14 Property and land use

This chapter considers the potential land use and property implications of constructing and operating the project, proposes mitigation measures to avoid or reduce impacts and outlines how the desired performance outcomes have been met. **Table 14-1** sets out the SEARs relevant to land use and property and identifies where the requirements have been addressed in this EIS.

Table 14-1 SEARs - Property and land use

Assessment requirements	Where addressed in this EIS
Socio-economic, Land Use and Property	
1. The Proponent must assess social and economic impacts (of all phases of the project) in accordance with the current guidelines (including cumulative construction and operational impacts of the proposal and other major projects in the vicinity of the project) and in consultation with relevant land owners (such as those land owners whose property is being acquired or local residents who would be directly affected by road widening or loss of on street parking).	An assessment of construction and operation impacts on potentially affected properties, businesses, and recreational users with regard to the below listed items is provided in section 14.4 and section 14.5 of this report: • property acquisitions / adjustments • future land uses • relevant statutory rights. Assessment of social and economic impacts is provided in Chapter 15 (Social and economic).
2. The Proponent must assess impacts from construction and operation on potentially affected properties, businesses, and recreational space users, including amenity impacts (including from cumulative and extended construction time frames and construction fatigue, particularly where use of current road project construction facilities are proposed), traffic congestion, property acquisitions/ adjustments, future land uses, restricted access, parking and business disruption, relevant statutory rights, and community severance and barrier impacts resulting from the project.	An assessment of construction and operation impacts on potentially affected properties, businesses, and recreational users with regard to the below listed items is provided in section 14.4 and section 14.5 of this report: • property acquisitions / adjustments • future land uses • relevant statutory rights. Assessment of amenity impacts with regard to the below listed items are provided in Chapter 8 (Traffic and transport), Chapter 15 (Social and economic) and Chapter 13 (Landscape and visual impact assessment): • traffic congestion • restricted access • parking and business disruption • community severance • barrier impacts resulting from the project.
3. The Proponent must identify and assess the need for temporary and permanent relocation during construction of community facilities such as sports fields and playgrounds.	Section 14.4 and section 14.5
5. The Proponent must assess potential impacts on utilities directly affected by the project (including communications, electricity, gas, fuel, stormwater, potable water and sewerage) and identify management options for impacted utilities, including its relocation or adjustment.	Section 14.5.3

14.1 Assessment methodology

The assessment method used the following approach:

- Review of the existing environment with reference to existing land uses and aerial photography and a detailed site investigation (see **section 14.2**)
- Reviewing key strategic planning policies and documents relevant to the study area, to identify planned future priorities, land uses, planning controls and developments (see **section 14.3**)
- Assessing the potential impacts of construction and operation on existing and likely future land uses (see **section 14.5**), and properties in and around the project (see **section 14.4**)
- Identifying mitigation measures that would assist in reducing or avoiding land use and property impacts (see **section 14.6**).

14.2 Existing environment

The project generally traverses the south eastern Sydney suburbs of Arncliffe, Banksia, Rockdale, Kogarah and Brighton-Le-Sands, within the Bayside Local Government Area (LGA) with the permanent power supply connection also crossing through Earlwood, Wolli Creek and Bardwell Valley. Land use zonings within and in the vicinity of the project are set by the following environmental planning instruments:

- Sydney Regional Environmental Plan No.33 – Cooks Cove
- Rockdale LEP 2011 (current plan for Bayside Council).
- Canterbury LEP 2012 (current plan for Canterbury-Bankstown Council)

Under these instruments, the land within and in the vicinity of the project is zoned for a mix of infrastructure, residential, recreation, industrial, commercial and environmental uses (refer to **Figure 14-1**)**.**

Current land uses primarily comprise road infrastructure, open space and low / medium density residential land uses.

There are two major arterial roads within the area - Princes Highway and the M5 Motorway – as well as, other main roads such as President Avenue and West Botany Street. A large area of land within and in the vicinity of the project has also been zoned for the existing F6 reserved corridor. Having been set aside for future infrastructure, this area has largely been protected from development. However, there are some small areas within the zoned area which have been developed for residential and other purposes in the interim as a result of changes in government initiatives.

The open space in the area includes the Rockdale Wetlands and Recreation Corridor (which is located partially within and adjacent to the existing F6 reserve corridor), parks and reserves adjacent to and adjoining muddy creek and the Kogarah Golf Course.

Commercial uses in the area are primarily focussed around the Princes Highway, the Grand Parade, and Rockdale Plaza. There is also an area of light industrial land located to the south of Bay Street, focussed around West Botany Street.

Although the area consists of primarily lower density housing, there are some areas that have transitioned to higher densities, particularly near Marsh Street and along the Princes Highway.

A number of health and education uses are also located along the Princes Highway, near its intersection with president Avenue. The recently constructed Cairnsfoot Special school is also located to the east of where the project would be located.

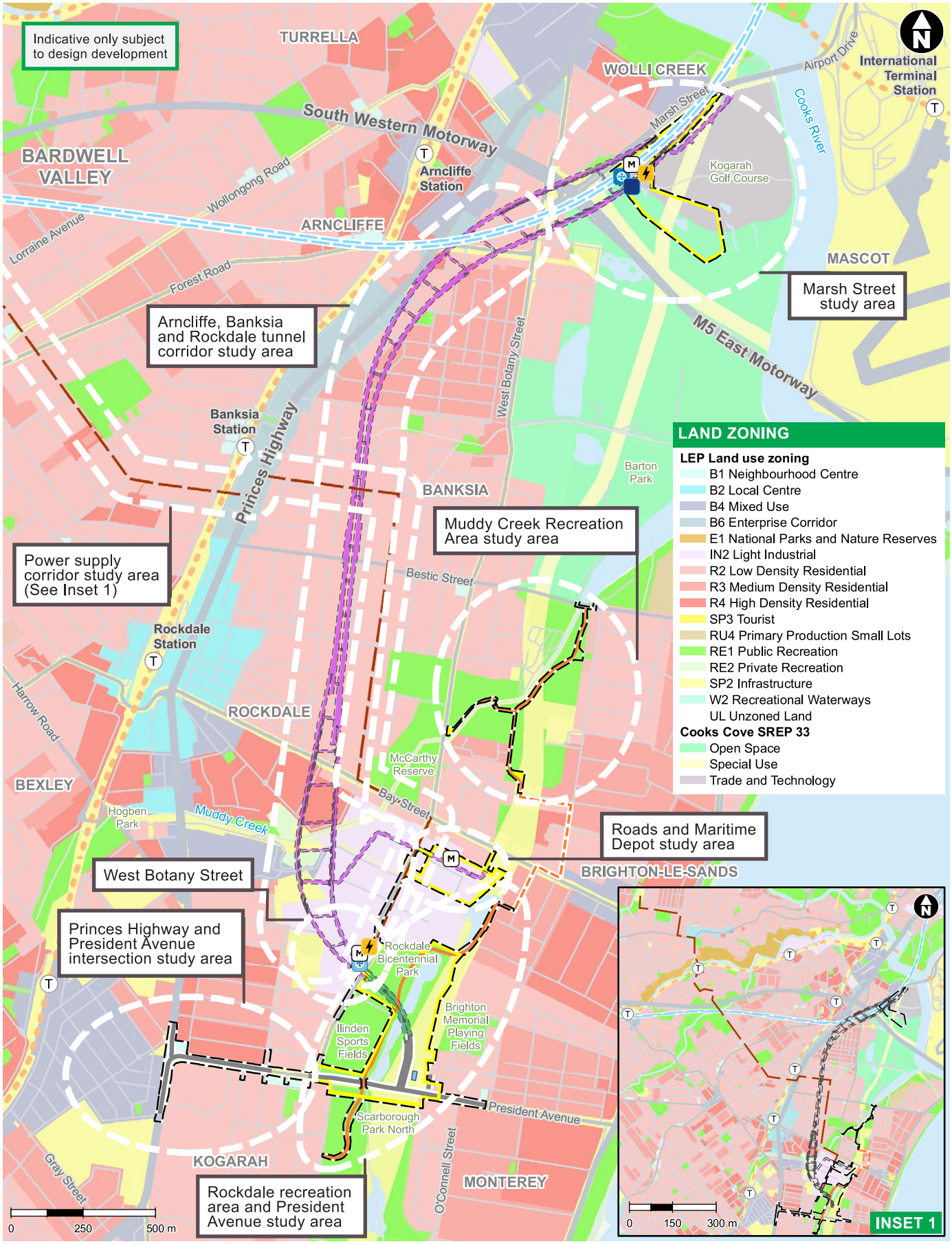
Sydney Airport is located to the east and has a significant influence on the surrounding development.

The majority of the project would be located underground within tunnels and have limited potential for impact on property and land use. Surface sites occur where works are required to build temporary construction facilities or permanent operational infrastructure.

For the purposes of assessment, the project has been divided into study areas. These study areas are outlined in **Table 14-2** and shown on **Figure 14-1.** A description of the existing environment within these study areas is provided in the following sections.

Table 14-2 Property and land use study areas

Study area	Project construction elements	Project operation elements
Marsh Street	• Arncliffe construction ancillary facility (C1)	• Motorway Operations Complex (MOC1)
Muddy Creek recreation area	• Shared cycle and pedestrian pathways east construction ancillary facility (C4) • Shared cycle and pedestrian pathways west construction ancillary facility (C5)	• Shared cycle and pedestrian pathways
Rockdale Roads and Maritime Depot	• Rockdale construction ancillary facility (C2)	• Rockdale Motorway Operations Complex (north) (MOC2)
West Botany Street	• President Avenue construction ancillary facility (C3)	• Rockdale Motorway Operations Complex (south) (MOC3)
Rockdale recreation area and President Avenue	• President Avenue construction ancillary facility (C3) • Construction of shared cycle and pedestrian path and on-road cycleway	• President Avenue interchange • Entry and exit ramps • Shared cycle and pedestrian pathways (including President Avenue shared cycle and pedestrian bridge)
Princes Highway and President Avenue intersection	• President Avenue / Princes Highway intersection upgrade works	• President Avenue / Princes Highway intersection upgrade
Arncliffe, Banksia and Rockdale tunnel corridor	• Cut and cover tunnel construction	• Road tunnels
Permanent power supply corridor	• Permanent power supply connection construction	• 33 kV permanent power supply



LEGEND

- Construction boundary
- Cut-and-cover structures
- Underground construction
- Construction ancillary facility
- On-road cycleway
- President Avenue shared cycle and pedestrian bridge
- Shared cycle and pedestrian pathways
- Substation
- Water treatment facility
- Rockdale ventilation facility
- Motorway operations complex
- Surface works
- Permanent power supply line
- Water quality basin
- New M5 Tunnel
- Parks and recreation
- Arncliffe ventilation facility*
  * Under construction as part of the New M5 Motorway project
- Road
- Waterway
- Railway line
- Railway station

Figure 14-1 Land use zoning and study areas

Marsh Street

Land Use

The project in the Marsh Street study area would be located on land currently being used to construct the New M5 Motorway. Prior to commencement of the project, the construction site would be demobilised and the area prepared. The northern sector of this area adjacent to Marsh Street would be the Motorway Operations Complex (MOC1) permanent facility for both New M5 Motorway and the project.

The land north of Marsh Street consists predominately of low density residential land uses with a pocket of high density residential and commercial land uses to the north east. The low density residential area consists of a mix of one to two storey detached dwellings while the high density residential and commercial area consists of a number of hotels with ground floor retail and apartment buildings that range between five and 13 storeys.

The land to the south, east and west consists primarily of the Kogarah Golf Club including greens and a club house. The heritage listed Southern and Western Suburbs Ocean Outfall Sewer (SWSOOS) and the M5 East Motorway are also located to the south of the site, running in parallel to each other.

Purpose built breeding ponds for the Green and Gold Bell Frog are located in an area to the south west near Marsh Street and the SWSOOS (the RTA Ponds).

Planning Controls

According to the *Cooks Cove Sydney Regional Environment Plan No. 33 2004* (SREP 33), the south eastern parts of this study area (including the land that would be used for the project) is zoned a mix of 'Trade and Technology', 'Special Uses' and 'Open Space (Investigation Area)' (refer **Figure 14-1**). The aims of each of these zones are:

- Trade and Technology: To encourage economic activity and trade-focussed businesses as defined in the SREP
- Special Uses**:** To accommodate existing special uses, including the SWSOOS and M5 corridor and to provide for the development of a transport corridor
- Open Space: To provide for open space and recreational uses and environmental protection areas.

