as shown in **Figure 8-6**) and adjacent to properties and streets in close proximity to the President Avenue intersection, including Sybil Lane, O'Neill Street and President Lane. The removed houses at the corner of O'Neill Street and President Avenue would create new areas of open space within this view, surrounding the new intersection. The open space surrounding the portal and ramps would be reinstated for recreational use, including sporting fields and parkland and a combined bioretention and stormwater basin would be located to the northeast of the President Avenue intersection. Some areas of mature wetland would not be reinstated to accommodate the new operational road and tunnel. Whilst the intersection would be visible, the tunnel portal would be oriented away from the viewer and therefore not visible. The surrounding parkland would have new tree planting reinstating the trees removed during construction, providing some filtering of the intersection in the short term and maturing over time to screen views of the intersection. The widening of President Avenue and the new shared pedestrian and cycle bridge structure would also be seen in the background of these views. Overall, there would be a low magnitude of change, to views of moderate sensitivity, resulting in **moderate-low visual impact**.

Similarly, in views from the Brighton-Le-Sands Public School the tunnel portal would be oriented away from the viewer. Existing and proposed vegetation within the park would screen views towards the portal. This vegetation would screen the entry and exit tunnels and ramps, and the President Avenue Intersection beyond over time as the vegetation matures. Mature existing vegetation along the wetlands to the west of the school would have been protected and would screen views to the Rockdale ventilation facility on West Botany Street. This would result in a low magnitude of change, to views of moderate sensitivity, and a **moderate-low visual impact** (refer viewpoint 7 as shown in **Figure 8-7**).

Residential properties on Colson Crescent, south of President Avenue, are in close proximity to the site and would have views to the President Avenue intersection and widened President Avenue. The intersection and road would be elevated above the existing landform, and widened with signage and traffic signals, creating a visually dominant feature in these views. The entry and exit ramps leading into the tunnel portal would also be seen in the background. Whilst vegetation on the southern embankment and street trees located along President Avenue would somewhat soften these views, with this effect increasing as the vegetation matures over time, the road infrastructure would be visually prominent. Overall, there would be a moderate magnitude of change, to this view of low sensitivity, resulting in a **moderate-low visual impact** (refer viewpoint 8 as shown in **Figure 8-8**).

Views from Scarborough Park North at the dog exercise park and adjacent residences on Civic Avenue would have views to the new pedestrian and cycle pathway in the fore and middle ground, and the viaduct and bridge over the widened President Avenue, and President Avenue intersection in the background. New planting along the President Avenue streetscape and within Scarborough Park would assist in screening and filtering views to the road corridor and bridge, with the screening effect increasing as the vegetation matures. This would result in a low magnitude of change to views from Civic Avenue and Scarborough Park North, which are of low sensitivity, creating a **low visual impact** during operation (refer to viewpoint 10 as shown in **Figure 8-10**).

Figure 8-17 Existing condition – View west from Brighton-Le-Sands Public School

Figure 8-18 Artist's impression – View west from Brighton-Le-Sands Public School during operation (design is indicative only)

Views along President Avenue and to the Intersection with the Princes Highway

Impacts during construction

In views along President Avenue, alongside the Rockdale Bicentennial and Scarborough parks, (refer to Viewpoint 9 as shown in **Figure 8-9**), elements works to raise and widen the road would be visible including vegetation clearing, temporary site fencing, the closure and the diversion of pedestrian pathways, temporary lane diversions, bulk earthworks, installation of culverts, road construction. Outside the road corridor, the Rockdale construction ancillary facility (C3) would be seen to the north of the road, including the removal of vegetation within the park and demolition of residential properties on President Avenue, a water treatment planting, car parking area and cut-and-cover tunnel activities. Views from President Avenue would experience a moderate magnitude of change, to views of moderate sensitivity, resulting in **high-moderate visual impact** during construction.

In eastward views along President Avenue, west of Rockdale Bicentennial and Scarborough parks, such as from the small retail area west of Moorefield Avenue and nearby residential properties on President Avenue (refer to Viewpoint 11 as shown in **Figure 8-11**). The construction works along this section of President Avenue would be seen in the foreground of the view. In the background, major earthworks to raise the Avenue as it continues through the parks, roadworks and construction of the shared pedestrian and cycle bridge, would be seen obliquely. The mature street trees on the northern and southern side of President Avenue would be removed, opening up views into the park and to other construction activities. This view would experience a moderate magnitude of change, to views which are of low sensitivity, resulting in **moderate-low visual impact**.

In westward views along President Avenue, such as in the vicinity of Lachal Avenue (refer to Viewpoint 12 as shown in **Figure 8-12**). The construction works along this section of President Avenue would be seen in the foreground of the view. This would include the removal of mature street trees, opening up views into adjacent residential areas, and views over the roadworks. This view would experience a moderate magnitude of change, to views which are of low sensitivity, resulting in **moderate-low visual impact**.

During construction there would be views to the President Avenue and Princes Highway intersection upgrade works from the adjacent streets and residential properties. This would include views from elevated apartments and offices, the TAFE campus, St George Private Hospital, and the apartment building directly opposite President Avenue (79-87 Princes Highway). The service station on the north eastern corner of the President Avenue and Princes Highway intersection would be removed and the Princes Highway construction ancillary facility (C6) would be seen in its place. The diversion of vehicular and pedestrian traffic to widen the intersection would also be prominent. Elevated views along the entire length of President Avenue would include the construction ancillary facility, located at Rockdale Bicentennial Park in the background of views. This view (refer to Viewpoint 13 as shown in **Figure 8-13**) would experience a high magnitude of change, to views which are of low sensitivity, resulting in **moderate visual impact**.

Impacts during operation

In views along President Avenue, alongside the Rockdale Bicentennial and Scarborough parks, (refer to Viewpoint 9 as shown in **Figure 8-9**), the intersection and the entry and exit ramps would be seen unobstructed in the middle and foreground, set within parkland and screen planting. This view would be transformed by the new intersection, additional lanes and new level of the road, raised above the surrounding parkland. The character of the road would be intensified with the introduction of a wide intersection with signals, lighting and signage. The character of the upgraded road and new intersection would contrast with the surrounding open space context. This would result in a high magnitude of change, within this view of moderate sensitivity, and a **high-moderate visual impact**.

In eastward views along President Avenue, west of Rockdale Bicentennial and Scarborough parks, such as from the small retail area west of Moorefield Avenue and nearby residential properties on President Avenue (refer viewpoint 11 as shown in **Figure 8-11**). President Avenue would be a wider corridor in these views, with the road raised above the surrounding parkland. The character of the road would be intensified with the introduction of a wide intersection with signals, lighting and signage and the cycle and pedestrian bridge in the background, increased vehicular traffic. This view would experience a low magnitude of change, to views which are of low sensitivity, resulting in **low visual impact**.

In westward views along President Avenue, such as in the vicinity of Lachal Avenue (refer to Viewpoint 12 as shown in **Figure 8-12**). The wider President Avenue road corridor would be seen in the foreground of the view. New tree planting would be provided where space allows, and would provide some visual relief as it matures over time, to the increased intensity of the road infrastructure in this view. Overall, in this view there would be a low magnitude of change, to a view which is of low sensitivity, resulting in **low visual impact** during operation.

Figure 8-19 Existing condition – View west along President Avenue

Figure 8-20 Artist's impression – View west along President Avenue during operation (design is indicative only)

The new President Avenue and Princes Highway intersection would be seen connecting to the widened President Avenue road corridor (refer to Viewpoint 13 as shown in **Figure 8-13**). The intersection would include additional turning lanes and an expanded footprint, visually dominating views from adjacent footpaths. Elevated apartments and offices in the apartment building directly opposite President Avenue (79-87 Princes Highway) would experience elevated views over the intersection and along the widened President Avenue. In the background of this view would be the shared pedestrian and cycle pathway bridge between Rockdale Bicentennial and Scarborough parks, and President Avenue intersection beyond. New streetscape planting would provide some visual softening, but the wide road corridor would remain a visually dominant element. Views in close proximity to the intersection, and from elevated residential properties facing President Avenue, would experience a low magnitude of change, within a zone of low sensitivity, resulting in **low visual impact**.

Views from West Botany Street to the Rockdale ventilation facility and the Rockdale Motorway Control Centre

Impacts during construction

Views to the Rockdale ventilation facility site, from West Botany Street, would be transformed as it is diverted west into the construction site (refer to Viewpoint 14 as shown in **Figure 8-14**). To the east (left) the view would include major construction activities, vehicles and plant associated with the cut-and-cover tunnelling works. To the west (left), the demolition of a row of commercial buildings (seven properties in total) and construction of the ventilation facility (approximately 35 metres tall) and substation would be prominent in views from West Botany Street and adjacent properties. This would result in a high magnitude of change, in views from West Botany Street and surrounding commercial areas which are of low visual sensitivity, resulting in **moderate visual impact**.

To the north of the study area, the Rockdale Operational Motorway Control Centre construction site would be visible from West Botany Street and adjacent residential properties, hotels, warehouses and commercial buildings (refer to **Figure 8-21** and Viewpoint 15 as shown in **Figure 8-15**). Works would include the removal of several mature trees and construction of several buildings. From West Botany Street to the Roads and Maritime maintenance depot there would be a low magnitude of change. This is a view of low sensitivity, and this would result in a **low visual impact**.

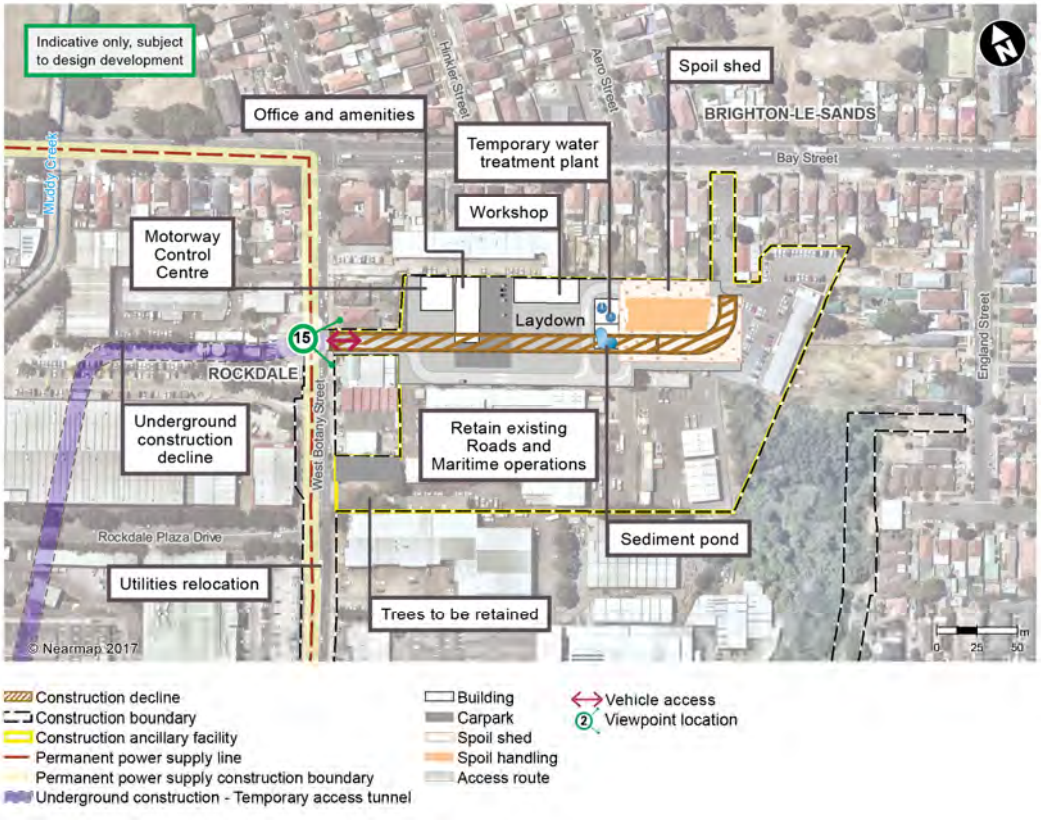


Figure 8-21 Rockdale Motorway Control Centre layout during construction (Rockdale construction ancillary facility – C2)

Figure 8-22 Existing condition – View north along West Botany Street

Figure 8-23 Artist's impression – View north along West Botany Street during operation (design is indicative only)

Impacts during operation

The cut-and-cover structures through Rockdale Bicentennial Park would be restored to open space and West Botany Street would also have been reinstated. The Rockdale ventilation facility would be seen from West Botany Street, filtered by new street trees along the western verge (subject to consultation with Council). The built form and massing of the ventilation facility would be compatible and visually absorbed into the surrounding commercial and light industrial precinct (refer to Viewpoint 14 as shown in **Figure 8-14**, **Figure 8-22** and **Figure 8-23**). Overall, views from West Botany Street towards the Operational Motorway Control Centre would experience a low magnitude of change, to views which are of low sensitivity, resulting in **low visual impact**.

Views to the Rockdale Operational Motorway Control Centre would be limited by the surrounding large scale buildings and flat terrain. The character of this complex would be compatible with the surrounding built form and readily absorbed into views. (refer to Viewpoint 15 as shown in **Figure 8-15**)This would result in a low magnitude of change, within a view of low sensitivity, and a low visual impact.

Views at night

Existing conditions and sensitivity

The Princes Highway, President Avenue and West Botany Street area are brightly lit areas with street lighting, the service station and commercial properties. This setting is surrounded by lower levels of lighting in the adjacent suburban areas. Areas of open space and surrounding residential areas of Kogarah and Brighton-Le-Sands would have lower lighting levels with streetlights, lights from residential properties and lit sporting fields. Overall, the setting of the southern (President Avenue) works area at night is of **low sensitivity**.

Impacts during construction

Night works would be required within Rockdale Bicentennial Park at the President Avenue construction ancillary facility (C3) and to construct the President Avenue intersection and upgrade President Avenue. Lighting would be directed to minimise light spill into the park and trespass on adjacent private property. However, there would be direct light sources and a general sky glow seen from nearby residential properties and local roads. This includes properties on O'Neill Street and President Lane to the east and Colson Crescent to the southeast. This would result in a moderate magnitude of change, to views of low sensitivity, resulting in a **moderate-low visual impact** at night.

Construction of the shared pedestrian and cycle bridge at President Avenue would also include night works. This activity and lighting would be elevated above President Avenue and would therefore have the potential to be seen from a greater distance, with a greater opportunity for light spill. There would be views to this lighting to from residential properties on Civic Avenue and properties along President Avenue, west of the park, in the middle and background of views. There would be some filtering from trees in the open space in views from the southern area of Civic Avenue, however, overall there would be a moderate magnitude of change, to views of low sensitivity, resulting in a **moderate-low visual impact**.

Works at the intersection of President Avenue with the Princes Highway would require some night works to minimise impacts on traffic. This would include lighting associated with the Princes Highway construction ancillary facility (C6), bright task lighting, lit vehicles and plant. Although the setting is brightly lit, there would be a moderate magnitude of change, in a setting with low sensitivity, resulting in a **moderate-low visual impact** on views from adjacent residential and residential properties.

Construction at the construction ancillary facility and Rockdale ventilation facility site, and the temporary diversion of traffic from West Botany Street through Rockdale Bicentennial Park would require works at night. These works would introduce safety lighting for vehicle diversions, construction task lighting and after-hours security lighting. This would create a moderate magnitude of change to night time views, in this area of low sensitivity, resulting in a **moderate-low visual impact** at night.

Rockdale Bicentennial Park and Scarborough Park would either become a part of the construction site, or not used at night. The Ilinden Sports Centre and carpark, in Rockdale Bicentennial Park, however, is used at night and elevated above the surrounding parkland and roads. From this location there would potentially be views at night of activity at the President Avenue construction ancillary facility (C3) to the north and east of the view. This would create a moderate magnitude of change in night time views, in this area of low sensitivity, resulting in a **moderate-low visual impact** at night.

Impacts during operation

At night there would be lighting introduced to the southern (President Avenue) works area around the President Avenue intersection in addition to upgraded street lighting along President Avenue. This lighting would be directed to avoid light spill on neighbouring properties, however there would be additional light sources visible in views towards these elements from adjacent residential properties. The proposed planting around the portal and ramps would provide some screening of these in these views, however there would be a general sky glow above the intersection and roads. Overall, the project would result in a moderate magnitude of change, within a zone of low sensitivity, and a **moderate-low visual impact**.

There would be lighting provided along the shared pedestrian and cycle pathway between Bestic Street in the north and Civic Avenue reserve in the south. This would introduce lighting through open space and adjacent to residential areas. In particular, there may be additional lighting seen from the rear of residential properties on Francis Avenue and Bruce Street in the north, and Civic Avenue in the south. The lighting of the shared pedestrian and cycle bridge over President Avenue, would also be visible above the surrounding streetscape. This lighting would be directed to avoid light spill on private property, however there would be additional light sources visible in views towards these elements from adjacent residential properties. In some areas existing and proposed trees would provide some screening of these in these views. Overall, the project would result in a low magnitude of change, within a zone of low sensitivity, and a **low visual impact** along the shared pedestrian and cycle pathway.

The lighting at the President Avenue intersection with the Princes Highway would also be upgraded and expanded over a wider area. This intersection is currently brightly lit and therefore the additional lighting would be consistent in character with this current setting. Lighting would be directed to avoid light spill onto private properties, however there would be additional visible light sources and sky glow. On balance, there would be a low magnitude of change within a zone of low sensitivity, resulting in a **low visual impact**.

The lighting at the Rockdale ventilation facility on West Botany Street would introduce some minor security lighting to the existing brightly lit setting. Lighting would be directed to avoid light spill onto private properties, the new lighting would be consistent in character with this current lighting levels on this site in its current light industrial use. There would be a negligible magnitude of change within a zone of low sensitivity, resulting in a **negligible visual impact**.

Summary tables

Table 8-17 summarises the impacts on views within the southern surface works area (President Avenue).

Table 8-17 Southern surface works area (President Avenue) – summary of visual impacts

		Construction		Operation	
Viewpoint	**Sensitivity**	**Magnitude of change**	**Impact level**	**Magnitude of change**	**Impact level**
Daytime views					
VP4: View north from the Ilinden Sports Centre	Moderate	High	High-moderate	Low	Moderate-low
VP5: View south from Rockdale Bicentennial Park	Moderate	High	High-moderate	Moderate	Moderate
VP6: View south from the Rockdale Bicentennial Park East	Moderate	High	High-moderate	Low	Moderate-low
VP7: View south from Brighton-Le-Sands Public School	Moderate	Moderate	Moderate	Low	Moderate-low
VP8: View north from Colson Crescent	Low	High	Moderate	Moderate	Moderate-low
VP9: View northeast from President Avenue	Moderate	High	High-moderate	High	High-moderate
VP10: View east from Civic Avenue	Low	Moderate	Moderate-low	Low	Low
VP11: View east from President Avenue retail area	Low	Moderate	Moderate-low	Low	Low
VP12: View west along President Avenue at Lachal Avenue	Low	Moderate	Moderate-low	Low	Low
VP13: View east along President Avenue from the Princes Highway	Low	High	Moderate	Low	Low
VP14: View south from West Botany Street	Low	High	Moderate	Low	Low
VP15: View east from West Botany Street to Roads and Maritime maintenance depot	Low	Low	Low	Low	Low
Night views					
VP4: View north from the Ilinden Sports Centre	Low	Moderate	Moderate-low	Low	Low
VP5: View south from Rockdale Bicentennial Park	Low	High	Moderate	Moderate	Moderate-low
VP6: View south from Rockdale Bicentennial Park East	Low	High	Moderate	Moderate	Moderate-low
VP7: View south from Brighton-Le-Sands Public School	Low	Moderate	Moderate-low	Low	Low
VP8: View north from Colson Crescent	Low	Moderate	Moderate-low	Moderate	Moderate-low
VP9: View northeast from President Avenue	Low	Moderate	Moderate-low	Moderate	Moderate-low
VP10: View east from Civic Avenue	Low	Moderate	Moderate-low	Low	Low

		Construction		Operation	
Viewpoint	**Sensitivity**	**Magnitude of change**	**Impact level**	**Magnitude of change**	**Impact level**
VP11: View east from President Avenue retail area	Low	Low	Low	Low	Low
VP12: View west along President Avenue at Lachal Avenue	Low	Moderate	Moderate-low	Low	Low
VP13: View east along President Avenue from the Princes Highway	Low	Moderate	Moderate-low	Low	Low
VP14: View south from West Botany Street	Low	Moderate	Moderate-low	Negligible	Negligible
VP15: View east from West Botany Street to Roads and Maritime maintenance depot	Low	Negligible	Negligible	Negligible	Negligible

9 Assessment of cumulative impacts

9.1 Other motorway projects

9.1.1 Northern surface works area (Arncliffe)

Construction impacts

During construction there would be some cumulative effects between the project and the New M5 Motorway project. Whilst the construction works for the project would be undertaken on a reduced area of the former New M5 Motorway construction site, the duration of works at this location would be extended. The landscape character, day and night time visual impacts should be appreciated in the context of several years of impact already experienced due to the New M5 Motorway construction works.

Operational impacts

During operations there would be no cumulative effects between the project and the New M5 Motorway project. There would be no additional visible elements required for the project and therefore a negligible landscape character, daytime and night time visual impact has been identified for the project.

9.1.2 Southern surface works area (President Avenue)

Construction impacts

There would not be any other motorway projects likely to result in a cumulative impact upon landscape character areas identified for the southern surface works area (President Avenue).

Operational impacts

There would not be any other motorway projects visible from the visual catchment of the southern surface works area (President Avenue) during the day or night.

10 Management of impacts

10.1 Management of construction impacts

Where feasible and reasonable, the following measures would be undertaken to mitigate construction landscape and visual impacts:

- Existing trees to be retained would be protected prior to the commencement of construction in accordance with Australian Standard AS4970 the Australian Standard for Protection of Trees on Development Sites and Adjoining Properties
- Opportunities for the retention and protection of existing trees would be identified during detailed construction planning. This would prioritise the protection of trees identified as having a high tree retention value in the Arboricultural Assessment (refer to Appendix A-A Arboricultural Assessment)
- Trees removed during the project would be replaced as per the below tree replacement strategy
- Lighting of worksites and construction compounds would be oriented to minimise glare and light spill impact on adjacent receptors
- The design and maintenance of construction compound hoardings would aim to minimise visual and landscape character impact, including the prompt removal of graffiti
- The Bicentennial Park East playing fields would be relocated to an alternative site in consultation with Council
- The skate park, play equipment and open space located within Bicentennial Park North would be relocated to an alternative site in consultation with Council
- Graffiti would be removed promptly in accordance with Roads and Maritime guidelines.