The north western parts of this study area are zoned a mix of SP2 Infrastructure, B4 Mixed Use, R4 High Density Residential, R3 Medium Density Residential and RE1 Public Recreation under the Rockdale LEP 2011 (refer to **Figure 14-2).**

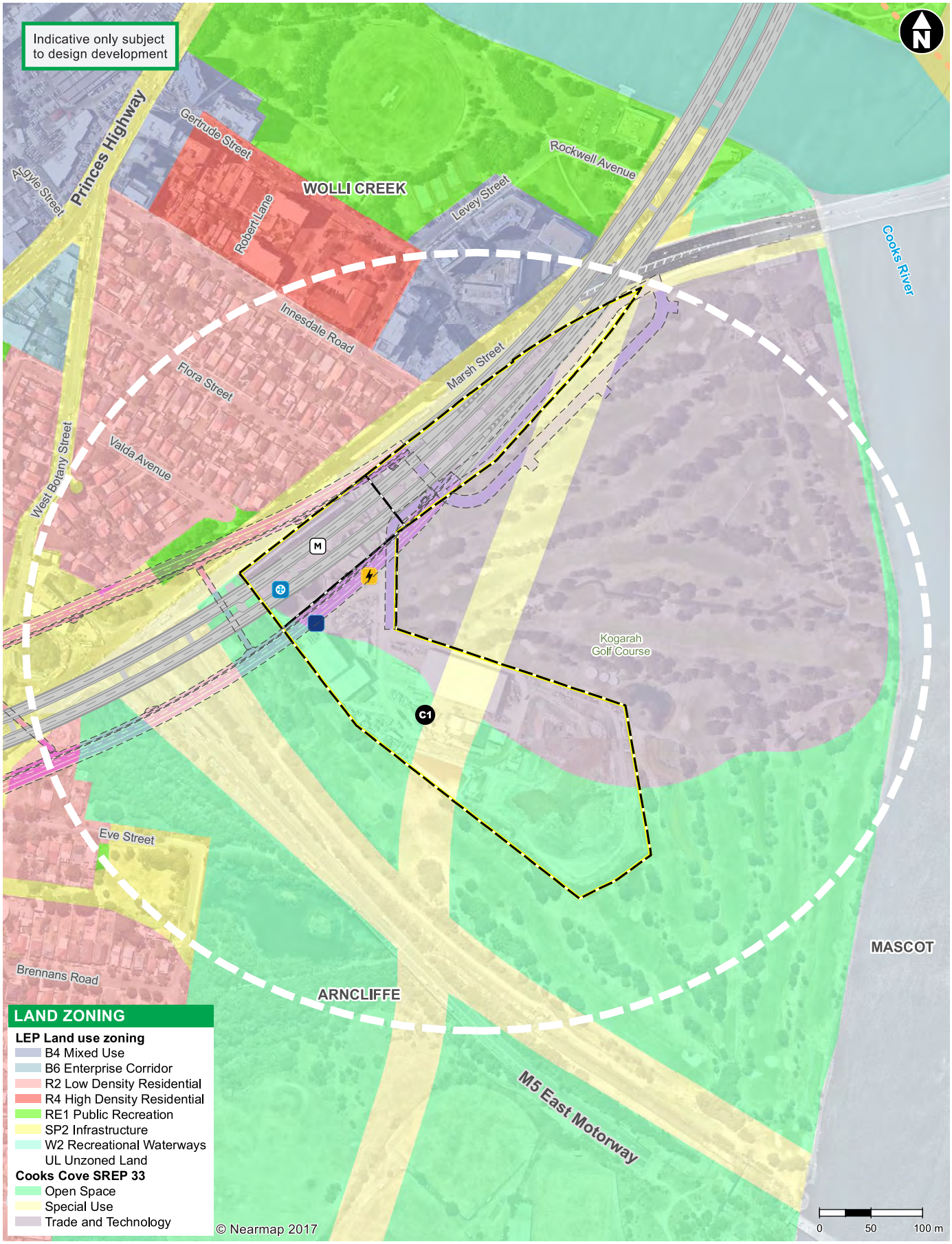


Figure 14-2 Marsh Street study area

Muddy Creek recreation area

Land Use

This study area consists primarily of open space, utilised for active and passive recreation uses. This includes White Oak Reserve, Rockdale Park, Rockdale Womens Sports Field, White Oak Creek Reserve, C.A. Redmond Field, Ador Reserve and McCarthy Reserve.

A constructed portion of the Muddy Creek canal runs north east to south west through the centre of the study area.

Low scale, detached dwellings lie to the east and south east while to the south west residential dwellings are primarily townhouses. A caravan park is located to the north west, across Muddy Creek.

An education facility (Cairnsfoot Special School) is located to the east adjoining the C.A. Redmond Field.

A cycleway is located along the eastern bank of Muddy Creek to the north of Bestic Street, connecting to the Cooks River and the Botany Bay foreshore.

Planning Controls

Within the Rockdale LEP 2011, land in this area is Infrastructure (SP2) and Public Recreation (RE1). The objectives of the SP2 Infrastructure and Public Recreation (RE1) zones are to provide for transport infrastructure and related uses and to enable land to be used for public open space or recreational purposes respectively.

Land use zones in the vicinity of the project comprise the following zones: Infrastructure (SP2), Public Recreation (RE1), Low Density Residential (R2) and Medium Density Residential (R3) (refer to **Figure 14-3**).

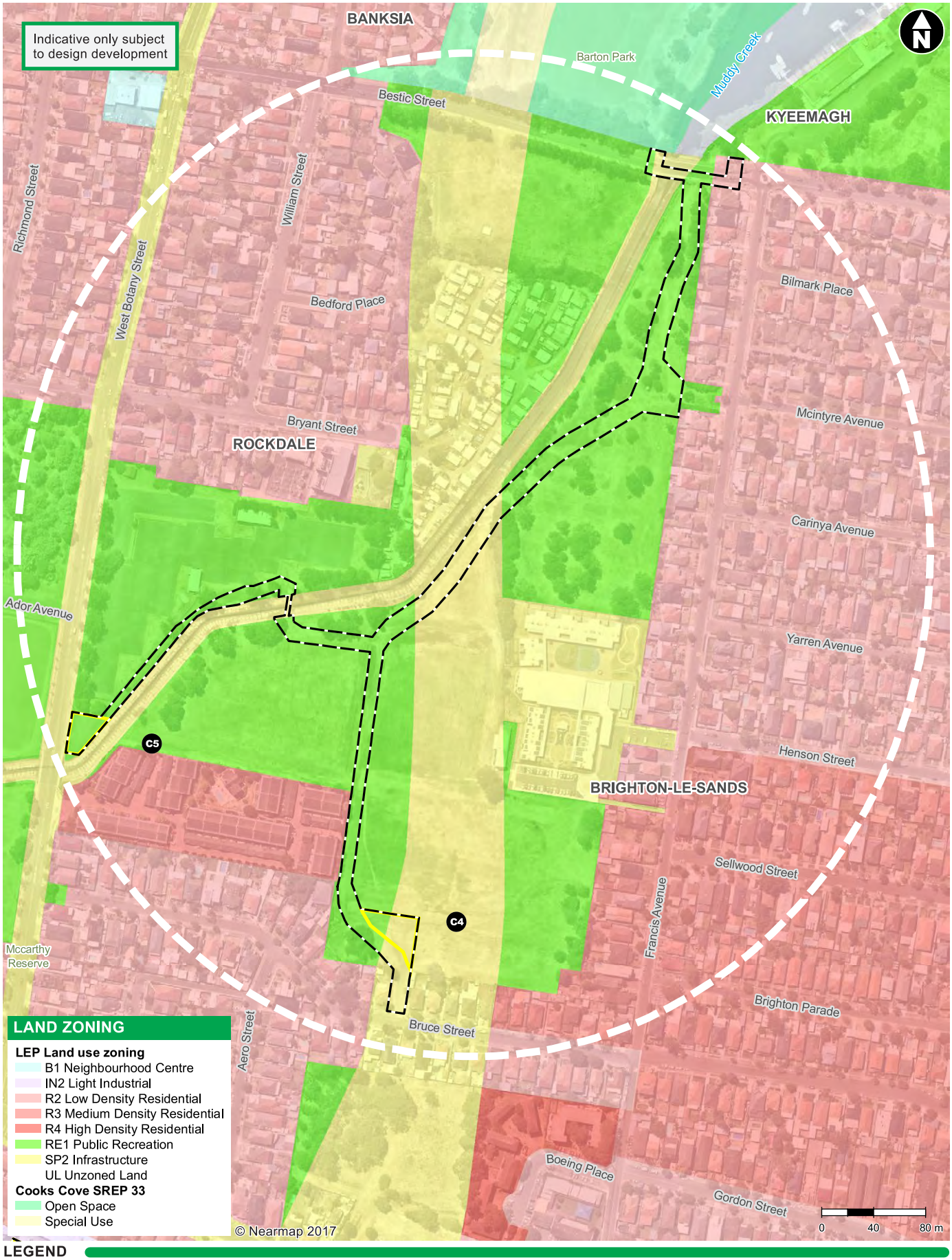


Figure 14-3 Muddy Creek recreation area study area

Rockdale Roads and Maritime Depot

Land Use

The project in this area would occupy around half of the existing Roads and Maritime maintenance depot (35,000 square metres in total). Surrounding land uses in the vicinity of the project include road infrastructure, light industrial, commercial, residential and public open space.

The commercial uses surrounding the project include a number of independent small businesses, bulky goods and other retail.

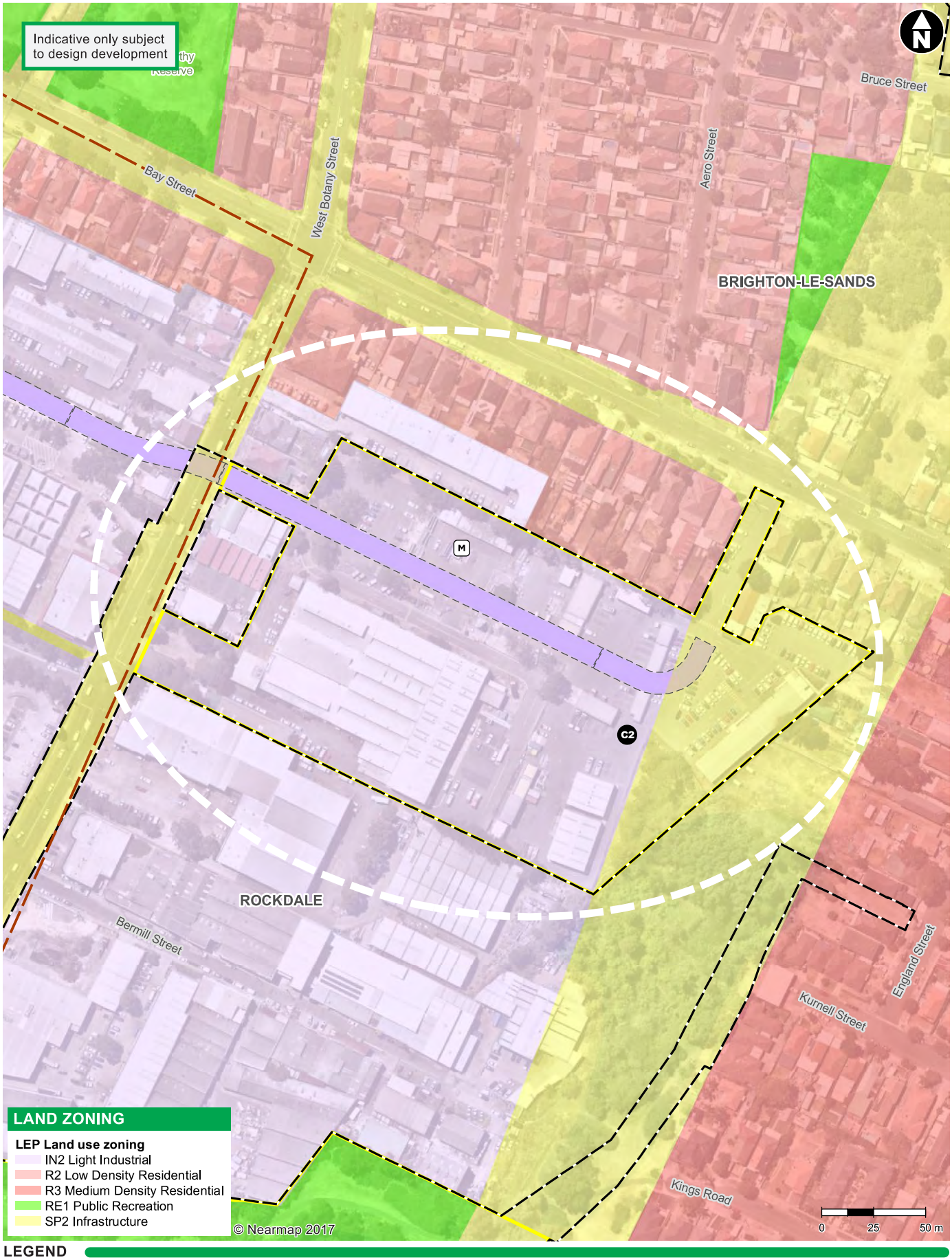
Kings Wetland (which forms part of the Rockdale Wetlands) is located to the east and consists primarily of dense vegetation with pockets of open space.

Residential land uses are located to the north and consist of low scale detached dwellings with the exception of a two storey walk up apartment building adjacent to the north west corner of the site.

Planning Controls

The land that would be used for the project is zoned Light Industrial (IN2) and Infrastructure (SP2) under Rockdale LEP 2011. The objectives of the Light Industrial (IN2) and Infrastructure (SP2) zones are to provide a wide range of light industrial, warehouse and related land uses and to provide for transport infrastructure and related uses respectively.

The land use zoning surrounding the project area comprises Infrastructure (SP2), Light Industrial (IN2), Low Density Residential (R2), Medium Density Residential (R3) and Public Recreation (RE1) (refer to **Figure 14-4**).