Tree Strategy

Where removal of trees is unavoidable, trees would be replaced in accordance with the tree management strategy for the project, which would be prepared in consultation with relevant stakeholders (including Bayside Council). The strategy would be used to guide the management of trees, including those within riparian areas, that need to be removed and to consider options for their replacement. The strategy would address:

- The need to minimise tree removal
- Protection of trees being retained
- Replacement of trees

The strategy would provide for the following:

- Consideration of all options to minimise the need for tree removal and to retain as many trees as possible
- Preparation of comprehensive tree reports (by a qualified arborist) for trees requiring protection, pruning, or removal, to guide the approach to managing trees
- Measures to minimise damage to, and ensure the health and stability of, trees to be retained, in accordance with AS4970-2009 Protection of trees on development sites
- Replacement of trees where removal cannot be avoided, in accordance with the following general principles:
- net increase in the number of replacement trees
- provision of replacement trees to achieve similar outcomes as those removed where possible, such as screening, amenity, etc.
- replacement trees are to have a minimum pot size of 75 litres, except where the plantings are consistent with the pot sizes specified in a relevant authority's plans for vegetation management, or as agreed by the relevant authority(s) (such as Bayside Council)
- trees to be planted within 500 metres of the project area wherever practicable, or in another location determined in consultation with the relevant council

- Consideration of plant species that would benefit Grey-headed Flying-fox foraging
- Targets to be achieved such as established vegetation cover and water quality parameters.

A management of operation impacts mitigation measures is:

- Semi-mature trees (assume minimum container size of 100 litres) should be provided where short term screening is required, such as in areas between the President Avenue intersection and tunnel entry, and exit ramps and adjacent residential areas of Brighton-Le-Sands.

10.2 Management of operational impacts

Where feasible and reasonable, the following measures will be undertaken to mitigate operational landscape and visual impacts:

- Cut off and direct light fittings (or similar technologies) would be used to minimise glare and light spill impacts onto private property.
- Semi-mature trees (assume minimum container size of 100 litres should be provided where short term screening is required, such as in areas between the President Avenue intersection and tunnel entry, and exit ramps and adjacent residential areas of Brighton-Le-Sands.

10.3 Management of cumulative impacts

There were no cumulative landscape and visual impacts identified.

11 Conclusion

11.1 Impacts during construction

11.1.1 Northern surface works area (Arncliffe)

Landscape impacts

During construction there would be **moderate-low landscape character impact** on the LCZ2c Recreation - Open Space at the northern surface works area (Arncliffe). This is due to the continuation of intensive construction undertaken on an area that would otherwise be returned to open space. There would be no works undertaken in other landscape character zones, and therefore an otherwise **negligible landscape character impact** on surrounding areas.

Visual impacts

During construction there would be **moderate visual impact** on views from the Eve Street cycleway due to the proximity of the construction works to this moderately sensitive recreational route. There would also be a **low visual impact** from Marsh Street, where some construction activity would be seen over the Golf Course and adjacent to the New M5 motorway operations complex. This low impact is due to visual absorption capacity of the landscape and limited visibility of the site.

11.1.2 Southern surface works area (President Avenue)

Landscape impacts

There would be a **high-moderate landscape impact** on the Rockdale Bicentennial and Scarborough Parks landscape (LCZ4) during construction. This is due several factors including substantial vegetation removal within the park; reduced access to open space including the playground, skate park and sporting fields; the introduction of construction activity across large areas of park, and the temporary diversion of West Botany Street.

Visual impacts

In views from President Avenue to the tunnel portal, entry and exit ramps and the President Avenue intersection there would be a **high-moderate visual impact.** This is due to the removal of mature trees and open space, and construction of the tunnel portal, intersection and road upgrades visible in close proximity. In views towards the tunnel portal and intersection, such as the Brighton-Le-Sands Public School and residential areas of Brighton-Le-Sands, proposed vegetation the visual impact to **moderate**. Retained vegetation to the northeast of Rockdale Bicentennial Park East would enclose views to works within Rockdale Bicentennial Park from areas of Brighton-Le-Sands, including the Brighton-Le-Sands Public School.

The major earthworks and roadworks required to upgrade President Avenue, and construction of the shared pedestrian and cycle bridge, would also result in **moderate visual impacts** to views from adjacent residential areas to the east (Colson Crescent) and **moderate-low visual impacts** to views from the west (Civic Avenue).

Construction of the Rockdale ventilation facility and diversion of West Botany Street would result in a **moderate visual impact** due to the scale of the works.

At the Princes Highway and President Avenue intersection the demolition of the service station, establishment of the Princes Highway construction ancillary facility (C6) and roadworks would have a **moderate visual impact**. There would also be elevated views from properties on the Princes Highway where both the Princes Highway intersection works and the Presidents Avenue intersection works would be seen in the a long range view, resulting in an increased impact.

At night there would be **moderate-low visual impacts** due to the low sensitivity of the setting at night, and enclosure of works within site areas.

11.2 Impacts during operations

11.2.1 Northern surface works area (Arncliffe)

Landscape impacts

During operation there would be **moderate-low landscape character impact** on the LCZ2c Recreation - Open Space at the northern surface works area (Arncliffe). This is due to the introduction of an additional F6 Extension Stage 1 water treatment facility and substation, extending the New M5 motorway operations complex, and replacing an additional area of open space. There would be no works undertaken in other landscape character zones, and therefore an otherwise **negligible landscape character impact** on surrounding areas during operation.

Visual impacts

There would be a **moderate-low visual impact** on views from the Eve Street cycleway during operation. This is due to the additional F6 Extension Stage 1 water treatment plant and substation which would expand the New M5 motorway operations complex and extend this built character across the view to open space. There would also be a **low visual impact** in views from Marsh Street, where the MOC would appear larger within views across the existing Kogarah Golf Course. In other areas the F6 Extension Stage 1 water treatment facility and substation would be screened by the New M5 motorway operations complex and have a **negligible visual impact**.

11.2.2 Southern surface works area (President Avenue)

Landscape impacts

There would continue to be a **high-moderate landscape impacts** to the Rockdale Bicentennial and Scarborough Parks landscape character zone primarily due to the loss of open space. There would also be modifications to the landform, a reduction in vegetation cover, and introduction of culverts at the wetland crossing under President Avenue, altering the landscape character in this location.

Visual impacts

In views directly to the works at President Avenue, a change from views to open space to a major intersection, entry and exit ramps, and tunnel portal would have a **high-moderate visual impact**. Whereas, from middle distance locations, such as the Brighton Le-Sands Public School and residential areas of Brighton-Le-Sands, the location of this intersection and tunnel portal within the parkland allows for vegetation within the parkland to be provided to screen the infrastructure. **Moderate-low visual impacts** would be experienced from these locations.

The location of the Rockdale ventilation facility within a setting of light industrial built form would allow the impact to be reduced. There would be a **low visual impact** in views of the Rockdale ventilation facility from West Botany Street and adjacent areas due to the compatibility of this structure with the surrounding industrial and commercial setting.

The cycle and pedestrian bridge over President Avenue would have a **low visual impact** on views from the surrounding open space and adjacent roads. Vegetation within the park would mature over time to visually integrate the viaduct structure, and screen views towards the bridge over time.

At night the new President Avenue intersection, entry and exit ramps and tunnel portal would be brightly lit. President Avenue would also have upgraded lighting. This would contrast with the surrounding dark setting of the park, and result in a **moderate-low visual impact.** Lighting at the President Avenue intersection with the Princes Highway, at the Rockdale ventilation facility, and Motorway Operations Complex would result in **low** and **negligible visual impact** due to the consistency of the lighting levels with the existing setting.

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Annexure A – Arborist Report

F6 Extension Stage 1

Arboricultural Assessment

Prepared for
AECOM

23 July 2018

Disclaimer

This document may only be used for the purpose for which it was commissioned and in accordance with the contract between Eco Logical Australia Pty Ltd and AECOM. The scope of services was defined in consultation with AECOM by time and budgetary constraints imposed by the client, and the availability of reports and other data on the subject area. Changes to available information, legislation and schedules are made on an ongoing basis and readers should obtain up to date information.

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All trees have been assessed based on the observations from the site inspection and information presented by the client or relevant parties at the time of inspection. No responsibility can be taken for incorrect or misleading information provided by the client or other parties.

Trees are living organisms. As such, their health and structure may alter, they will grow, and their environmental circumstances may change from the time of the site inspection upon which this assessment is based. Trees, as with all living things, pose some level of risk.

Tree assessments are valid for 12 months after the date of inspection, unless otherwise stated. Any significant change to the subject tree(s) or surrounding environment, including significant or catastrophic storm/wind events will require the immediate re-inspection and assessment of the tree(s).

Trees fail in ways that the arboricultural community are yet to fully understand. There is no guarantee expressed or implied that failure or deficiencies may not arise of the subject trees in the future. No responsibility is accepted for damage to property or injury/death caused by the nominated trees.

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Abbreviations

Abbreviation	Description
AQF	Australian Qualifications Framework
AS	Australian Standards
DBH	Diameter at Breast Height
ELA	Eco Logical Australia
m	Metre
mm	Millimetre
NDE	Non-Destructive Excavation
NO	Number
NSW	New South Wales
SP	Species
SRZ	Structural Root Zone
TPZ	Tree Protection Zone
VTA	Visual Tree Assessment

1 Background

1.1 Introduction

Eco Logical Australia Pty Ltd (ELA) was commissioned by AECOM to prepare an arboricultural assessment for the proposed F6 extension – Stage 1.

The purpose of this report is to:

- identify the trees within the study area
- assess the current overall health and condition of the subject trees
- evaluate the significance of the subject trees and assess their suitability for retention.

1.2 The proposal

The proposal is for the construction and operation of a new multi lane road link between the New M5 at Arncliffe and President Avenue at Kogarah. The project would comprise:

- twin motorway tunnels around four kilometres in length
- a tunnel portal at Brighton-Le-Sands connecting to on- and off-ramps
- an interchange with a widened President Avenue
- ancillary infrastructure and operational facilities
- new and modified utility services.

The key features of the proposed construction likely to negatively affect the subject trees can be summarised as follows:

- excavation works
- plant movement
- changes in soil grades
- installation of underground services.

1.3 The study area

The study area is located within the land between the New M5 at Arncliffe and President Avenue at Kogarah.

1.4 The subject trees

A total of **449** subject trees were inspected in June 2018. Further information, observations and measurements specific to each of the subject trees can be found in **Chapter 3.**

1.5 Documents and plans referenced

The conclusions and recommendations of this report are based on the *Australian Standard, AS 4970-2009, Protection of Trees on Development Sites*, the findings from the site inspections and analysis of the following documents/plans:

- *Field Map prepared by Ecological Australia dated 4 June 2018.*

2 Method

2.1 Visual tree assessment

The subject trees were assessed in accordance with a stage one visual tree assessment (VTA) as formulated by Mattheck & Breloer (1994)[1], and practices consistent with modern arboriculture.

The following limitations apply to this methodology:

- Trees were inspected from ground level, without the use of any invasive or diagnostic tools and testing.
- No aerial inspections or root mapping was undertaken.
- Tree heights, canopy spread and diameter at breast height (DBH) was estimated, unless otherwise stated.
- Trees of the same species, with similar dimensions growing near each other, have been documented as a group and presented under a single way point.
- Tree identification was based on broad taxonomical features present and visible from ground level at the time of inspection.

2.2 Retention Value

The retention value/importance of a tree or group of trees, is determined using a combination of environmental, cultural, physical and social values.

- **Low:** These trees are not considered important for retention, nor require special works or design modification to be implemented for their retention.
- **Medium:** These trees are moderately important for retention. Their removal should only be considered if adversely affected by the proposed works and all other alternatives have been considered and exhausted.
- **High:** These trees are considered important and should be retained and protected. Design modification or re-location of building/s should be considered to accommodate the setbacks as prescribed by *Australian Standard AS4970 Protection of trees on development sites*.

This tree retention assessment has been undertaken in accordance with the *Institute of Australian Consulting Arboriculturists* (IACA) *Significance of a Tree, Assessment Rating System* (STARS). Further details and assessment criteria are in **Appendix C**.

[1] VTA is an internationally recognised practice in the visual assessment of trees as prescribed by Mattheck, C. and Breloer, H. 1994. 'Field Guide for Visual Tree Assessment' *Arboricultural Journal*, Vol 18 pp 1-23.