LEGEND

- Construction boundary
- Cut-and-cover structures
- Underground construction
- Underground construction - Temporary access tunnel
- Construction ancillary facility
- Assessment area
- Motorway operations complex
- Permanent power supply line

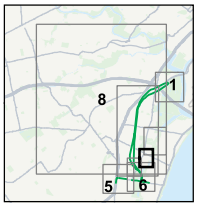


Figure 14-4 Rockdale Roads and Maritime Depot study area

West Botany Street

Land Use

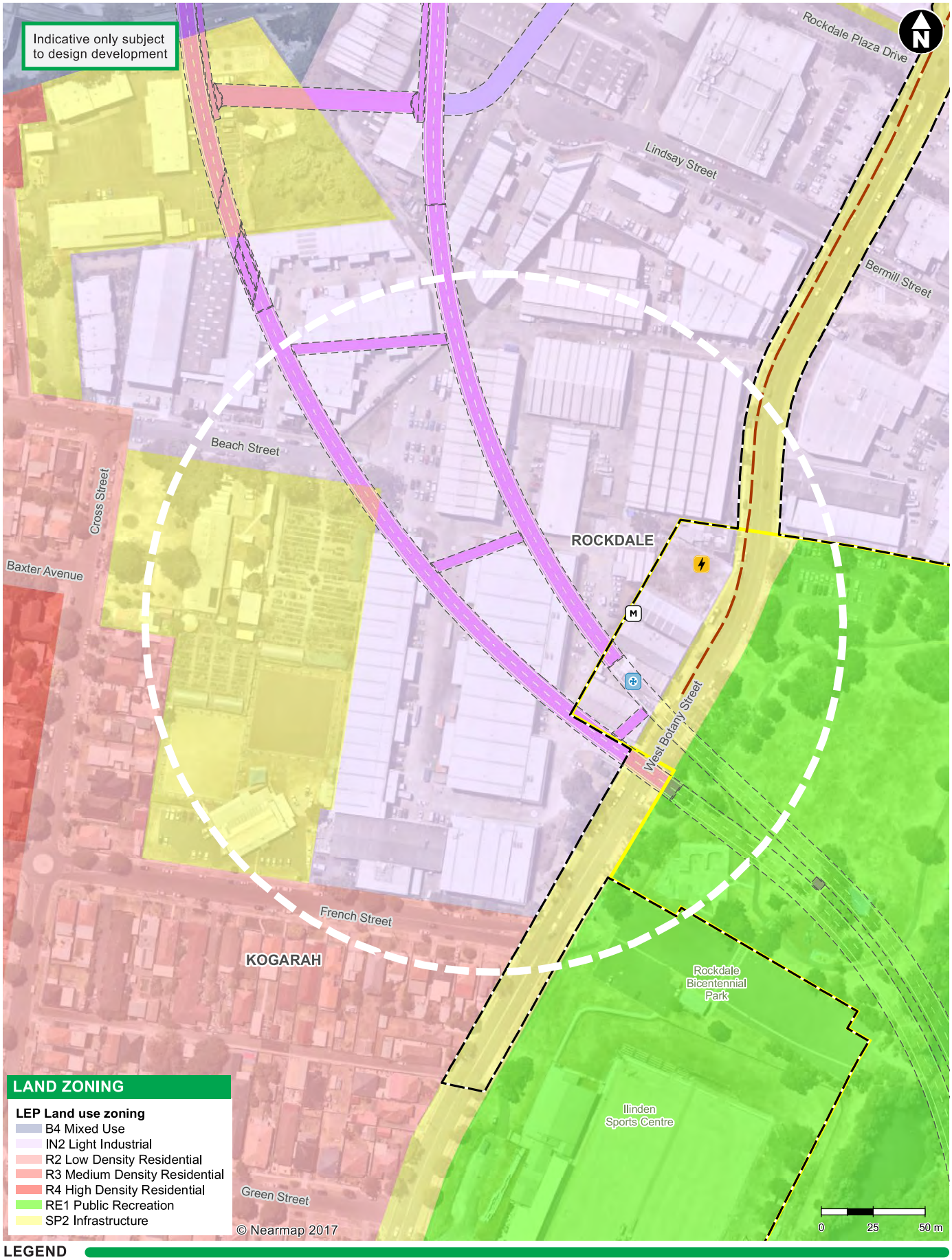
The project in the West Botany Street study area would be located on land that currently comprises seven lots of commercial land use. Existing business uses include a joinery and fitout services business, a glass business and a clothing retail outlet. Two of the lots are vacant.

Land uses surrounding these seven lots include road infrastructure, light industrial and commercial. The land use on the other (eastern) side of West Botany Street is open space.

Planning Controls

The project would be located on land zoned Light Industrial (IN2) under Rockdale LEP 2011. The objective of this zone is to provide a wide range of light industrial, warehouse and related land uses.

The land use zoning surrounding this area is a mix of the following zones: Light Industrial (IN2), Infrastructure (SP2) and Public Recreation (RE1) (refer to **Figure 14-5**).



LEGEND

- Construction boundary
- Cut-and-cover structures
- Underground construction
- Underground construction - Temporary access tunnel
- Construction ancillary facility
- Assessment area
- Substation
- Rockdale ventilation facility
- Motorway operations complex
- Permanent power supply line

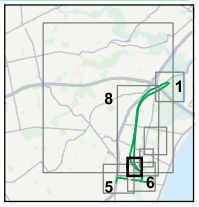


Figure 14-5 West Botany Street study area

Rockdale recreation area and President Avenue

Land Use

The project in this area would be almost wholly located within the existing F6 reserved corridor, currently designated as Rockdale Bicentennial Park situated between West Botany Street and Crawford Road and north of President Avenue.

Rockdale Bicentennial Park consists of open grassed areas, a children's play area, a skate park and the Kings Wetland area. Rockdale Bicentennial Park (East) is characterised by open parkland primarily used for sporting fields while areas of Scarborough Park (north of President Avenue) are primarily vegetated open space. Residential land uses within the existing F6 reserved corridor consist of low density detached dwellings.

Surrounding land uses include light industrial, commercial, road infrastructure, residential and open space. The surrounding open space consists of the remainder of Bicentennial Park, Memorial Fields, and Scarborough Park, Ilinden Sports Centre (adjoining the site to its west) and Civic Avenue Reserve (to the south of the site).

Residential uses in the surrounding area comprise one and two storey detached dwellings to the south, east and west of the site with some scattered townhouses.

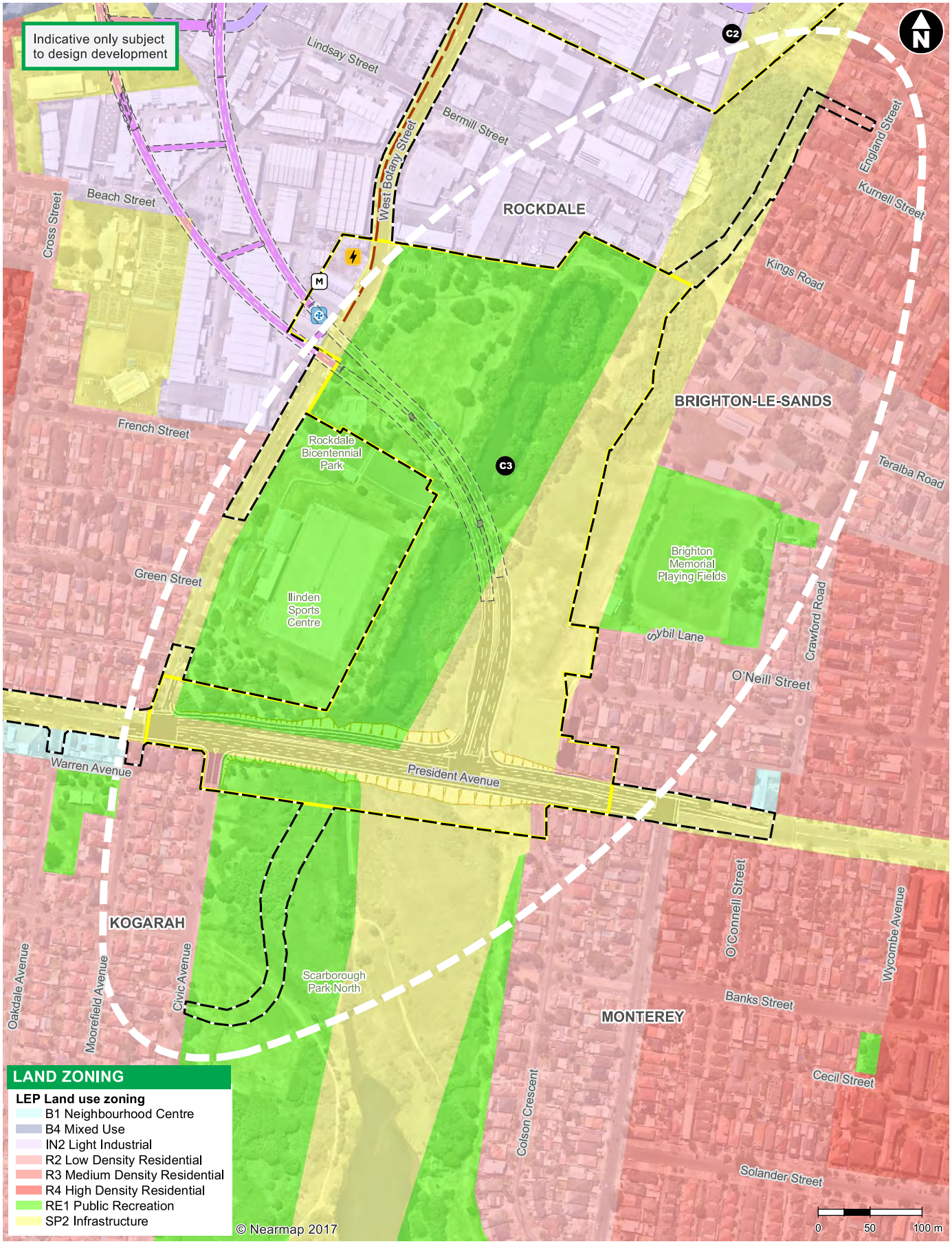
Industrial uses adjacent to the project include a range of service and retail related commercial premises. A scout hall adjoins Rockdale Bicentennial Park to the north east, accessed via Kurnell Street.

Planning Controls

The project would be located on land zoned a mix of Infrastructure (SP2), Public Recreation (RE1), Low Density Residential (R2) and Light Industrial (IN2). The objectives of these zones are:

- Infrastructure (SP2): To provide for transport infrastructure and related uses
- Public Recreation (RE1): To enable land to be used for public open space or recreational purposes respectively
- Light Industrial (IN2): To provide a wide range of light industrial, warehouse and related land uses
- Low Density Residential (R2): To provide for the housing needs of the community within a low density residential environment as well as other land uses that provide facilities or services to meet the day to day needs of residents.

Land use zones surrounding the project are a mix of the following zones: Infrastructure (SP2), Public Recreation (RE1), Low Density Residential (R2), Medium Density Residential (R3) and Light Industrial (IN2) (refer to **Figure 14-6**).



LEGEND

- Construction boundary
- Cut-and-cover structures
- Underground construction
- Underground construction - Temporary access tunnel
- Construction ancillary facility
- Assessment area
- Surface works
- Substation
- Rockdale ventilation facility
- Motorway operations complex
- Permanent power supply line

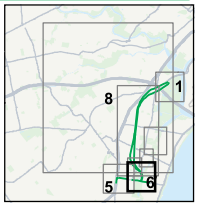


Figure 14-6 Rockdale recreation area and President Avenue study area

Princes Highway and President Avenue intersection

Land Use

This study area is located between West Botany Street and Bank Lane and primarily comprises parts of the road corridor (including verges).

The part of the study area that runs along the Princes Highway includes land between the St George Private hospital (near South Street) and Green Street. The project would be primarily located within the road corridor, although would also be located on some small areas of land to the eastern side of the Princes Highway. These land uses outside of the road corridor include three walk up apartments, the TAFE NSW St George Campus, a service station and a co-located auto service business.

Land uses in the area surrounding where the project would be located include a mix of commercial, residential, education facilities and health facilities including the TAFE NSW St George Campus, St George Private Hospital and James Cook Boys Technology High School which are located to the south of the site.

There are two commercial strips adjoining the project footprint, one fronting President Avenue and one along Princes Highway. The southern side of President Avenue, west of West Botany Street, consists of a row of commercial premises with uses that include a pet store, dentist, massage and chiropractic services, beauty services, clothing retailer, cooking school, butcher, café, bakery and veterinary hospital. A service station is also located to the west of this commercial strip. The Princes Highway, between South Street and Gladstone Street consists of an accountant firm, chocolate shop, furniture retailer, car wash and two service stations (one on each side of the road).

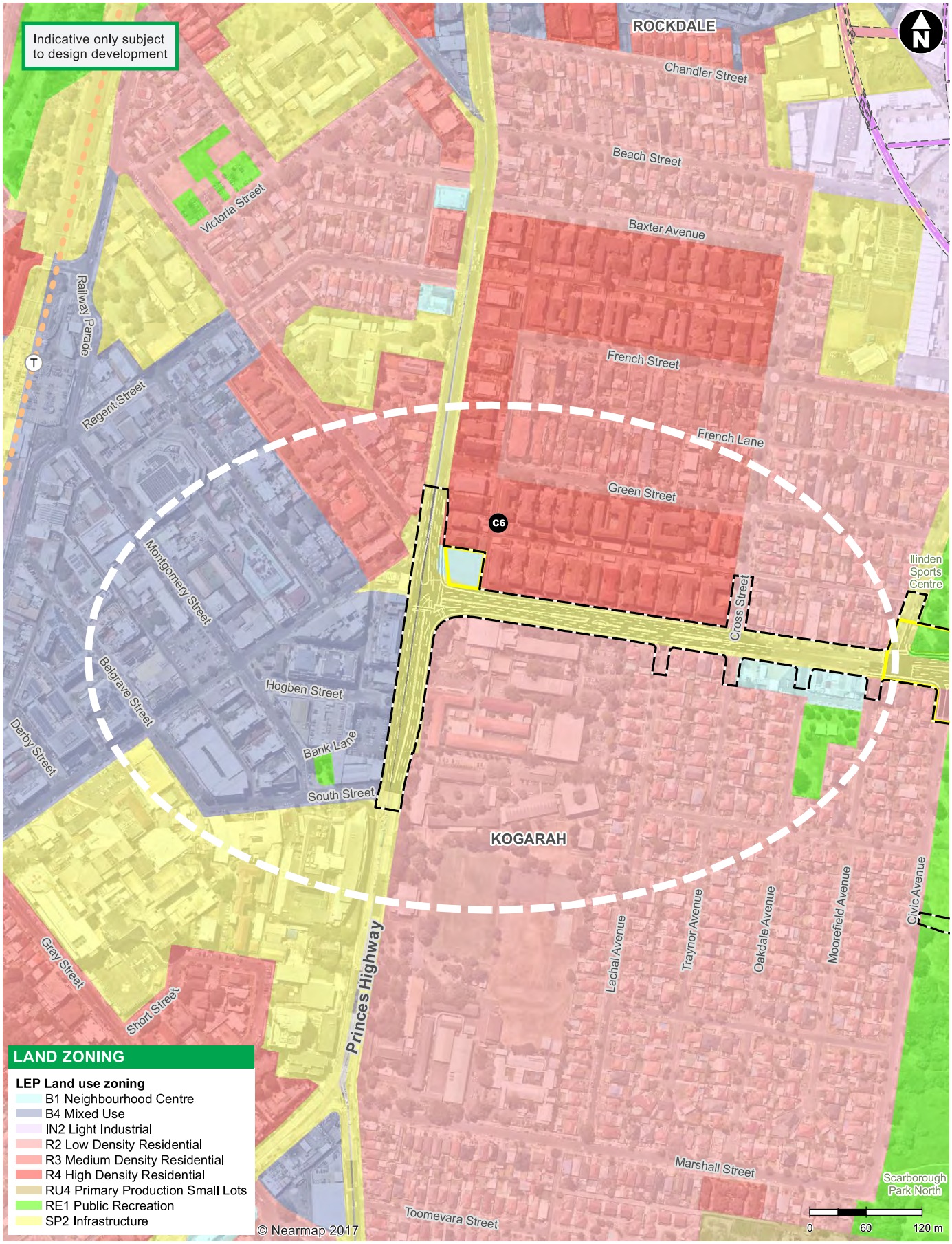
The surrounding residential uses comprise a mix of walk up apartments along President Avenue and to the north west of the project, larger scale apartment buildings located with frontages to Princes Highway to the west and south west of the project and low scale detached dwellings to the south of President Avenue and the project.

Planning Controls

The upgraded Princes Highway and President Avenue intersection would be located on land zoned as a mix of Infrastructure (SP2), High Density Residential (R4), Low Density Residential (R2) and Neighbourhood Centre (B1) by the Rockdale LEP 2011. The objectives of these zones are:

- Infrastructure (SP2): To provide for transport infrastructure and related uses
- High Density Residential (R4): To provide for the housing needs of the community within a high density residential environment and enable other land uses that provide facilities or services to meet the day to day needs of residents
- Low Density Residential (R2): To provide for the housing needs of the community within a low density residential environment as well as other land uses that provide facilities or services to meet the day to day needs of residents
- Neighbourhood Centre (B1): To provide a range of small-scale retail, business and community uses that serve the needs of people who live or work in the surrounding neighbourhood.

The land use zoning surrounding the project is a mix of the following zones: Infrastructure (SP2), Neighbourhood Centre (B1), Low Density Residential (R2), High Density Residential (R4) and Mixed Use (B4) (refer to **Figure 14-7**).



LEGEND

- Construction boundary
- Cut-and-cover structures
- Underground construction
- Underground construction - Temporary access tunnel
- Construction ancillary facility
- Assessment area
- Surface works
- Railway line
- Railway station

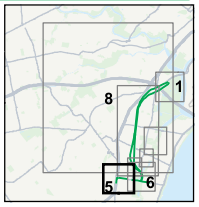


Figure 14-7 Princes Highway and President Avenue intersection study area

Arncliffe, Banksia and Rockdale tunnel corridor

Land Use

This study area comprises a corridor of land between the M5 East Motorway near Marsh Street in Arncliffe and Beach Street in Kogarah, crossing through Rockdale and Banksia.

The project in this study area would be located below land which comprises primarily low density residential uses with a pocket of industrial uses to the southern end and some pockets of open space.

Land uses in the area surrounding where the project would be located include a mix of commercial, residential and education facilities (Arncliffe Public School).

Planning Controls

The project within this study area would be located on land zoned a mix of Infrastructure (SP2), Low Density Residential (R2), Medium Density Residential (R3), High Density Residential (R4), Mixed Use (B4), Light Industrial (IN2) Public Recreation (RE1) and Private Recreation (RE2) by the Rockdale LEP 2011. The objectives of these zones are outlined following:

- Infrastructure (SP2): To provide for transport infrastructure and related uses
- High Density Residential (R4): To provide for the housing needs of the community within a high density residential environment and enable other land uses that provide facilities or services to meet the day to day needs of residents
- Medium Density Residential (R3): To provide for the housing needs of the community within a medium density residential environment and to enable other land uses that provide facilities or services to meet the day to day needs of residents
- Low Density Residential (R2): To provide for the housing needs of the community within a low density residential environment as well as other land uses that provide facilities or services to meet the day to day needs of residents
- Mixed Use (B4): To provide a mixture of compatible land uses and to integrate suitable business, office, residential, retail and other development in accessible locations so as to maximise public transport patronage and encourage walking and cycling
- Light Industrial (IN2): To provide a wide range of light industrial, warehouse and related land uses
- Public Recreation (RE1): To enable land to be used for public open space or recreational purposes respectively
- Private Recreation (RE2): To enable land to be used for private open space or recreational purposes, to provide a range of recreational settings and activities and compatible land uses and to protect and enhance the natural environment for recreational purposes.

The land use zoning surrounding the project is a mix of the following zones: Infrastructure (SP2), High Density Residential (R4), Medium Density Residential (R3), Low Density Residential (R2), Public Recreation (RE1), Private Recreation (RE2), Mixed Use (B4), Enterprise Corridor (B6), Light Industrial (IN2) (refer to **Figure 14-8**).

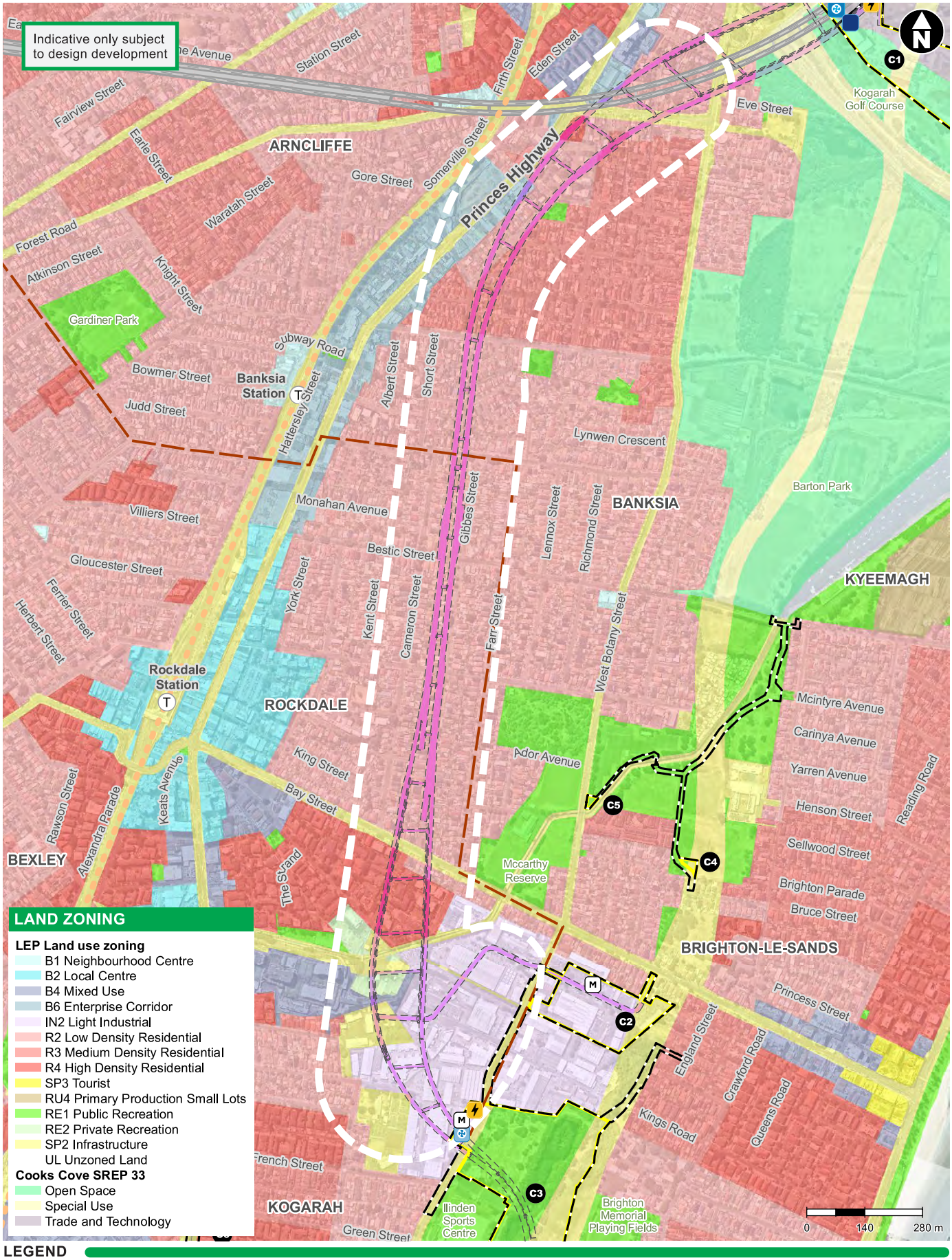


Figure 14-8 Arncliffe, Banksia and Rockdale tunnel corridor study area

Permanent power supply corridor

Land Use

This study area comprises a corridor of land between Westfield Street Earlwood and West Botany Street in Rockdale, traversing Bardwell Park, Bardwell Valley and Wolli Creek.

The project in this study area would be located primarily below land which comprises road reserve with the exception of passing across the Bardwell Valley Golf Course, along the edge of Silver Jubilee Park and under the T4 Illawarra and Eastern Suburbs Line.

Land uses in the area surrounding where the project would be located include a mix of commercial, industrial, residential and recreation.

Planning Controls

The project within this study area would be located on land zoned a mix of Infrastructure (SP2), Low Density Residential (R2), Medium Density Residential (R3), High Density Residential (R4), Neighbourhood Centre (B1), Enterprise Corridor (B6), Public Recreation (RE1) and Unzoned Land by the Rockdale LEP 2011 and Low Density Residential (R2), Local Centre (B2), Public Recreation (RE1), Infrastructure (SP2) and Unzoned Land by the Canterbury Local Environment Plan 2012. The objectives of these zones are outlined following:

- Infrastructure (SP2): To provide for transport infrastructure and related uses
- High Density Residential (R4): To provide for the housing needs of the community within a high density residential environment and enable other land uses that provide facilities or services to meet the day to day needs of residents
- Medium Density Residential (R3): To provide for the housing needs of the community within a medium density residential environment and to enable other land uses that provide facilities or services to meet the day to day needs of residents
- Low Density Residential (R2): In both the Rockdale (2011) and Canterbury (2012) LEPs, the objective of this zone is to provide for the housing needs of the community within a low density residential environment as well as other land uses that provide facilities or services to meet the day to day needs of residents
- Neighbourhood Centre (B1): To provide a range of small-scale retail, business and community uses that serve the needs of people who live or work in the surrounding neighbourhood
- Local Centre (B2): To provide a range of retail, business, entertainment and community uses that serve the needs of people who live in, work in and visit the local area, encourage employment opportunities in accessible locations, maximise public transport patronage and encourage walking and cycling and facilitate and support investment, economic growth and development for active, diverse and well-designed centres
- Enterprise Corridor (B6): To promote businesses along main roads, encourage a mix of compatible uses, provide a range of employment uses, limit retail activity and promote redevelopment that will contribute to the locality
- Public Recreation (RE1): In both the Rockdale (2011) and Canterbury (2012) LEPs, the objective of this zone is to enable land to be used for public open space or recreational purposes respectively
- Unzoned Land: The unzoned land as indicated in both the Rockdale (2011) and Canterbury (2012) LEPs, refers to the bridge that forms part of Hartill-Law Avenue above Wolli Creek. There are no objectives for this land.