2.3 Protection zones

- **Tree protection zone (TPZ):** The TPZ is the optimal combination of crown and root area (as defined by AS 4970-2009) that requires protection during the construction process. The TPZ is an area that is isolated from the work zone to ensure no disturbance or encroachment occurs into this zone. Tree sensitive construction measures must be implemented if works are to proceed within the Tree Protection Zone.
- **Structural root zone (SRZ):** The SRZ is the area of the root system (as defined by AS 4970-2009) used for stability, mechanical support and anchorage of the tree. It is critical for the support and stability of the tree, and provides the bulk of mechanical support and anchorage. Severance of roots (>50 mmØ) within the SRZ is generally not recommended as it may lead to the destabilisation and/or decline of the tree.
- **Root investigation:** When assessing the potential impacts of encroachment into the TPZ consideration will need to be given to the location and distribution of the roots, including above or below ground restrictions affecting root growth. Location and distribution of roots may be determined through non-destructive excavation (NDE) methods such as hydro-vacuum excavation (sucker truck), air spade and manual excavation. Root investigation is used to determine the extent and location of roots within the zone of conflict. Root investigation does not guarantee the retention of the tree.

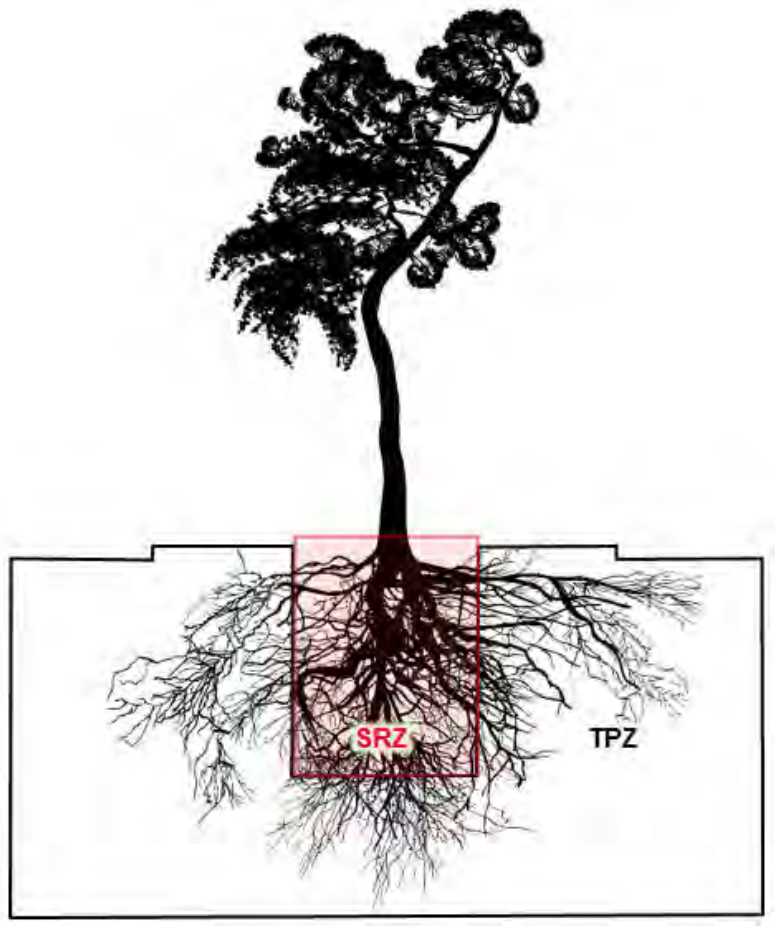

Figure 1: Indicative TPZ and SRZ

Table 1: Results of the arboricultural assessment

NO	BOTANICAL NAME	HEIGHT (M)	SPREAD (M)	DBH (MM)	HEALTH	STRUCTURE	NOTES	RETENTION VALUE	TPZ (M)	SRZ (M)	Tree Group	No.of trees
1	Livistona australis	7	2	500	Good	Good	Group of 3	Medium	6.0	2.5	YES	3
2	Eucalyptus microcorys	10	6	750	Good	Good	Group of 3	High	9.0	2.9	YES	3
3	Eucalyptus botryoides	10	6	700	Good	Good	Group of 3	High	8.4	2.8	YES	3
4	Eucalyptus microcorys	9	5	700	Good	Good	Group of 3	High	8.4	2.8	YES	3
6	Casuarina glauca	7	2	300	Good	Fair	Group of 5	Medium	3.6	2.0	YES	5
7	Casuarina glauca	11	6	1000	Good	Fair		Medium	12.0	3.3	NO	1
8	Eucalyptus microcorys	7	3	450	Fair	Poor		Low	5.4	2.4	NO	1
9	Eucalyptus microcorys	10	6	700	Fair	Fair		Medium	8.4	2.8	NO	1
10	Melaleuca styphelioides	4	4	300	Good	Fair		Medium	3.6	2.0	NO	1
11	Eucalyptus camaldulensis	12	10	900	Good	Good		High	10.8	3.2	NO	1
12	Melaleuca quinquenervia	7	3	400	Fair	Fair		Medium	4.8	2.3	NO	1
13	Lophostemon confertus	5	3	300	Fair	Poor		Low	3.6	2.0	NO	1
14	Eucalyptus tereticornis	11	7	900	Fair	Poor	Minor lean	Medium	10.8	3.2	NO	1
15	Eucalyptus tereticornis	12	4	700	Poor	Poor	Dead	Low	8.4	2.8	NO	1
16	Eucalyptus tereticornis	15	10	1110	Fair	Fair	Hollows	High	13.3	3.5	NO	1
17	Casuarina cunninghamiana	6	2	200	Fair	Poor	Group of 10	Low	2.4	1.7	YES	10
18	Ficus benjamina	5	5	400	Good	Poor	Multi trunked	Low	4.8	2.3	NO	1
19	Banksia integrifolia	5	3	709	Fair	Poor		Low	8.5	2.9	NO	1
20	Eucalyptus nicholii	8	3	500	Fair	Fair		Low	6.0	2.5	NO	1
21	Ficus macrophylla	7	6	800	Fair	Poor		Low	9.6	3.0	NO	1
22	Ficus benjamina	4	4	300	Fair	Poor		Low	3.6	2.0	NO	1
23	Araucaria heterophylla	7	3	609	Good	Fair	Rear yard	Medium	7.3	2.7	NO	1
24	Casuarina cunninghamiana	9	4	560	Fair	Fair		Medium	6.7	2.6	NO	1
25	Casuarina cunninghamiana	7	4	600	Good	Fair		Medium	7.2	2.7	NO	1
26	Casuarina cunninghamiana	10	4	600	Good	Fair		Medium	7.2	2.7	NO	1
27	Casuarina cunninghamiana	9	4	650	Fair	Fair		Medium	7.8	2.8	NO	1
28	Casuarina cunninghamiana	8	4	600	Fair	Fair		Medium	7.2	2.7	NO	1

NO	BOTANICAL NAME	HEIGHT (M)	SPREAD (M)	DBH (MM)	HEALTH	STRUCTURE	NOTES	RETENTION VALUE	TPZ (M)	SRZ (M)	Tree Group	No.of trees
29	Eucalyptus microcorys	7	4	500	Good	Good		High	6.0	2.5	NO	1
30	Eucalyptus microcorys	11	7	650	Good	Fair		Medium	7.8	2.8	NO	1
31	Acer negundo	5	3	240	Fair	Poor		Low	2.9	1.8	NO	1
32	Eucalyptus scoparia	11	9	940	Poor	Fair	Bracket fungi x 3	Medium	11.3	3.2	NO	1
33	Casuarina cunninghamiana	12	5	530	Good	Fair	Group of 4	Medium	6.4	2.5	YES	4
34	Allocasuarina littoralis	4	2	250	Fair	Fair	Group of saplings x 5	Low	3.0	1.8	YES	5
35	Eucalyptus sp.	10	7	980	Poor	Poor	Borer, half dead	Low	11.8	3.3	NO	1
36	Triadica sebifera	5	5	550	Fair	Poor	Multi trunked	Low	6.6	2.6	NO	1
37	Allocasuarina littoralis	10	5	680	Good	Fair		Medium	8.2	2.8	NO	1
38	Eucalyptus botryoides	9	5	340	Good	Fair		Medium	4.1	2.1	NO	1
39	Eucalyptus globulus 'bicostata'	7	5	620	Poor	Fair	Half dead	Low	7.4	2.7	NO	1
40	Eucalyptus haemastoma	7	4	460	Good	Fair		Medium	5.5	2.4	NO	1
41	Eucalyptus haemastoma	5	3	320	Fair	Poor		Low	3.8	2.1	NO	1
42	Cupressus macrocarpa	4	4	800	Good	Fair		Medium	9.6	3.0	NO	1
43	Melaleuca quinquenervia	7	2	630	Good	Good		Medium	7.6	2.7	NO	1
44	Melaleuca quinquenervia	11	4	380	Good	Fair		Medium	4.6	2.2	NO	1
45	Allocasuarina littoralis	8	2	450	Fair	Poor	Wound	Low	5.4	2.4	NO	1
46	Melaleuca quinquenervia	9	2	300	Fair	Poor		Low	3.6	2.0	NO	1
47	Eucalyptus haemastoma	6	3	300	Fair	Fair		Low	3.6	2.0	NO	1
48	Melaleuca quinquenervia	7	3	350	Poor	Fair		Low	4.2	2.1	NO	1
49	Eucalyptus robusta	9	4	420	Fair	Fair		Medium	5.0	2.3	NO	1
50	Eucalyptus robusta	9	4	440	Good	Fair		Medium	5.3	2.3	NO	1
51	Allocasuarina littoralis	7	4	390	Fair	Poor		Low	4.7	2.2	NO	1
52	Casuarina cunninghamiana	9	3	340	Fair	Fair	Group of 2	Medium	4.1	2.1	YES	2
53	Erythrina x sykesii	8	6	600	Poor	Fair	Group x 3	Low	7.2	2.7	YES	3

NO	BOTANICAL NAME	HEIGHT (M)	SPREAD (M)	DBH (MM)	HEALTH	STRUCTURE	NOTES	RETENTION VALUE	TPZ (M)	SRZ (M)	Tree Group	No.of trees
54	Melaleuca styphelioides	5	3	230	Good	Fair		Medium	2.8	1.8	NO	1
55	Araucaria heterophylla	16	8	850	Good	Good		High	10.2	3.1	NO	1
56	Lagerstroemia indica	5	3	240	Poor	Poor	Multi trunks	Low	2.9	1.8	NO	1
57	Melaleuca styphelioides	8	4	600	Good	Fair		Medium	7.2	2.7	NO	1
58	Eucalyptus robusta	9	6	600	Good	Poor		Medium	7.2	2.7	NO	1
59	Eucalyptus microcorys	15	6	700	Good	Good		High	8.4	2.8	NO	1
60	Eucalyptus nicholii	11	6	700	Good	Fair		Medium	8.4	2.8	NO	1
61	Eucalyptus nicholii	7	3	550	Fair	Fair		Medium	6.6	2.6	NO	1
62	Eucalyptus robusta	9	8	900	Good	Fair		Medium	10.8	3.2	NO	1
63	Eucalyptus robusta	7	5	600	Good	Fair		Medium	7.2	2.7	NO	1
64	Melaleuca quinquenervia	7	4	500	Good	Fair		Medium	6.0	2.5	NO	1
65	Melaleuca styphelioides	5	3	400	Poor	Fair		Low	4.8	2.3	NO	1
66	Allocasuarina littoralis	12	7	1000	Good	Good		High	12.0	3.3	NO	1
67	Eucalyptus robusta	12	6	650	Good	Fair		Medium	7.8	2.8	NO	1
68	Melaleuca quinquenervia	6	4	600	Good	Good		High	7.2	2.7	NO	1
69	Eucalyptus robusta	8	3	500	Good	Fair		Medium	6.0	2.5	NO	1
70	Melaleuca quinquenervia	6	3	400	Good	Fair		Medium	4.8	2.3	NO	1
71	Eucalyptus robusta	7	4	450	Fair	Poor		Low	5.4	2.4	NO	1
72	Melaleuca quinquenervia	7	3	500	Good	Fair		Medium	6.0	2.5	NO	1
73	Melaleuca quinquenervia	8	3	450	Good	Fair		Medium	5.4	2.4	NO	1
74	Allocasuarina littoralis	11	6	750	Good	Fair		Medium	9.0	2.9	NO	1
75	Melaleuca quinquenervia	12	5	700	Good	Fair		Medium	8.4	2.8	NO	1
76	Corymbia maculata	14	7	550	Good	Good		High	6.6	2.6	NO	1
77	Casuarina cunninghamiana	9	4	700	Good	Fair		Medium	8.4	2.8	NO	1
78	Eucalyptus robusta	9	5	990	Good	Good		High	11.9	3.3	NO	1
79	Melaleuca styphelioides	6	3	400	Good	Fair		Medium	4.8	2.3	NO	1
80	Melaleuca quinquenervia	7	5	750	Good	Fair		Medium	9.0	2.9	NO	1
81	Allocasuarina littoralis	10	4	600	Fair	Fair		Medium	7.2	2.7	NO	1