The land use zoning surrounding the project is a mix of the following zones: Infrastructure (SP2), Low Density Residential (R2), Medium Density Residential (R3), High Density Residential (R4), Neighbourhood Centre (B1), Enterprise Corridor (B6), Public Recreation (RE1), Light Industrial (IN2) and Unzoned Land by the Rockdale LEP 2011 and Low Density Residential (R2), Local Centre (B2), Public Recreation (RE1), National Parks and Nature Reserves (E1), Infrastructure (SP2) and Unzoned Land by the Canterbury Local Environment Plan 2012 (refer to **Figure 14-9**).

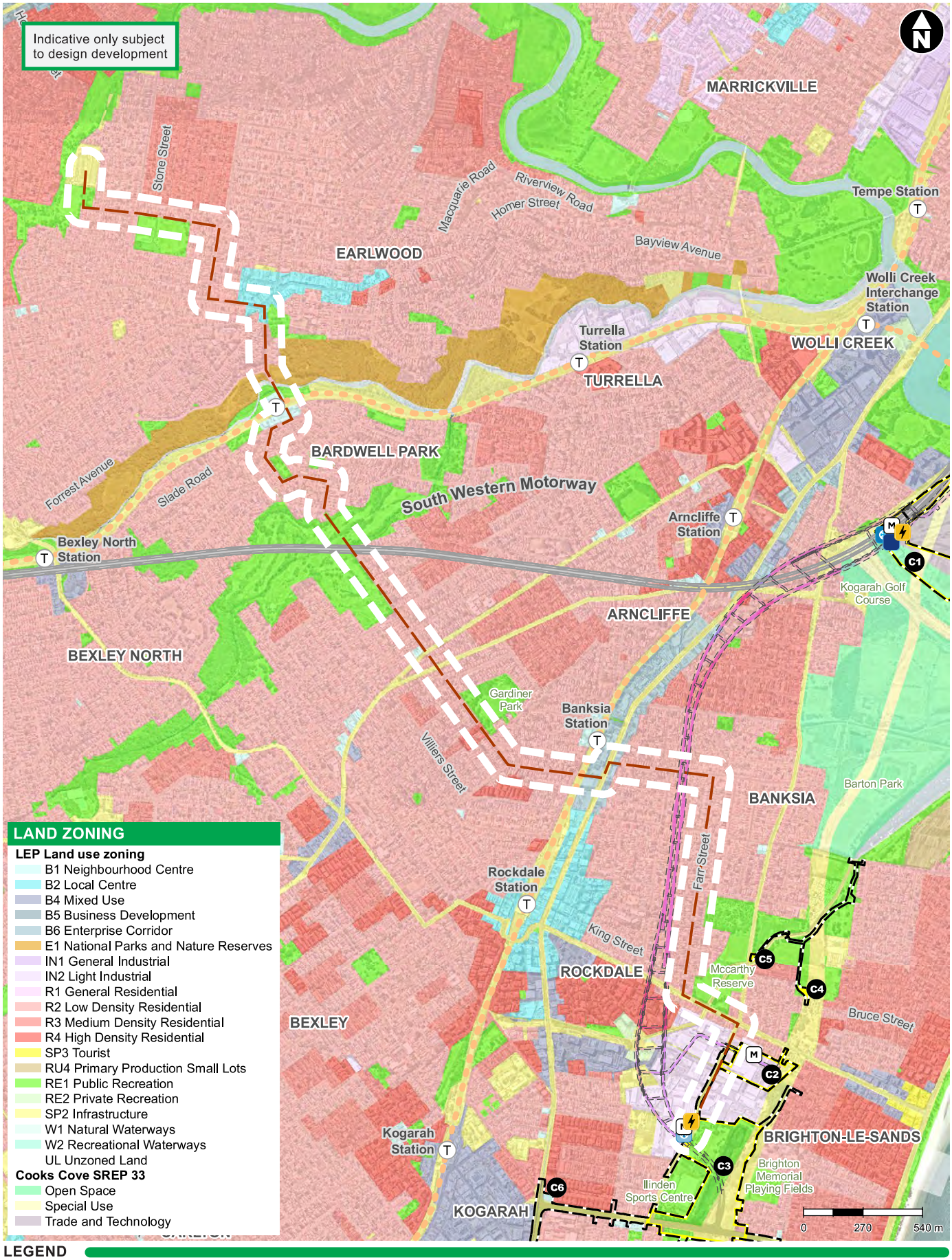


Figure 14-9 Permanent power supply corridor study area

14.3 Future land use

14.3.1 Strategic planning

Relevant strategies directing future land use planning for the study area are summarised below. These strategies are further detailed in **Chapter 4** (Strategic context and project need).

Greater Sydney Region Plan

The *Greater Sydney Region Plan*[1] sets the vision and strategy for Greater Sydney. The *Greater Sydney Region Plan* brings new thinking to land use and transport patterns with the aim of boosting Greater Sydney's liveability, productivity and sustainability.

The project is identified in the *Greater Sydney Region Plan* as a committed initiative for immediate detailed planning (subject to final business case).The *Greater Sydney Region Plan* places a strong focus on the integration of land use and transport planning with the aim of delivering benefits such as improved access to transport and services, connectivity to jobs and homes and positive health and environmental outcomes.

The *Greater Sydney Region Plan* includes a direction to deliver great places that bring people together and identifies that these are characterised by a mix of land uses in walkable, human scale, fine grain neighbourhoods. It also advocates for encouraging the substitution of walking and cycling for short car journeys through the provision of suitable pathways.

The *Greater Sydney Region Plan* also identifies an objective of ensuring industrial and urban services land is protected, particularly from encroachment of residential and other incompatible uses.

District Plans

The *Eastern City District Plan*[2] is a guide for implementing the *Greater Sydney Region Plan* at a District level and is a bridge between regional and local planning.

The *Eastern City District Plan* acknowledges the potential benefits of the F6 and recognises it as a committed project that is subject to a final business case (refer to **Chapter 4** (Strategic context and project need).

The plan identifies Kogarah as a health and education precinct and a nominated Collaboration Area. The Kogarah health and education precinct crosses the boundary of the South and Eastern City districts and so the strategic direction for the precinct is detailed in the *South District Plan*[3]. The *South District Plan* states that collaborative planning will be used to encourage and prioritise land uses that can grow health and ancillary services and provide opportunities for new allied health and education services within the Kogarah health and education.

The *Eastern City District Plan* also identifies Brighton-Le-Sands and Rockdale as local centres. The *Eastern City District Plan* states that Councils are in the best position to investigate and confirm locations in their LGA required for additional medium-density land use opportunities and proposes the following be considered in doing so:

- Transitional areas between urban renewal precincts and existing neighbourhoods
- Residential land around local centres where links for walking and cycling help promote a healthy lifestyle in identifying for this land use
- Areas with good proximity to regional transport where more intensive urban renewal is not suitable due to challenging topography or other characteristics
- Lower density parts of suburban Greater Sydney undergoing replacement of older housing stock
- Areas with existing social housing that could benefit from urban renewal and which provide good access to transport and jobs.

[1] Greater Sydney Commission *(2018) Greater Sydney Region Plan*
[2] Greater Sydney Commission (2018*)Eastern City District Plan*
[3] Greater Sydney Commission *(2018) South District Plan*

Bayside West Precincts 2036 – Arncliffe and Banksia

The Bayside West Precincts 2036[4] is a strategic plan for the Arncliffe Precinct and Banksia Precinct. The plan aims to create connected town centres for Arncliffe and Banksia, better transport connections, more housing choices, a vibrant Princes Highway corridor and new areas of open space.

Of particular relevance, the strategy proposes the following in terms of future land uses for land areas that would be located within the Marsh Street study area (refer **Figure 14-10**):

- High density residential to the north of the site across Marsh Street
- Medium – low density residential development to the south of the site
- Reconfigured open space within the study area.

Sydney Green Grid

The NSW Office of the Government Architect has released a plan to seek out opportunities for a network of high-quality green space that connects town centres, public transport hubs, and major residential areas. This network is known as the Sydney Green Grid[5].

The vision for the Sydney Green Grid is identified in the *Eastern City District Plan,* and includes the Rockdale Wetlands Open Space Corridor which runs from the Muddy Creek recreation area and Rockdale recreation area to south of President Avenue (refer **Figure 14-11**). The plan states that parts of this corridor are zoned for a future motorway, and that the motorway should be designed to retain and protect recreational open spaces and the ecological values of the corridor.

Future Transport 2056

The project is listed as a committed initiative for the next 0 – 10 years in the *Future Transport Strategy* (refer to **Chapter 4** (Strategic context and project need)), with future stages of the F6 Extension also acknowledged as a visionary motorway for investigation. Committed initiatives are for immediate detailed planning or are part of key maintenance, renewal or safety programs.

[4] NSW Department of Planning and Environment (2018) *Bayside West Precincts 2036 – Arncliffe and Banksia*
[5] www.governmentarchitect.nsw.gov.au/articles/2017/06/sydney-green-grid

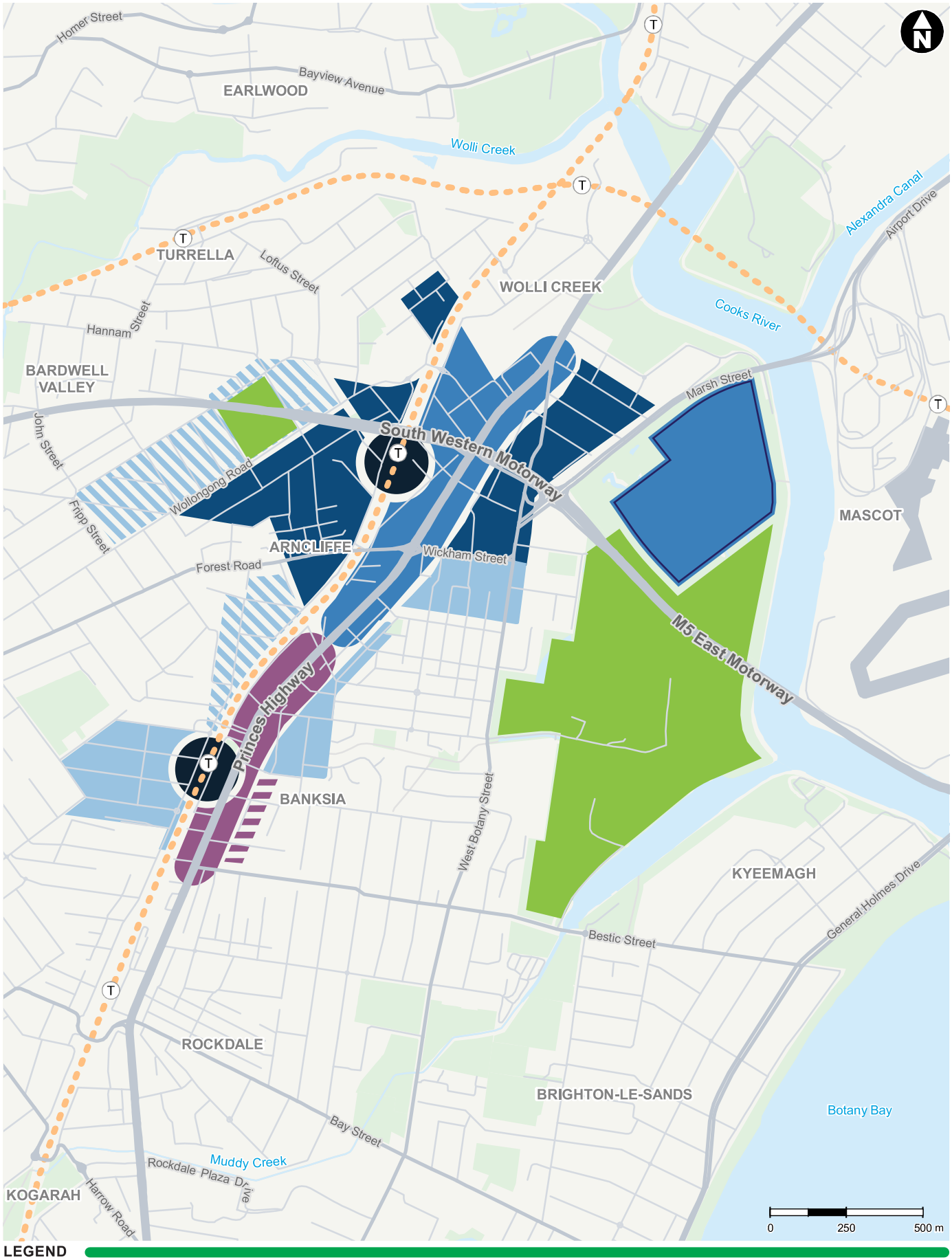


Figure 14-10 Bayside West Precincts 2036 Plan

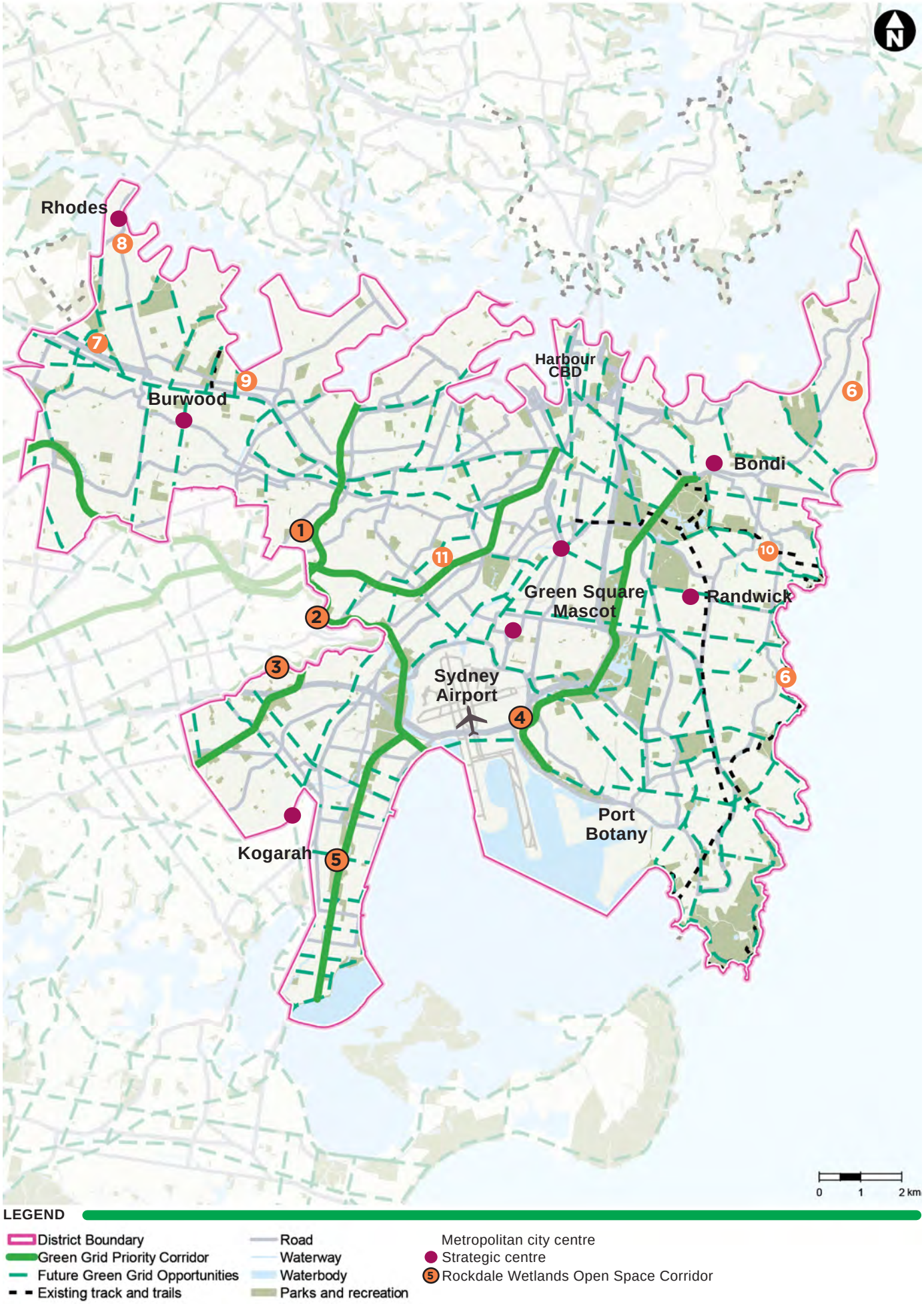


Figure 14-11 Sydney Green Grid including the Rockdale Wetlands Open Space Corridor

14.3.2 Future developments within and surrounding the project

Proposed development on land proposed to be used for the project

There are no current development proposals for land that would be used for the project. The potential development of residual land following completion of construction is considered in **section 14.4.2.**

Proposed development surrounding the project

A search of Bayside Council's development application (DA) register, the NSW major project tracking system and the Joint Regional Planning Panels development and planning register, found the following proposed development relevant to land surrounding the project (located within the study areas):

- A DA for the construction of a two storey child care centre at 47-47A Bestic Street, Rockdale, approximately 700m to the west of the shared cycle and pedestrian path at Muddy Creek. The DA comprises accommodation of 50 children, ten staff, operating 7am - 7pm Monday to Friday with basement car parking accessed from Cameron Street and demolition of existing structures was submitted to Bayside Council on 2 March 2017. This application is currently under assessment
- A DA for the construction of a seven storey mixed use development at 648-652 Princes Highway and 1-3 Ashton Street, Rockdale, approximately 600m to the west of the ventilation facilities at West Botany Street. The DA comprises 63 residential units (including 22 units as affordable housing), three commercial units, basement car parking and demolition of existing structures was lodged with Bayside Council on 14 December 2016. This application is currently under assessment
- A DA for the construction of a ten storey mixed use development at 295 Bay Street Brighton-Le Sands, approximately 300m to the east of the shared cycle and pedestrian path at Rockdale Bicentennial Park. The DA comprises a boarding house containing 79 rooms (including manager's room), two levels of basement car parking and demolition of existing structures was submitted to Bayside Council on the 2 December 2016. This application is currently under assessment.

In addition to the above major developments, the Cooks Cove precinct, within which the project at Marsh Street would be located, has a history of development proposals going back 14 years. Although there are no current development applications for the precinct, previous proposals have largely focused on its development for mixed residential and commercial uses. The most recent DA was submitted to Bayside Council and subsequently withdrawn by the proponent in 2017. This DA sought approval for development of the southern part of the precinct, (representing Stage 1 of development) for an 18-hole golf course and driving range as well as site remediation, environmental improvements and public domain enhancements[7].

14.3.3 Existing and future use of the F6 reserved corridor

The existing F6 reserved corridor has been in place since 1951. The corridor is zoned SP2 Infrastructure (Classified Road) in the Local Environment Plan, which is a 'special purpose' zone used to provide infrastructure and related uses, and to protect land from development that is not compatible with, or that may detract from, the provision of infrastructure.

The existing F6 reserved corridor between Arncliffe and Kogarah includes land that is held privately, by local councils, Roads and Maritime and other NSW Government agencies. It is predominantly open space, parkland and public use facilities and includes residential and commercial properties. The location of the existing F6 reserved corridor is shown on **Figure 5-5**. The project is largely located subsurface and outside of the existing F6 reserved corridor for reasons outlined in **section 5.4.1**.

The future use of the existing F6 reserved corridor between Arncliffe and Kogarah that would not be required for the project is being considered by Transport for NSW. Initially a review of the corridor for possible alternative future public and active transport uses is being undertaken as part of a wider review of the integrated transport needs for the area. Future Transport 2056 released in March 2018, provides the vision for how transport can support growth and the economy of Greater Sydney and NSW over the next 40 years. The strategy identifies strategic directions and visionary initiatives, including a South East Mass Transit Link to Kogarah and Miranda. This is an initiative for long term (20+ years) investigation that would consider options using the established SP2 Infrastructure corridor.

[7] http://rccweb.rockdale.nsw.gov.au/EPlanning/Pages/XC.Track/SearchApplication.aspx?id=285529

Any assessment or decision regarding the lifting of the existing corridor reservation or rezoning of this corridor, would be separate to the planning approval process for the project and be developed in collaboration with the Department of Planning and Environment and Bayside Council.

Roads and Maritime has accumulated property within Stage 1 of the existing F6 reserved corridor that is generally residential in nature and includes dwellings that have been tenanted as well as vacant residential lots. Roads and Maritime also holds some greenfield sites that are currently used as park land.

Subject to the assessment of the existing F6 reserved corridor for integrated, long term transport purposes, the NSW Government may consider these properties to be surplus to requirements and may seek to sell its interest in these properties as a consequence.

14.4 Potential impacts – property

14.4.1 Property impacts

The main property impact would be where an acquisition of the land is required either for construction and/or operation of the project or where occupation of property is required during construction only.

The majority of sites required to support construction are located within the permanent operational footprint of the project, therefore minimising the need for property acquisition and occupation. Notwithstanding, additional land would be required beyond this footprint at the northern and southern ends of the project which would result in temporary impacts on property.

Where private land required for the project is not currently owned by Roads and Maritime, discussions are being held with the affected property owners concerning the purchase, lease or licence of the land.

The project would also require Council owned land within Rockdale Bicentennial Park and the use of other Government owned lands. Roads and Maritime would enter into agreements with the relevant Government departments about the temporary or permanent use of this land. Where government owned land is required temporarily, this would generally be established through a lease or a Memorandum of Understanding. For any land owned by local or state government that would be required permanently for public purposes, Roads and Maritime would discuss and make arrangement with the relevant government owners for the transfer of this land.

In addition to the properties affected by surface activities, land (or interests in land, such as easements) below the surface of the ground would be acquired. This is called substratum acquisition and is discussed separately in **section 14.4.1**.

All acquisitions required for the project would be carried out in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991* and the land acquisition reforms announced by the NSW Government in 2016[8], which can be viewed online at:

https://www.finance.nsw.gov.au/land-property/land-acquisition-reform-2016

Roads and Maritime would appoint a Personal Manager Acquisitions to assist each of the land owners, residents and commercial tenants affected by acquisition for the project. The Personal Manager Acquisitions would be appointed at the beginning of the acquisition process and would continue to work with the land owners, residents and commercial tenants to offer them assistance and support throughout the acquisition and relocation process. Further information about this process can be found online at:

http://www.propertyacquisition.nsw.gov.au/

The project has limited permanent infrastructure at surface, with the majority of infrastructure comprising the underground tunnel. The property impacts are generally located around the President Avenue intersection and West Botany Street, where the tunnel surfaces.

Permanent private land acquisition for operational infrastructure would involve:

- Full acquisition of 12 privately owned properties
- Partial acquisition of three privately owned properties.

[8] NSW Government (2016) Review of the NSW *Land Acquisition (Just Terms) Compensation Act 1991*

Private property to be permanently acquired in addition to existing Roads and Maritime owned properties are detailed in **Table 14-3** and **Table 14-4**. These properties do not include any that are already owned by the Roads and Maritime.

Table 14-3 Private property to be permanently acquired

Title	Location	Acquisition	Category	Project component
1/DP100164	427 West Botany Street, Rockdale	Full	Industrial	Rockdale (south) motorway operations complex (MOC3)
2/DP100164 3/DP22338	429 West Botany Street, Rockdale	Full	Industrial	Rockdale (south) motorway operations complex (MOC3)
4/DP22338	433 West Botany Street, Rockdale	Full	Industrial	Rockdale (south) motorway operations complex (MOC3)
5/DP22338	435 West Botany Street, Rockdale	Full	Industrial	Rockdale (south) motorway operations complex (MOC3)
6/DP22338	437 West Botany Street, Rockdale	Full	Industrial	Rockdale (south) motorway operations complex (MOC3)
7/DP381773	439-441 West Botany Street, Rockdale	Full	Industrial	Rockdale (south) motorway operations complex (MOC3)
2/DP28912	136 President Avenue, Brighton-Le-Sands	Full	Residential	President Avenue intersection
164/DP4393	140 President Avenue, Brighton-Le-Sands	Full	Residential	President Avenue intersection
166/DP4393	144 President Avenue, Brighton-Le-Sands	Full	Residential	President Avenue intersection
165/DP4393	142 President Avenue, Brighton-Le-Sands	Full	Residential	President Avenue intersection
A/DP360801	15 England Street, Brighton-Le-Sands	Full	Vacant residential	Shared cycle and pedestrian pathway
/SP66921	726-728 Princes Highway, Kogarah	Partial (about three per cent)	Residential (Common property)	Princes Highway /President Avenue intersection upgrade
4/DP650223	730 Princes Highway, Kogarah	Partial (about seven per cent	Residential	Princes Highway /President Avenue intersection upgrade
/SP9797	732 Princes Highway, Kogarah	Partial (about nine per cent)	Residential (Common property)	Princes Highway /President Avenue intersection upgrade
2/DP659367 2/DP659366 1/DP659365	734 Princes Highway, Kogarah	Full	Commercial	Princes Highway /President Avenue intersection upgrade

Table 14-4 Public property to be permanently acquired

Title	Location	Acquisition	Category	Ownership	Project component
3/DP810353	"St George TAFE" 750 Princes Highway, Kogarah	Partial strip	Education	Department of Education	Princes Highway /President Avenue upgrade
1/DP535905 74/DP746043 71/DP738382	Rockdale Bicentennial Park	Partial (about 1.1 hectares)	Park reserve / Recreation	Bayside Council	President Avenue intersection
1/DP1113262	Scarborough Park North	Partial strip	Park reserve / Recreation	Bayside Council	Shared cycle and pedestrian pathway / President Avenue intersection
14/DP213314 1/DP108492	Kogarah Golf Course, Arncliffe	Partial	Park reserve / Recreation	Bayside Council	Arncliffe motorway operations complex (MOC1)

The shared cycle and pedestrian pathways would predominately be located on local roads and park reserve owned by State or Local Governments. Roads and Maritime would enter into agreements with the relevant Government departments about the permanent use of this land. The shared cycle and pedestrian pathways would require the acquisition of one privately owned property on England Street (refer to **Table 14-3**).

Further development of the design for the shared cycle and pedestrian pathways would occur in consultation with key stakeholders. The identification of property requirements for the shared cycle and pedestrian pathways would be ongoing and is provided as indicative at this stage.