NO	BOTANICAL NAME	HEIGHT (M)	SPREAD (M)	DBH (MM)	HEALTH	STRUCTURE	NOTES	RETENTION VALUE	TPZ (M)	SRZ (M)	Tree Group	No.of trees
82	Acacia elata	6	3	400	Poor	Fair		Low	4.8	2.3	NO	1
83	Allocasuarina littoralis	9	6	800	Good	Poor		Medium	9.6	3.0	NO	1
84	Allocasuarina littoralis	10	6	500	Fair	Fair	Group of 2	Medium	6.0	2.5	YES	2
85	Corymbia maculata	12	4	400	Good	Fair		Medium	4.8	2.3	NO	1
86	Angophora costata	8	2	300	Poor	Poor		Low	3.6	2.0	NO	1
87	Eucalyptus microcorys	11	9	850	Good	Good		High	10.2	3.1	NO	1
88	Eucalyptus microcorys	9	4	400	Good	Fair		Medium	4.8	2.3	NO	1
89	Allocasuarina littoralis	15	8	800	Good	Fair		Medium	9.6	3.0	NO	1
90	Allocasuarina littoralis	12	8	650	Good	Fair		Medium	7.8	2.8	NO	1
91	Ficus microcarpa	4	3	150	Good	Good		Medium	2.0	1.5	NO	1
92	Eucalyptus microcorys	12	6	650	Good	Good		High	7.8	2.8	NO	1
93	Araucaria heterophylla	10	5	650	Good	Poor	Forks @ 1 m	Low	7.8	2.8	NO	1
94	Plumeria spp	4	2	200	Good	Fair	Group of 3	Low	2.4	1.7	YES	3
95	Cinnamomum camphora	9	4	640	Fair	Poor		Low	7.7	2.7	NO	1
96	Cinnamomum camphora	11	6	800	Poor	Poor		Low	9.6	3.0	NO	1
97	Morus sp.	5	4	400	Poor	Poor		Low	4.8	2.3	NO	1
98	Salix babylonica	9	4	600	Poor	Poor		Low	7.2	2.7	NO	1
99	Salix babylonica	6	3	800	Poor	Poor		Low	9.6	3.0	NO	1
100	Ficus macrophylla	8	5	700	Good	Fair		Medium	8.4	2.8	NO	1
101	Allocasuarina littoralis	8	4	600	Fair	Poor		Low	7.2	2.7	NO	1
102	Casuarina cunninghamiana	11	5	500	Good	Fair		Medium	6.0	2.5	NO	1
103	Allocasuarina littoralis	11	5	600	Fair	Fair		Low	7.2	2.7	NO	1
104	Allocasuarina littoralis	13	6	1000	Fair	Poor	Splits at base	Low	12.0	3.3	NO	1
105	Allocasuarina littoralis	10	5	450	Fair	Poor	Suppressed canopy	Low	5.4	2.4	NO	1
106	Eucalyptus sp.	11	4	430	Poor	Poor		Low	5.2	2.3	NO	1
107	Allocasuarina littoralis	11	4	600	Good	Fair		Medium	7.2	2.7	NO	1
108	Casuarina cunninghamiana	15	6	400	Fair	Poor	Group of 5	Low	4.8	2.3	YES	5

NO	BOTANICAL NAME	HEIGHT (M)	SPREAD (M)	DBH (MM)	HEALTH	STRUCTURE	NOTES	RETENTION VALUE	TPZ (M)	SRZ (M)	Tree Group	No.of trees
109	Casuarina cunninghamiana	15	5	900	Poor	Poor		Low	10.8	3.2	NO	1
110	Populus sp.	10	3	450	Fair	Poor		Low	5.4	2.4	NO	1
111	Casuarina cunninghamiana	12	4	400	Fair	Poor		Low	4.8	2.3	NO	1
112	Casuarina cunninghamiana	10	4	500	Good	Fair	Group of 5	Medium	6.0	2.5	YES	5
113	Ficus macrophylla	10	5	600	Good	Fair		Medium	7.2	2.7	NO	1
114	Populus sp.	9	4	400	Poor	Poor		Low	4.8	2.3	NO	1
115	Populus sp.	12	9	350	Poor	Poor	Group of 6	Low	4.2	2.1	YES	6
116	Eucalyptus robusta	5	2	350	Good	Fair	Group of 5	Medium	4.2	2.1	YES	5
117	Eucalyptus robusta	4	2	200	Good	Fair	Group of 3	Medium	2.4	1.7	YES	3
118	Eucalyptus robusta	10	6	600	Good	Good	Group of 3	High	7.2	2.7	YES	3
119	Corymbia maculata	5	3	250	Good	Good	Group of 3	Medium	3.0	1.8	YES	3
120	Casuarina cunninghamiana	4	2	200	Good	Fair	Group of 6	Medium	2.4	1.7	YES	6
121	Eucalyptus punctata	7	3	400	Good	Fair		Medium	4.8	2.3	NO	1
122	Casuarina cunninghamiana	5	1	200	Good	Fair		Low	2.4	1.7	NO	1
123	Casuarina cunninghamiana	8	3	400	Fair	Fair	Group of 5	Low	4.8	2.3	YES	5
124	Eucalyptus robusta	8	5	500	Good	Good		High	6.0	2.5	NO	1
125	Eucalyptus punctata	11	4	500	Fair	Fair		Medium	6.0	2.5	NO	1
126	Eucalyptus punctata	8	3	400	Good	Fair	Group of 7	Medium	4.8	2.3	YES	7
127	Casuarina cunninghamiana	11	3	400	Good	Fair		Medium	4.8	2.3	NO	1
128	Eucalyptus robusta	8	4	450	Good	Fair		Medium	5.4	2.4	NO	1
129	Eucalyptus robusta	9	5	650	Good	Good		High	7.8	2.8	NO	1
130	Eucalyptus robusta	9	8	850	Good	Good		High	10.2	3.1	NO	1
131	Allocasuarina littoralis	7	5	400	Fair	Poor		Low	4.8	2.3	NO	1
132	Lophostemon confertus	6	4	350	Good	Fair		Medium	4.2	2.1	NO	1
133	Eucalyptus microcorys	9	5	400	Good	Fair		Medium	4.8	2.3	NO	1
134	Casuarina cunninghamiana	8	2	450	Poor	Fair	Group of 5	Low	5.4	2.4	YES	5
135	Eucalyptus microcorys	7	3	500	Poor	Poor		Low	6.0	2.5	NO	1
136	Lophostemon confertus	8	3	360	Good	Fair		Medium	4.3	2.2	NO	1

NO	BOTANICAL NAME	HEIGHT (M)	SPREAD (M)	DBH (MM)	HEALTH	STRUCTURE	NOTES	RETENTION VALUE	TPZ (M)	SRZ (M)	Tree Group	No.of trees
137	Casuarina cunninghamiana	9	4	400	Fair	Fair		Medium	4.8	2.3	NO	1
138	Eucalyptus sp.	5	2	100	Fair	Poor	Co dominant from base	Low	2.0	1.5	NO	1
139	Casuarina glauca	9	3	300	Fair	Fair	Group of 4	Low	3.6	2.0	YES	4
140	Casuarina glauca	6	1	100	Poor	Poor	Group of 10	Low	2.0	1.5	YES	10
141	Casuarina glauca	9	3	410	Good	Fair		Medium	4.9	2.3	NO	1
142	Casuarina glauca	9	3	400	Fair	Fair	Group of 6	Low	4.8	2.3	YES	6
143	Grevillea robusta	8	3	400	Good	Fair	Group of 3	Low	4.8	2.3	YES	3
144	Ficus macrophylla	5	6	600	Good	Good		High	7.2	2.7	NO	1
145	Eucalyptus robusta	8	8	400	Good	Good		High	4.8	2.3	NO	1
146	Eucalyptus robusta	10	8	840	Good	Good		High	10.1	3.1	NO	1
147	Casuarina glauca	7	8	530	Good	Fair		Medium	6.4	2.5	NO	1
148	Eucalyptus robusta	8	6	500	Good	Good		High	6.0	2.5	NO	1
149	Melaleuca quinquenervia	8	4	520	Good	Good		High	6.2	2.5	NO	1
150	Eucalyptus punctata	8	3	300	Fair	Fair		Medium	3.6	2.0	NO	1
151	Casuarina glauca	9	3	200	Fair	Poor	Group of 4	Low	2.4	1.7	YES	4
152	Eucalyptus eximia	9	3	300	Fair	Poor	Group of 2	Low	3.6	2.0	YES	2
153	Casuarina glauca	8	2	200	Poor	Poor	Group of 10	Low	2.4	1.7	YES	10
154	Casuarina glauca	8	3	300	Fair	Fair		Low	3.6	2.0	NO	1
155	Casuarina glauca	9	3	300	Fair	Fair	Group of 10	Low	3.6	2.0	YES	10
156	Eucalyptus microcorys	4	3	250	Poor	Poor		Low	3.0	1.8	NO	1
157	Eucalyptus microcorys	8	5	400	Good	Good		High	4.8	2.3	NO	1
158	Eucalyptus microcorys	8	5	400	Good	Fair		Medium	4.8	2.3	NO	1
159	Eucalyptus microcorys	7	5	450	Good	Fair		Medium	5.4	2.4	NO	1
160	Eucalyptus microcorys	8	5	500	Good	Fair		Medium	6.0	2.5	NO	1
161	Eucalyptus robusta	7	5	400	Good	Fair	Multi stemmed	Medium	4.8	2.3	NO	1
162	Eucalyptus robusta	8	5	350	Poor	Fair		Low	4.2	2.1	NO	1
163	Ficus microcarpa	9	9	820	Good	Good		High	9.8	3.0	NO	1