Work would be needed on the existing road network to support the project. This work would impact five properties not owned by Roads and Maritime, all of which are located on the Princes Highway, Rockdale outside of the existing F6 reserved corridor.

Table 14-3 indicates one private residential property and two parts of residential strata common property are expected to require partial acquisition. A full acquisition of one commercial property would also be required (refer to **Table 14-3**). The State Government partial acquisition relates to a partial strip of land, adjacent to President Ave and Princes Highway, which is currently occupied by the St George College TAFE (refer to **Table 14-4**).

The project would also require existing leases on five properties owned by Roads and Maritime to be extinguished for purposes of permanent infrastructure. These properties are detailed in **Table 14-5**.

Table 14-5 Roads and Maritime property with leases to be extinguished

Title	Location	Category	Ownership	Project component
6/DP28912	65 O'Neill Street, Brighton-Le-Sands	Residential	Roads and Maritime	President Avenue intersection
5/DP28912	67 O'Neill Street, Brighton-Le-Sands	Residential	Roads and Maritime	President Avenue intersection
4/DP28912	69 O'Neill Street, Brighton-Le-Sands	Residential	Roads and Maritime	President Avenue intersection
1/DP28912	134 President Avenue, Brighton-Le-Sands	Residential	Roads and Maritime	President Avenue intersection
3/DP28912	138 President Avenue, Brighton-Le-Sands	Residential	Roads and Maritime	President Avenue intersection

Temporary lease of property during construction

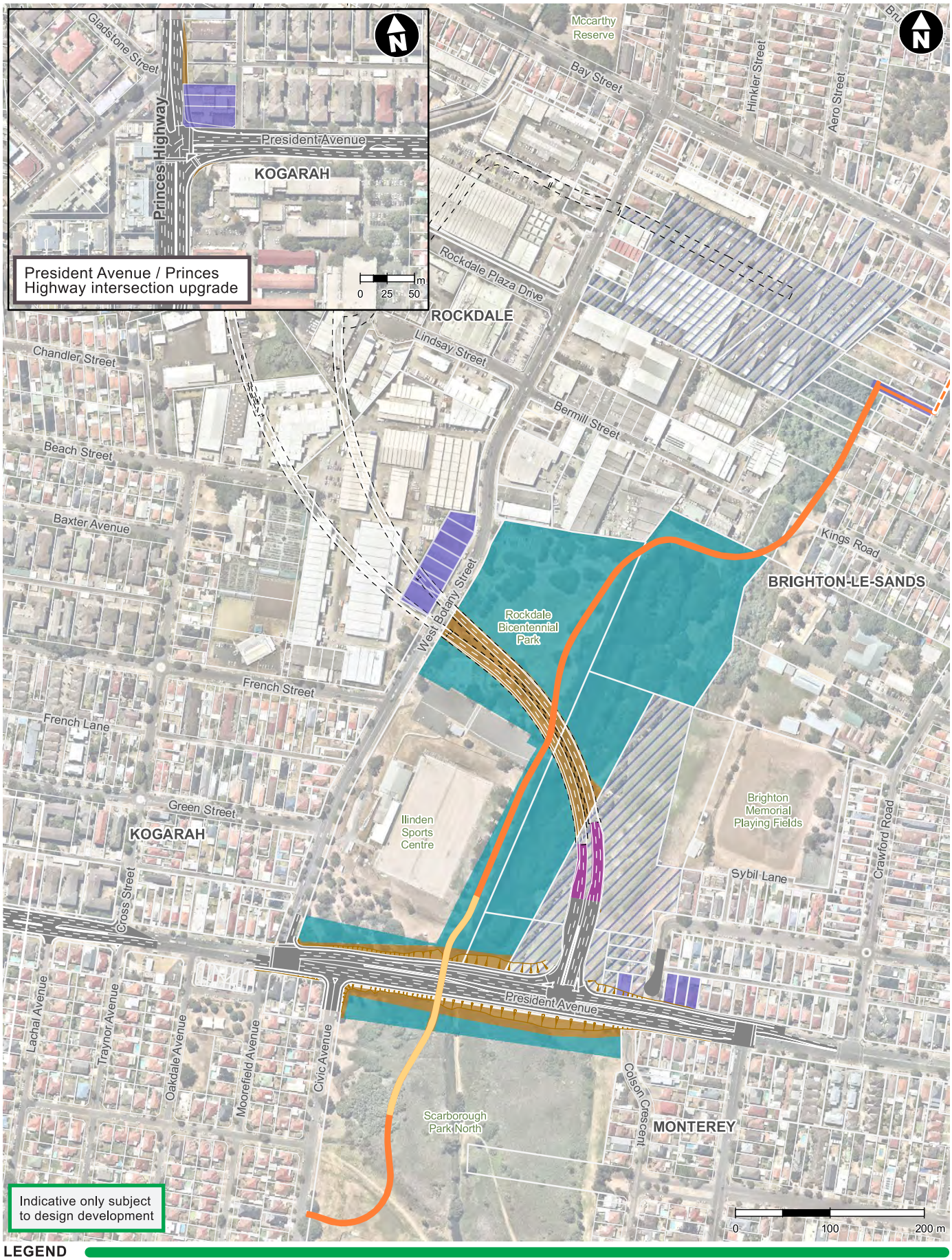
A number of construction ancillary facilities and work sites would be required for temporary use during construction. As a result some areas of land would need to be temporarily leased or occupied. Some of these sites would be located outside of the existing F6 reserved corridor. **Table 14-6** provides the leasing requirements for the project, which are also shown on **Figure 14-12** and **Figure 14-13**.

Table 14-6 Public property to be temporarily leased for construction

Title	Location	Category	Ownership	Leasing details[1]	Project component
14/DP213314 1/DP108492	Kogarah Golf Course	Park reserve / Recreation	Bayside Council	6 ha	Arncliffe construction ancillary facility
194/DP752056	Rockdale Bicentennial Park	Park reserve / Recreation	Bayside Council, State Government	2.2 ha	Shared cycle and pedestrian pathways
1/DP535905 74/DP746043 71/DP738382	Rockdale Bicentennial Park	Park reserve / Recreation	Bayside Council	5.4 ha	Tunnel Portal / President Avenue intersection
1/DP1113262	Scarborough Park North	Park reserve / Recreation	Bayside Council	0.5 ha	Shared cycle and pedestrian pathways / President Avenue intersection

[1] These areas do not include lands to be acquired for operation of the project, that may be leased during construction and then acquired. Land to be acquired is listed in **Table 14-4**.

Figure 14-12 Properties to be acquired and leased - northern area of the project



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
- Cadastre
- Embankment
- Full acquisition
- Partial acquisition
- RMS owned land
- Land to be leased for construction

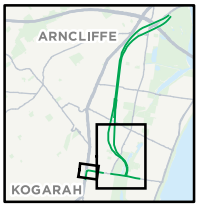


Figure 14-13 Properties to be acquired and leased - southern area of the project

14.4.2 Residual project land

The project has been design and developed to minimise the need to acquire privately owned property. Any private property acquisitions would largely be for permanent infrastructure. Consequently, it is expected that there would be very little, if any, reusable land to support alternative use at the completion of construction.

Residual land generated by the project would be limited to parcels of residual land at the following locations:

- 734 Princes Highway, Kogarah which includes lots 2/DP659367, 2/DP659366 and 1/DP659365
- 140 President Avenue, Brighton-Le-Sands (164/DP4393)
- 142 President Avenue, Brighton-Le-Sands (165/DP4393)
- 144 President Avenue, Brighton-Le-Sands (166/DP4393)

The locations and extent of residual project land are shown in **Figure 14-14**.

Land leased temporarily for construction of the project (e.g. for the construction within Rockdale Bicentennial Park and Kogarah Golf Course) would be returned to its former use as public space. Consequently, there would be no residual land remaining in these circumstances.

The land within Rockdale Bicentennial Park would be reinstated as open space/parkland. An indicative concept for the urban design and landscaping works at Bicentennial Park has been prepared and is included in **Appendix C** (Place making and urban design). The concept design would be refined during the development of an Urban Design and Landscape Plan and would be prepared in consultation with Bayside Council and other key stakeholders including the community.

Figure 14-14 Residual project land - southern area of the project

14.4.3 Substratum subsurface acquisition

In addition to the properties affected by surface activities, land (or interests in land, such as easements) below the surface of the ground would be acquired to accommodate the tunnels and entry and exit ramps. This is called subsurface (or substratum) acquisition and is illustrated in **Figure 14-15**.

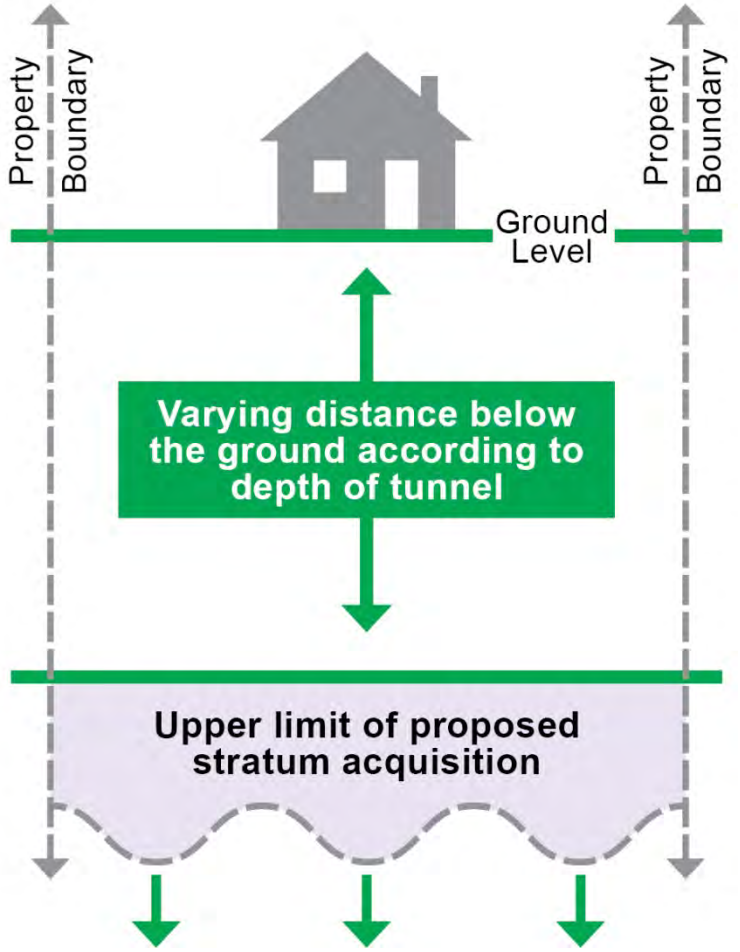


Figure 14-15 Example of substratum acquisition

The *Land Acquisition (Just Terms Compensation) Act 1991* (NSW) rules that compensation is not payable for the majority of subsurface acquisition of land or easements, unless specific circumstances as detailed in that Act apply. Appendix C of the Roads and Maritime *Land Acquisition Information Guide*[9] sets out in detail the compensation provisions of the Act relating to subsurface acquisition and the land acquisition reforms announced by the NSW Government in 2016 can be viewed online at:

https://www.finance.nsw.gov.au/sites/default/files/NSW_Government_Response.pdf

This subsurface acquisition would be a stratum acquisition envelope around the tunnels, including any associated ground support that may be required. The introduction of the subsurface stratum, and the tunnel itself, has the potential to limit development above the alignment in some circumstances. The tunnel depth is generally shallowest at tunnel portals. Tunnel portal locations and general depths are described in **Chapter 6** (Project description).

In most cases, subsurface acquisition would not affect the continued existing, or future use of property at the surface. Subject to council regulations and approvals, landowners would generally be able to:

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

[9] Roads and Maritime Services, 2014

Subsurface acquisition would include land both privately and publically owned, with separate processes for each as relevant. Where subsurface acquisition is confirmed during detailed design, Roads and Maritime would contact owners of directly affected properties. If private property is directly affected, Roads and Maritime has the authority to acquire the subsurface land, under the *Roads Act 1993* (NSW), by a compulsory acquisition process.

14.4.4 Commonwealth land

Subsurface acquisition of around 0.2 hectares of Commonwealth land would be required. The total land area is around 1.5 hectares. This land is located south of Rockdale Plaza and north of Beach Street, accessed off Chandler Street and Beach Street. The land is owned by the Department of Defence and is used for the purposes of the Kogarah Army Reserve Depot and Royal Australian Artillery Headquarters.

The project's northbound tunnel and a cross passage would be located around 25 metres below the Commonwealth land. No impacts to the property on the surface are anticipated.

14.4.5 Crown Land

Crown Land would not be impacted by the project.

14.4.6 Ground movement

Ground movement may occur in some areas along the tunnel alignment induced by tunnel excavation. A preliminary ground movement assessment was undertaken for the project to identify areas on the surface that may be subject to ground movement (refer **Chapter 17** (Ground water and geology). The assessment was based on a 15 degree angle of draw from the outside base of the tunnels.

An assessment of the anticipated ground movement impacts to properties during construction and operation of the Project is outlined below. Further investigations to support the detailed design of the project would confirm predicted ground movements and any potential associated impacts.

It is generally accepted that the risk of damage to surface features is negligible when subjected to total settlements of less than 10 mm.