NO	BOTANICAL NAME	HEIGHT (M)	SPREAD (M)	DBH (MM)	HEALTH	STRUCTURE	NOTES	RETENTION VALUE	TPZ (M)	SRZ (M)	Tree Group	No.of trees
164	Corymbia maculata	11	4	450	Poor	Fair		Low	5.4	2.4	NO	1
165	Brachychiton acerifolius	6	2	300	Good	Fair		Medium	3.6	2.0	NO	1
166	Eucalyptus microcorys	8	5	650	Good	Fair	Group of 2	Medium	7.8	2.8	YES	2
167	Ficus microcarpa	5	3	300	Good	Good		Medium	3.6	2.0	NO	1
168	Syagrus romanzoffiana	6	2	250	Poor	Poor	Group of 2	Low	3.0	1.8	YES	2
169	Syagrus romanzoffiana	7	4	400	Poor	Poor		Low	4.8	2.3	NO	1
170	Corymbia citriodora	10	6	510	Good	Fair		Medium	6.1	2.5	NO	1
171	Eucalyptus microcorys	8	6	450	Good	Fair		Medium	5.4	2.4	NO	1
172	Ficus microcarpa	11	10	1040	Good	Good	Feature tree in playground	High	12.5	3.4	NO	1
173	Eucalyptus microcorys	5	4	400	Fair	Poor	Leaning	Low	4.8	2.3	NO	1
174	Ficus benjamina	5	4	350	Good	Poor		Low	4.2	2.1	NO	1
175	Casuarina glauca	7	5	410	Fair	Poor		Low	4.9	2.3	NO	1
176	Casuarina glauca	6	5	500	Poor	Poor		Low	6.0	2.5	NO	1
177	Casuarina cunninghamiana	9	4	420	Fair	Fair	Group of 3	Medium	5.0	2.3	YES	3
178	Eucalyptus microcorys	14	13	770	Good	Good	Large amenity tree	High	9.2	3.0	NO	1
179	Callistemon viminalis	4	3	250	Good	Fair	Multi trunked	Low	3.0	1.8	NO	1
180	Eucalyptus microcorys	9	6	670	Good	Fair		Medium	8.0	2.8	NO	1
181	Eucalyptus microcorys	9	5	520	Fair	Fair		Medium	6.2	2.5	NO	1
182	Eucalyptus microcorys	8	6	560	Good	Good	Group of 2	High	6.7	2.6	YES	2
183	Eucalyptus microcorys	9	7	700	Good	Poor		Low	8.4	2.8	NO	1
184	Eucalyptus microcorys	8	5	500	Fair	Poor	Pruned for wires	Low	6.0	2.5	NO	1
185	Eucalyptus robusta	7	5	500	Poor	Poor		Low	6.0	2.5	NO	1
186	Eucalyptus robusta	4	3	300	Poor	Poor		Low	3.6	2.0	NO	1
187	Eucalyptus robusta	6	5	580	Poor	Fair	Bracket fungi	Low	7.0	2.6	NO	1
188	Eucalyptus robusta	9	7	530	Good	Good		High	6.4	2.5	NO	1

NO	BOTANICAL NAME	HEIGHT (M)	SPREAD (M)	DBH (MM)	HEALTH	STRUCTURE	NOTES	RETENTION VALUE	TPZ (M)	SRZ (M)	Tree Group	No.of trees
189	Melaleuca quinquenervia	4	4	300	Good	Fair	Multi trunked at base	Low	3.6	2.0	NO	1
190	Eucalyptus haemastoma	8	6	500	Fair	Poor		Low	6.0	2.5	NO	1
191	Eucalyptus robusta	8	8	600	Fair	Fair		Medium	7.2	2.7	NO	1
192	Eucalyptus robusta	7	4	300	Poor	Poor		Low	3.6	2.0	NO	1
193	Stenocarpus sinuatus	4	2	200	Good	Poor		Low	2.4	1.7	NO	1
194	Eucalyptus sp.	10	6	600	Poor	Fair		Low	7.2	2.7	NO	1
195	Melaleuca quinquenervia	3	3	350	Good	Poor		Low	4.2	2.1	NO	1
196	Eucalyptus microcorys	7	5	520	Good	Good		High	6.2	2.5	NO	1
197	Eucalyptus microcorys	8	6	400	Good	Fair		Medium	4.8	2.3	NO	1
198	Eucalyptus microcorys	9	5	600	Good	Fair		Medium	7.2	2.7	NO	1
199	Eucalyptus microcorys	5	3	400	Fair	Poor	Group of 3. Pruned for wires	Low	4.8	2.3	YES	3
200	Eucalyptus microcorys	5	3	250	Fair	Poor	Pruned for wires	Low	3.0	1.8	NO	1
201	Eucalyptus microcorys	5	4	360	Fair	Poor	Group of 3. Pruned for wires	Low	4.3	2.2	YES	3
202	Eucalyptus microcorys	7	4	400	Fair	Poor	Group of 2. Pruned for wires	Low	4.8	2.3	YES	2
203	Eucalyptus microcorys	6	3	500	Fair	Poor	Group of 2. Pruned for wires	Low	6.0	2.5	YES	2
204	Eucalyptus microcorys	5	3	350	Fair	Poor	Group of 2. Pruned for wires	Low	4.2	2.1	YES	2
205	Eucalyptus microcorys	8	4	450	Fair	Poor	Pruned for wires	Low	5.4	2.4	NO	1

NO	BOTANICAL NAME	HEIGHT (M)	SPREAD (M)	DBH (MM)	HEALTH	STRUCTURE	NOTES	RETENTION VALUE	TPZ (M)	SRZ (M)	Tree Group	No.of trees
206	Eucalyptus microcorys	7	3	470	Fair	Poor	Pruned for wires	Low	5.6	2.4	NO	1
207	Lophostemon confertus	5	3	400	Fair	Poor	Pruned for wires	Low	4.8	2.3	NO	1
208	Lophostemon confertus	5	3	400	Fair	Poor	Pruned for wires	Low	4.8	2.3	NO	1
209	Lophostemon confertus	4	3	390	Fair	Poor	Pruned for wires	Low	4.7	2.2	NO	1
210	Lophostemon confertus	5	3	300	Poor	Poor	Pruned for wires	Low	3.6	2.0	NO	1
211	Lophostemon confertus	4	2	450	Fair	Poor	Pruned for wires	Low	5.4	2.4	NO	1
212	Lophostemon confertus	5	2	400	Fair	Poor	Pruned for wires.	Low	4.8	2.3	NO	1
213	Lophostemon confertus	4	3	400	Poor	Poor	Pruned for wires	Low	4.8	2.3	NO	1
214	Eucalyptus microcorys	8	5	440	Good	Poor	Co dominant at base	Low	5.3	2.3	NO	1
215	Eucalyptus punctata	9	5	600	Fair	Poor	Co dominant at base	Low	7.2	2.7	NO	1
216	Lophostemon confertus	5	3	300	Good	Fair		Medium	3.6	2.0	NO	1
217	Eucalyptus microcorys	8	4	500	Poor	Fair		Low	6.0	2.5	NO	1
218	Ficus microcarpa	9	8	850	Good	Good		High	10.2	3.1	NO	1
219	Ficus microcarpa	9	6	500	Good	Good		High	6.0	2.5	NO	1
220	Eucalyptus tereticornis	15	13	880	Good	Good		High	10.6	3.1	NO	1
221	Agonis flexuosa	5	6	1000	Poor	Poor	Previous failure. Split	Low	12.0	3.3	NO	1
222	Ficus microcarpa	9	7	350	Good	Fair		Medium	4.2	2.1	NO	1
223	Casuarina glauca	7	3	400	Fair	Fair	Group of 3	Low	4.8	2.3	YES	3
224	Eucalyptus robusta	5	2	100	Good	Fair	Saplings x 10	Low	2.0	1.5	YES	10

NO	BOTANICAL NAME	HEIGHT (M)	SPREAD (M)	DBH (MM)	HEALTH	STRUCTURE	NOTES	RETENTION VALUE	TPZ (M)	SRZ (M)	Tree Group	No.of trees
225	Eucalyptus robusta	4	2	100	Fair	Fair	Saplings x 10	Low	2.0	1.5	YES	10
226	Eucalyptus robusta	5	2	150	Fair	Fair	Saplings x 10	Low	2.0	1.5	YES	10
227	Eucalyptus robusta	5	1	100	Fair	Fair	Saplings x 10	Low	2.0	1.5	YES	10
228	Eucalyptus robusta	5	2	100	Fair	Fair	Saplings x 10	Low	2.0	1.5	YES	10
229	Group of native	5	3	100	Good	Fair		Low	2.0	1.5	NO	1
230	Group of native	5	2	100	Good	Fair		Low	2.0	1.5	NO	1
231	Corymbia maculata	9	4	400	Good	Fair		Medium	4.8	2.3	NO	1
232	Shinus areira	5	6	700	Good	Fair		Medium	8.4	2.8	NO	1
233	Ficus microcarpa	8	8	900	Good	Good		High	10.8	3.2	NO	1
234	Ficus microcarpa	8	8	900	Good	Good		High	10.8	3.2	NO	1
235	Callistemon viminalis	4	3	200	Fair	Poor		Low	2.4	1.7	NO	1
236	Ficus microcarpa	6	6	600	Good	Poor		Low	7.2	2.7	NO	1
237	Eucalyptus saligna	12	6	800	Good	Good		High	9.6	3.0	NO	1
238	Eucalyptus sp.	8	5	600	Good	Fair	Group of 3	Medium	7.2	2.7	YES	3
239	Eucalyptus saligna	12	7	500	Good	Good	Group of 2	High	6.0	2.5	YES	2
240	Platanus acerifolia	15	10	1200	Good	Fair	Group of 4	Medium	14.4	3.6	YES	4
241	Lophostemon confertus	8	4	500	Good	Poor		Low	6.0	2.5	NO	1
242	Eucalyptus microcorys	15	10	700	Good	Good		High	8.4	2.8	NO	1
243	Callistemon viminalis	5	2	150	Good	Poor	Group of 3	Low	2.0	1.5	YES	3
244	Eucalyptus robusta	10	6	430	Good	Good		High	5.2	2.3	NO	1
245	Callistemon viminalis	4	2	200	Poor	Fair		Low	2.4	1.7	NO	1
246	Eucalyptus robusta	12	7	600	Fair	Good		Medium	7.2	2.7	NO	1
247	Corymbia maculata	12	9	460	Good	Fair		Medium	5.5	2.4	NO	1
248	Corymbia maculata	15	4	600	Good	Fair		Medium	7.2	2.7	NO	1
249	Eucalyptus robusta	10	5	520	Good	Fair		Medium	6.2	2.5	NO	1
250	Eucalyptus robusta	10	6	450	Fair	Fair		Medium	5.4	2.4	NO	1
251	Agonis flexuosa	5	4	500	Fair	Poor	Group of 2	Low	6.0	2.5	YES	2
252	Eucalyptus saligna	12	6	750	Good	Good		High	9.0	2.9	NO	1

NO	BOTANICAL NAME	HEIGHT (M)	SPREAD (M)	DBH (MM)	HEALTH	STRUCTURE	NOTES	RETENTION VALUE	TPZ (M)	SRZ (M)	Tree Group	No.of trees
253	Corymbia gummifera	5	6	400	Good	Poor	Pruned for wires	Low	4.8	2.3	NO	1
254	Corymbia gummifera	9	7	600	Good	Good		High	7.2	2.7	NO	1
255	Eucalyptus saligna	6	5	450	Good	Fair		Medium	5.4	2.4	NO	1
256	Corymbia maculata	7	4	400	Good	Fair		Medium	4.8	2.3	NO	1
257	Corymbia maculata	10	5	440	Good	Good		High	5.3	2.3	NO	1
258	Corymbia maculata	8	3	300	Good	Fair	Group of 5	Medium	3.6	2.0	YES	5
259	Corymbia maculata	6	3	300	Good	Fair	Group of 3	Medium	3.6	2.0	YES	3

3 Discussion

3.1 Trees within the footprint

A total of **449** trees were assessed as being within the construction footprint. Some trees were assessed as being part of a group of trees (see **Table 1**).

3.2 Tree work

- All tree work is to be carried out by an arborist with a minimum AQF Level 3 qualification in Arboriculture.
- All tree work must be in accordance with Australian Standard AS 4373-2007, Pruning of Amenity Trees and the NSW WorkCover Code of Practice for the Amenity Tree Industry (1998).
- Permission must be granted from the relevant consent authority, prior to removing or pruning of any of the subject trees.

3.3 Compensatory planting

Any loss of trees should be compensated for with replacement planting in accordance with the Roads and Maritime policy and in consultation with Bayside Council.

4 Tree protection plan

4.1 Tree protection measures

The following tree protection measures will be required if trees are retained:

- Tree protection fencing must be established around the perimeter of the TPZ. If the protective fencing requires temporary removal, trunk, branch and ground protection must be installed and must comply with *AS 4970-2009 - Protection of trees on development sites*. Existing fencing and site hoarding may be used as tree protection fencing.
- If temporary access for machinery is required within the TPZ, ground protection measures will be required. The purpose of ground protection is to prevent root damage and soil compaction within the TPZ. Ground protection may include a permeable membrane such as geotextile fabric beneath a layer of mulch, crushed rock or rumble boards.
- Any additional construction activities within the TPZ of the subject trees must be assessed and approved by the project arborist, and must comply with *AS 4970-2009 - Protection of trees on development sites.*

Further information and guidelines on tree protection is in **Appendix B**.

4.2 Hold points, inspection and certification

Any approved plans regarding retained trees must be available onsite prior to the commencement of works, and throughout the entirety of the project. Below are hold points which have been specified in the schedule of works below. It is the responsibility of the principal contractor to complete each of the tasks.

Once each stage is reached, the work will be inspected and certified by the project arborist and the next stage may commence. Alterations to this schedule may be required due to necessity, however, this shall be through consultation with the project arborist only.

Table 2: Schedule of works

Pre-construction	Prior to demolition and site establishment indicate clearly (with spray paint on trunks) trees marked for removal only.
	Tree protection (for trees that will be retained) shall be installed prior to demolition and site establishment, this will include mulching of areas within the TPZ
During Construction	Scheduled inspection of trees by the project arborist should be undertaken monthly during the construction period.
	Inspection of trees by project arborist after all major construction has ceased, following the removal of tree protection measures.
Post Construction	Final inspection of trees by project arborist.

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Appendix A – Tree Maps

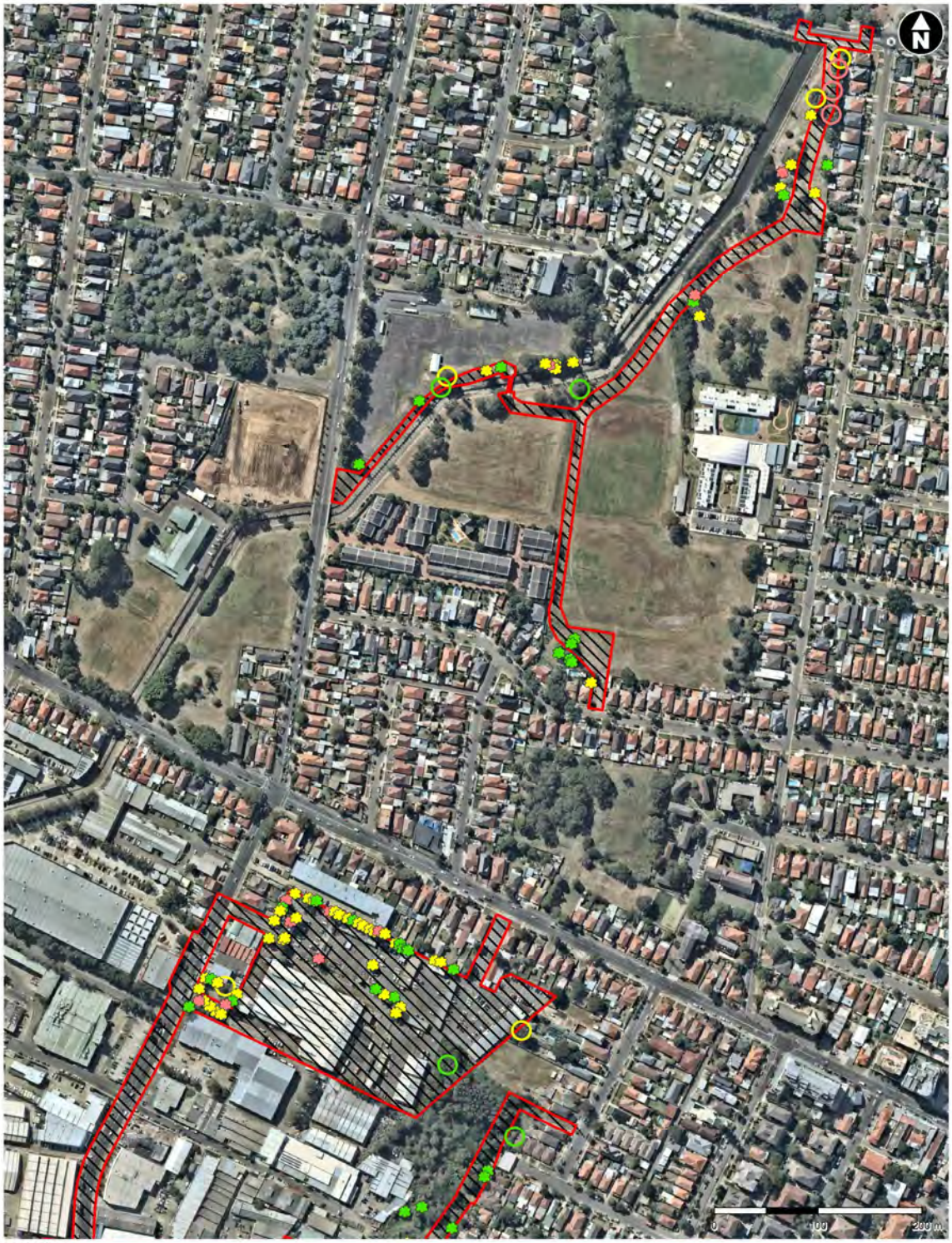


Figure 1-2 Tree Impact Assessment North

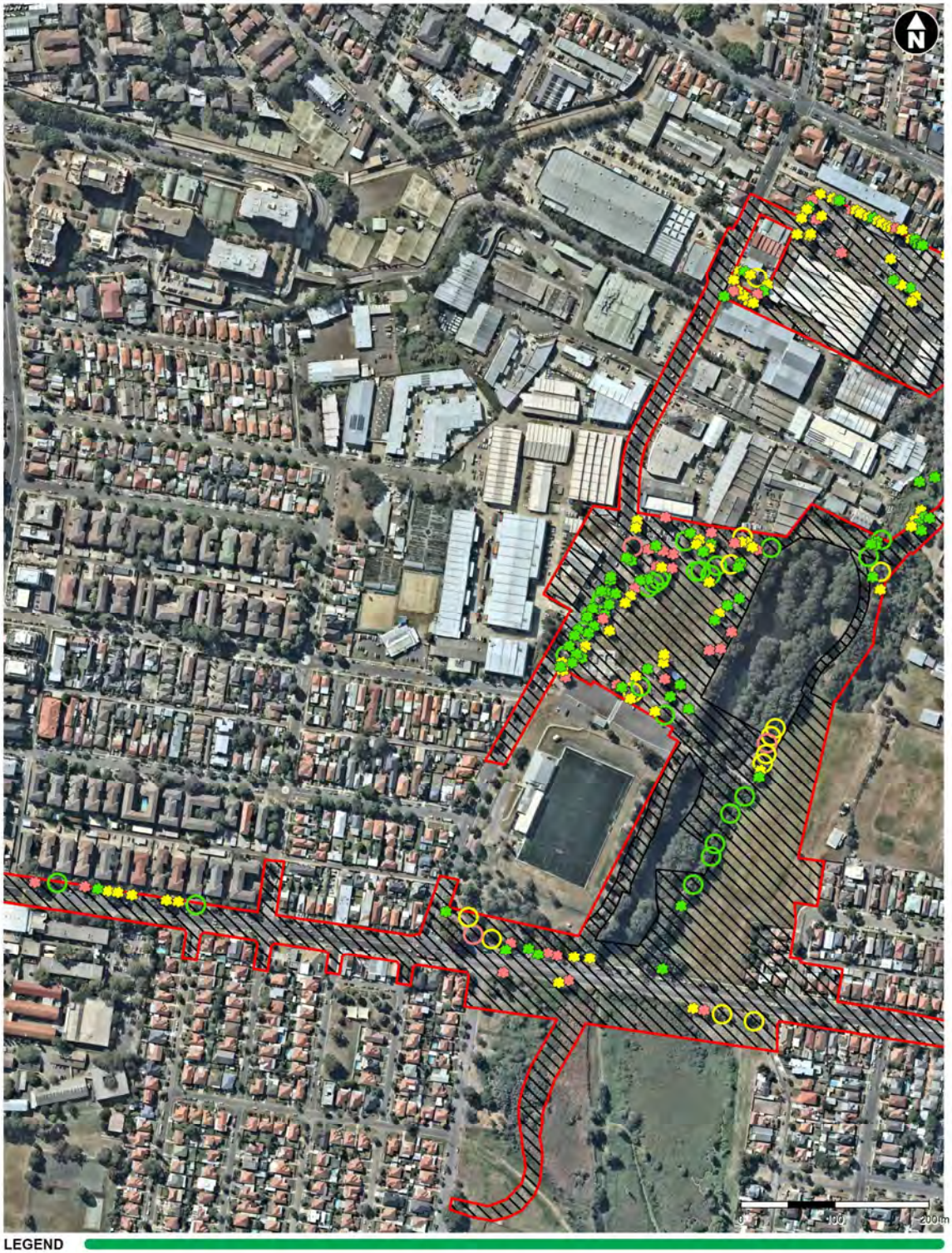


Figure 1-3 Tree Impact Assessment South

Figure 1-1 Tree Impact Assessment Overview

Appendix B Tree Protection Guidelines

The following tree protection guidelines must be implemented during the construction period if no tree-specific recommendations are detailed.

Tree protection fencing

The TPZ is a restricted area delineated by protective fencing or the use of an existing structure (such as a wall or fence).

Trees that are to be retained must have protective fencing erected around the TPZ (or as specified in the body of the report) to protect and isolate it from the construction works. Fencing must comply with the *Australian Standard, AS 4687-2007, Temporary fencing and hoardings*.

Tree protection fencing must be installed prior to site establishment and remain intact until completion of works. Once erected, protective fencing must not be removed or altered without the approval of the project arborist.

If the protective fencing requires temporary removal, trunk, branch and ground protection must be installed and must comply with *AS 4970-2009, Protection of Trees on Development Sites*.

Tree protection fencing shall be:

- Enclosed to the full extent of the TPZ (or as specified in the Recommendations and Tree Protection Plan).
- Cyclone chain wire link fence or similar, with lockable access gates.
- Certified and Inspected by the Project Arborist.
- Installed prior to the commencement of works.
- Prominently signposted with 300mm x 450mm boards stating “NO ACCESS - TREE PROTECTION ZONE”.

Crown protection

Tree crowns/canopy may be injured or damaged by machinery such as; excavators, drilling rigs, trucks, cranes, plant and vehicles. Where crown protection is required, it will usually be located at least one meter outside the perimeter of the crown.

Crown protection may include the installation of a physical barrier, pruning selected branches to establish clearance, or the tying/bracing of branches.

Ground protection

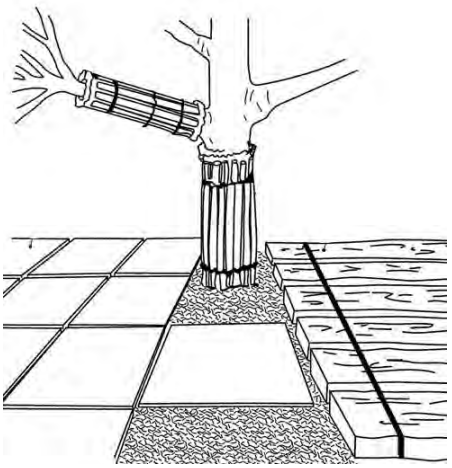
Tree roots are essential for the uptake/absorption of water, oxygen and mineral ions (solutes). It is essential to prevent the disturbance of the soil beneath the dripline and within the TPZ of trees that are to be retained. Soil compaction within the TPZ will adversely affect the ability of roots to function correctly.

If temporary access for machinery is required within the TPZ ground protection measures will be required. The purpose of ground protection is to prevent root damage and soil compaction within the TPZ. Ground protection may include a permeable membrane such as geotextile fabric beneath a layer of mulch, crushed rock or rumble boards.

If the grade is to be raised within the TPZ, the material should be coarser or more porous than the underlying material.

Trunk protection

Where provision of tree protection fencing is impractical or must be temporarily removed, truck protection shall be installed for the nominated trees to avoid accidental mechanical damage.



The removal of bark or branches allows the potential ingress of micro-organisms which may cause decay. Furthermore, the removal of bark restricts the trees' ability to distribute water, mineral ions (solutes), and glucose.

Trunk protection shall consist of a layer of either carpet underfelt, geotextile fabric or similar wrapped around the trunk, followed by 1.8 m lengths of softwood timbers aligned vertically and spaced evenly around the trunk (with an approx. 50 mm gap between the timbers).

The timbers must be secured using galvanised hoop strap (aluminium strapping). The timbers shall be wrapped around the trunk but not fixed to the tree, as this will cause injury/damage to the tree.

Root protection & pruning

If incursions/excavation within the TPZ are unavoidable, exploratory excavation (under the supervision of the Project Arborist) using non-destructive methods may be considered to evaluate the extent of the root system affected and determine whether or not the tree can remain viable.

If the project arborist identifies conflicting roots that requiring pruning, they must be pruned with a sharp implement such as; secateurs, pruners, handsaws or a chainsaw back to undamaged tissue. The final cut must be a clean cut.

Underground services

All underground services should be routed outside of the TPZ. If underground services need to be installed within the TPZ, they should be installed using horizontal directional drilling (HDD). The horizontal drilling/boring must be at minimum depth of 600mm below grade. Trenching for services is to be regarded as "excavation".

Appendix C Tree retention assessment method

Tree Significance - Assessment Criteria - STARS©		
Low	**Medium**	**High**
The tree is in fair-poor condition and good or low vigour. The tree has form atypical of the species The tree is not visible or is partly visible from the surrounding properties or obstructed by other vegetation or buildings The tree provides a minor contribution or has a negative impact on the visual character and amenity of the local area The tree is a young specimen which may or may not have reached dimensions to be protected by local Tree Preservation Orders or similar protection mechanisms and can easily be replaced with a suitable specimen The tree's growth is severely restricted by above or below ground influences, unlikely to reach dimensions typical for the taxa in situ – tree is inappropriate to the site conditions The tree is listed as exempt under the provisions of the local Council Tree Preservation Order or similar protection mechanisms The tree has a wound or defect that has the potential to become structurally unsound. The tree is an environmental pest species due to its invasiveness or poisonous/allergenic properties. The tree is a declared noxious weed by legislation	The tree is in fair to good condition The tree has form typical or atypical of the species The tree is a planted locally indigenous or a common species with its taxa commonly planted in the local area The tree is visible from surrounding properties, although not visually prominent as partially obstructed by other vegetation or buildings when viewed from the street The tree provides a fair contribution to the visual character and amenity of the local area The tree's growth is moderately restricted by above or below ground influences, reducing its ability to reach dimensions typical for the taxa in situ	The tree is in good condition and good vigour The tree has a form typical for the species The tree is a remnant or is a planted locally indigenous specimen and/or is rare or uncommon in the local area or of botanical interest or of substantial age. The tree is listed as a heritage item, threatened species or part of an endangered ecological community or listed on councils significant tree register The tree is visually prominent and visible from a considerable distance when viewed from most directions within the landscape due to its size and scale and makes a positive contribution to the local amenity. The tree supports social and cultural sentiments or spiritual associations, reflected by the broader population or community group or has commemorative values. The tree's growth is unrestricted by above and below ground influences, supporting its ability to reach dimensions typical for the taxa in situ – tree is appropriate to the site conditions.

Tree Significance

Useful Life Expectancy	High	Medium	Low		
Long >40 years					
Medium 15-40 years					
Short <1-15 years					
Dead					

Legend for Matrix Assessment

	Priority for retention (High): These trees are considered important for retention and should be retained and protected. Design modification or re-location of building/s should be considered to accommodate the setbacks as prescribed by the Australian Standard AS4970 Protection of trees on development sites. Tree sensitive construction measures must be implemented if works are to proceed within the Tree Protection Zone.
	Consider for retention (Medium): These trees may be retained and protected. These are considered less critical; however their retention should remain priority with the removal considered only if adversely affecting the proposed building/works and all other alternatives have been considered and exhausted.
	Consider for removal (Low): These tree are not considered important for retention, nor require special works or design modification to be implemented for their retention.
	Consider for removal (Low): These tree are not considered important for retention, nor require special works or design modification to be implemented for their retention.

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ecological AUSTRALIA

bsi. ISO 14001 Environmental Management

bsi. AS/NZS 4801:2001 Occupational Health and Safety Management

bsi. ISO 9001 Quality Management

Annexure B – Overshadowing Assessment

Introduction

This report was prepared by AECOM (2018) and provides an assessment of overshadowing for the following pieces of infrastructure -

Motorway Operations Complex 2 (MOC2):

- Motorway control centre building – 2 storeys (10 metres)
- Motorway maintenance facility – up to 3 storeys (large industrial shed)
- Motorway bulky equipment store – up to 3 storeys (large industrial shed)
- Deluge tanks – assume up to 2 storeys
- Pump station – assume 1 storey (5 metres)
- Pump room – assume 1 storey (5 metres)

Motorway Operations Complex 3 (MOC3):

- Disaster recovery site – 1 storey (5 metres)
- VSO building at West Botany Street is 15m high
- VSO stack 35m (38AHDm) – Note A: The stack is shown at required diameter. Architectural cladding may increase the width and breadth of the stack.
- Substation - 5m for the main building plus a 2 metres high screen wall on about half of the roof to hide the A/C units.

The overshadowing assessment was produced using actual building heights of existing buildings, and the above building heights for the proposed buildings. The overshadowing assessment was undertaken in SketchUp.

Assessment of MOC 2

Refer **Figure 1** for preliminary diagrams that locate the extent of overshadowing for the:

- Winter solstice at 9:00 am, 12:00 midday and 3:00 pm
- Spring / autumn equinox at 9:00 am, 12:00 midday and 3:00 pm, and
- Summer solstice at 9:00 am, 12:00 midday and 3:00 pm.

The key receptors are:

- Adjacent industrial buildings – a workplace – sensitivity is low.

Winter solstice

- 9:00 am: No significant overshadowing of adjacent buildings
- 12:00 midday: No overshadowing of adjacent buildings
- 3:00 pm: No significant overshadowing of adjacent buildings

The impact of the overshadowing is considered to be: **Negligible**.

Spring / autumn equinox

- 9:00 am: No overshadowing of adjacent buildings
- 12:00 midday: No overshadowing of adjacent buildings
- 3:00 pm: No overshadowing of adjacent buildings

The impact of the overshadowing is considered to be: **No impact**

Summer solstice

- 9:00 am: No overshadowing of adjacent buildings
- 12:00 midday: No overshadowing of adjacent buildings
- 3:00 pm: No overshadowing of adjacent buildings
- The impact of the overshadowing is considered to be: No impact

Assessment of MOC 3

Refer **Figure 2** for preliminary diagrams that locate the extent of overshadowing for the:

- Winter solstice at 9:00 am, 12:00 midday and 3:00 pm,
- Spring / autumn equinox at 9:00 am, 12:00 midday and 3:00 pm, and
- Summer solstice at 9:00 am, 12:00 midday and 3:00 pm.

The key receptors are:

- West: three storey industrial building with predominantly glazed façade – place of work – sensitivity low
- South-east: footpath – West Botany Street – public domain – busy street in industrial setting – sensitivity low
- East: Bicentennial Park – well-used recreational facility sensitivity high

Winter solstice

- 9:00 am: The VSO building line falls across the southern glazed end of the building face of the industrial premises. Overshadowing of windows by the VSO building is likely to be moderate during this period. By about 10.30, the industrial premises would be expected to be out of shadow. Sensitivity is low as above.
- 12:00 midday: Key issue is overshadowing of the footpath on West Botany Street. Sensitivity is low as above.
- 3:00 pm: Moderate overshadowing of Bicentennial Park, although most of this is limited to the street tree planting. The vent shaft projects substantially into the park, however the shadow is relatively narrow.

On balance, the impact of the overshadowing is considered to be **Low**.

Spring / autumn equinox

- 9:00 am: The VSO building shadow line barely touches the industrial premises.
- 12:00 midday: The footpath is unshaded.
- 3:00 pm: The footpath and northbound lane are in shadow. The stack overshadows a small portion of the opposite verge.

The impact of the overshadowing is considered to be **Negligible**.

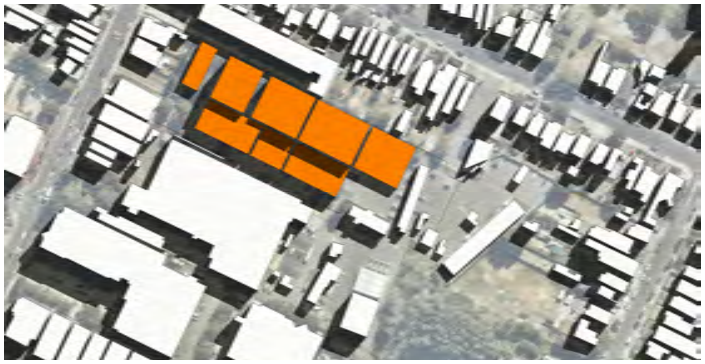
Summer solstice

- 9:00 am: The VSO building shadow line barely touches the industrial premises.
- 12:00 midday: Almost no shadow cast.
- 3:00 pm: The footpath is in shadow.

On balance, the impact of the overshadowing is considered to be **Negligible**.

Conclusion

On balance, the impact of the overshadowing from both MOC 2 and MOC 3 is considered to be **Negligible**.



JUNE 21_9AM

JUNE 21_12 NOON

JUNE 21_3PM

MARCH 21/SEPTEMBER 23_9AM

MARCH 21/SEPTEMBER 23_12 NOON

MARCH 21/SEPTEMBER 23_3PM

DECEMBER 22_9AM

DECEMBER 22_12 NOON

DECEMBER 22_3PM

PROJECT
F6 Extension Stage 1

DRAWING TITLE
SHADOW DIAGRAMS_MOC2

Project No.: 60557212 Date: 19.10.2018

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FIGURE 1

JUNE 21_9AM

JUNE 21_12 NOON

JUNE 21_3PM

MARCH 21/SEPTEMBER 23_9AM

MARCH 21/SEPTEMBER 23_12 NOON

MARCH 21/SEPTEMBER 23_3PM

DECEMBER 22_9AM

DECEMBER 22_12 NOON

DECEMBER 22_3PM

PROJECT
F6 Extension Stage 1

DRAWING TITLE
SHADOW DIAGRAMS_MOC3

Project No.: 60557212 Date: 19.10.2018

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FIGURE 2

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