Construction

The preliminary ground movement assessment determined that the land overlying the majority of the tunnel is expected to experience between around 2 mm – 5 mm of settlement during construction (refer **Figure 17-7**). Due to the increased widths of the tunnel at locations where there are caverns (refer **Figure 17-7**), these areas may experience settlement in the range of 10 – 13mm during construction.

It is therefore anticipated that the potential impacts to properties would be negligible to minor.

Operation

Drawdown of groundwater over time during operation of the project has the potential to result in ground movement. Ground movement due to groundwater drawdown is expected to be negligible along the tunnel alignment other than at the palaeochannels in the vicinity of Spring Street, Bay Street and President Avenue. At these locations ground movements could be within the range of 2 mm to 50 mm (refer to **Chapter 17** (Groundwater and geology) for further information). It is considered that the impacts to land uses would be nil to minor. Ground settlement as a result of the project will be managed to comply with criteria outlined in **Chapter 17** (Groundwater and geology). In addition, prior to the commencement of construction, pre-construction Building Condition Surveys will be offered in writing, to the owners of properties where there is a potential for construction activities to cause cosmetic or structural damage.

14.5 Potential impacts – land use

Land use changes as a result of the project would occur largely in response to the introduction of new transport infrastructure at Arncliffe and Rockdale. As outlined in **section 14.3.2,** the project would not impact on land subject to current development applications.

The following sections summarise the potential implications of the operational infrastructure and the key aspects of construction that impact land use, such as construction ancillary facilities.

Potential indirect impacts as a result of changes to land use would predominantly relate to social and economic values. **Chapter 15** (Social and economic) provides details relating to these potential impacts.

14.5.1 Impacts to land uses

An assessment of the potential impacts of the project on land uses, both during construction and operation is provided in **Table 14-7**.

Table 14-7 Potential impacts to land use

Potential impacts construction	Potential impacts operation
Marsh Street study area	
The project at the Marsh Street study area would be located on land currently used as a construction compound for the New M5 project. The New M5 construction compound would be partially demobilised before use by the project for the Arncliffe construction ancillary facility (C1). The construction ancillary facility would potentially affect the long term operation of the Kogarah golf course as it would result in requiring it to operate with nine holes for an extended period of time (the golf course is now nine holes, reduced from the 18 it was prior to the establishment of the New M5 construction compound). The land on which the tunnel site is located was previously leased by Council to the Kogarah Golf Club. During the period of construction, the occupied land would be unavailable for use for recreation purposes. Once project construction is completed however, the land not required for operational facilities would be returned for use by Rockdale City Council. Construction impacts would therefore be moderate. Future land use at this location would be subject to the Cooks Cove SREP. Although no development proposals have been confirmed under this planning framework, any future potential development under the Cooks Cove SREP would be restricted to areas outside the Arncliffe construction ancillary facility (C1) for the duration of construction activities.	The parts of the Arncliffe construction ancillary facility (C1) not required for the Arncliffe Motorway Operations Complex (MOC1) would be rehabilitated and returned for potential future development consistent with land use zoning provisions set out in the Cooks Cove SREP. The location of the Arncliffe Motorway Operations Complex at MOC1, particularly in combination with the facility constructed as part of the New M5 project, would influence the types of future land uses (development) within its vicinity. The ventilation facility to be operated as part of the project (refer to Chapter 9 (Air quality)) would require future surrounding development to meet height and distance (from the ventilation facility) requirements to ensure there are no air quality impacts. These requirements would be determined following detailed modelling. The desired potential development of the Cooks Cove precinct for high density mixed use purposes as outlined in the Bayside West Precincts 2036 Plan and indicated by the previous development proposals submitted for the site may therefore be restricted by the ventilation facility. The land on which the permanent facilities are located would also be prevented from being returned for recreational uses. Therefore, operational impacts are considered to be moderate.

Potential impacts construction	Potential impacts operation
Muddy Creek recreation study area	
The construction of a shared cycle and pedestrian pathways between Bestic Street and Bruce Street, to the east of West Botany Street would temporarily restrict use of open space/recreation land. This change in land use during construction would have a low impact on local and regional land use, as it would largely take place on the peripheral edges of the fields and reserves. The works would not dissect any of the sports fields and so would allow for their continued use during construction. The works would also be minimal in nature. Construction impacts would therefore be minimal.	Operational impacts to land use are considered to be negligible and would provide some benefits. The is because the provision of the shared pathway is compatible with, and enhances, the existing land use. The resulting permanent shared cycle and pedestrian pathways infrastructure would be compatible with and compliment the current land uses at the site. At operation, the project would create better connections through the surrounding open space and would be developed to align with the objectives of the Sydney Green Grid. The benefits provided by the shared path are consistent with the objectives set out in the Greater Sydney Region Plan with regard to encouraging the substitution of walking and cycling for short car journeys through the provision of suitable pathways. They would also be consistent with the objective set out for the Brighton-Le-Sands local centre in the Eastern City District Plan of improving walking and cycling connections (including through the Greater Sydney Green Grid). The works would therefore have a positive impact leading to improvements to land uses within and surrounding the site.
Roads and Maritime depot study area	
The location of the Rockdale construction ancillary facility (C2) at the Roads and Maritime depot would result in a temporary impact to land use for part of the site from a Roads and Maritime depot to construction infrastructure. Construction of the project would have a low impact as the Roads and Maritime depot would continue in its current use during construction, although restricted to a reduced area.	The parts of the site not used for Rockdale Motorway Operations Complex (north) (MOC2) would be rehabilitated and returned for continued use as the Roads and Maritime depot and would be consistent with land use zoning provisions. The Roads and Maritime depot would be restricted to a smaller area and some current activities would need to be moved to another location. Operational impacts are therefore considered to be moderate.

Potential impacts construction	Potential impacts operation
West Botany Street study area	
The construction of operational infrastructure such as the Rockdale ventilation facility at West Botany Street would result in a change of the land use from industrial to construction infrastructure and the loss of five commercial businesses. The impacts are therefore considered to be moderate/high.	The permanent location of the Rockdale Motorway Operations Complex (south) (MOC3) at this site would prevent the potential future redevelopment of this land for light industrial uses in accordance with the land zoning provisions in this area. The loss of this land for future development for these uses would in part not meet the objective set out in the *Greater Sydney Region Plan* to ensure industrial and urban services land is retained and managed. Although a small portion of the industrial and urban services land in Rockdale would not be retained for its current use as a result of the project, part of this objective relates to safeguarding this land from competing pressures and the encroachment of incompatible uses. The Operations complex would not be incompatible with surrounding industrial uses and would therefore meet this part of the objective. This change in land use from commercial to transport infrastructure would have a moderate impact on local industrial land use. However, the broader area surrounding the site (to the south, west, north and north east) along West Botany Street, contains commercial/industrial uses and proportionately the loss of these commercial premises is minor in a regional context. It is therefore considered that the operation impacts are moderate/high

Potential impacts construction	Potential impacts operation
Rockdale recreation area and President Avenue study area	
The President Avenue construction ancillary facility (C3) would result in a temporary change in land use from primarily public open space/recreation to construction infrastructure. The works would temporarily restrict access to much of the Rockdale Bicentennial Park (East) as well as the north western parts of Bicentennial Park as shown on Figure 14-6. This would require the temporary relocation of some community facilities located within these areas. This would include a skate park and children's playground which would be temporarily relocated to a nearby open space and some existing playing fields which would be temporarily relocated nearby following consultation with Council. Some of the associated playing fields could be reconfigured for use at their current location during construction depending on suitable access. Although the development of this construction ancillary facility would see a significant reduction in public open space/recreation land use at this location, it is considered to constitute a moderate impact, due to the fact that Roads and Maritime would work with community groups to relocate community facilities to areas within proximity. The relocation of these amenities to nearby locations would ensure the wider community would continue to benefit from their use during the construction period.	The permanent location of project infrastructure at this site including entry and exit ramps and other road infrastructure would result in the permanent change of land use from primarily open space to transport infrastructure. Following construction, the majority of the existing open space areas being utilised would be returned to parkland as shown on Figure 14-14. Rockdale Bicentennial Park and the associated playing fields would be reinstated with a new car park to the north, a skate park and children's playground. The playing fields on the eastern side of the Rockdale Wetlands would also be reinstated to the existing condition following construction. A new shared cycle and pedestrian pathways would be constructed which would include a new pedestrian bridge which would provide access to the Rockdale Wetlands. A concept design for the urban design and landscaping works associated with this land is included in Appendix C (Place making and urban design). The reinstatement of Rockdale Bicentennial Park would be undertaken in consultation with Bayside Council and relevant stakeholders. The project would also result in the permanent change of some residential land to either transport infrastructure or open space with the acquisition of properties to the south near President Avenue. Given the repurposing of this land would follow a considered urban design, operational impacts within this study area would be moderate-low.

Potential impacts construction	Potential impacts operation
Princes Highway / President Avenue intersection study area	
The introduction of temporary construction facilities at this site for the purposes of widening parts of President Avenue and the Princes Highway would result primarily in a temporary change in land use from transport infrastructure to construction infrastructure. The construction impacts are therefore considered to be low.	Operation of the project would in large part see the continued use of the site for transport infrastructure. The widening of the two roads would however require the permanent acquisition of three lots (currently used as a service station and auto business) and partial acquisition of three residential lots (all fronting the Princes Highway) and a partial strip of the TAFE NSW St George Campus. The project would require a small area on the western edge of each of the partially impacted lots (refer to section 14.4.1) and as the built form within each is generally setback, it would not greatly impede their continued respective uses. Much of the land within the three lots that are currently used for the purposes of a service station would become residual project land during operation. The future use of this land is yet to be determined, however it would not be precluded from similar commercial uses. It would also not prevent use of this or other land in the study area, for the purposes of growing health and ancillary services within the Kogarah health and education precinct. It is therefore considered that the land use impacts would be moderate.
Arncliffe, Banksia and Rockdale tunnel corridor	
Tunnel construction would take place underground and so is anticipated to have minimal impacts to land uses. There is however the potential for some impacts as a result of ground movement. It is generally accepted that the risk of damage to surface features is negligible when subjected to total settlements of less than 10 mm. The preliminary qualitative ground movement assessment (refer Chapter 17 (Ground water and geology)) has determined that the land overlying the majority of the tunnel is expected to experience between around 2 mm – 5 mm of settlement (refer Figure 17-7). Due to the increased widths of the tunnel at locations where there are caverns, these areas may experience settlement in the range of 10 – 13mm. Land uses in these areas predominately comprise residential land. The impacts of ground movement as a result of the project are therefore anticipated to range from negligible to minor.	As operation of the project within this study area would take place underground, impacts to land uses are anticipated to be minimal. There is however the potential for impacts to land uses above ground as a result of surface settlement due to drawdown of groundwater (refer to section 14.4.6). It is considered that the impacts to land uses would be nil to minor. Ground settlement as a result of the project will be managed to comply with criteria outlined in Chapter 17 (Groundwater and geology).

Potential impacts construction	Potential impacts operation
Permanent power supply corridor	
The introduction of temporary construction facilities within this study area for the purposes of constructing the permanent power supply would result in a brief temporary change in land use from primarily road infrastructure to construction infrastructure. There would also be brief, temporary interruptions to some recreation land uses at Bardwell Valley Golf Club and Silver Jubilee Park. The works would primarily require small amounts of localised excavation for trenching or under-boring activities. In locations where the project would be located within the road reserve, this would result in the temporary disruption of traffic (along isolated sections of road) for a period of several days to weeks. Where the project would traverse the Bardwell Valley Golf Club, use of some holes/sections of the course may be interrupted for a period of approximately one to two weeks (depending on the final construction method). Use of a small part of the north eastern edge of Silver Jubilee Park would also be interrupted for a short period of time (approximately one to two weeks) during construction. As works would take place at the edge of the park and would be minor in nature, interruptions to the general use of the park for its current purposes would be minimal and largely associated with potentially restricting access via a paved pathway at the park's entrance near Wolli Creek Road. Accessibility via this location may be interrupted for a short period of time (one to two weeks). Users requiring a paved pathway would however be able to access the park from the Alsace Avenue Entrance (approximately 200 metres to the south west). The permanent power supply would cross two railways. It would cross the T8 Airport and South Line in conduit across an existing bridge, and would be underbored below the T4 Illawarra and Eastern Suburbs Line. No impacts to train services are anticipated. Due to the temporary nature of the land use changes associated with construction of the project within this study area and the generally limited nature of the disruptions to existing land uses as outlined above, construction impacts are considered to be low.	The operation of the power supply would have no impacts on land uses as they would each be returned to their existing uses following completion of construction. The impacts from power installation are therefore considered to be nil.

14.5.2 Impacts to elevated receptors

Elevated receptors include multistorey residential and commercial buildings. The project has the potential to influence development patterns for future elevated receptor locations as a consequence of operation of the project's ventilation outlets at Arncliffe and Rockdale. **Chapter 9** (Air quality) includes an assessment of potential air quality impacts for elevated receptor locations. **Chapter 10** (Health, safety and hazards) presents the calculated risks associated with the maximum predicted change in $PM_{2.5}$ concentrations at heights of 10 metres, 20 metres, 30 and 45 metres above ground level throughout the study area in the 2036 Cumulative scenario. It should be noted that it is not necessarily the case that there are existing buildings at these heights at the residential, workplace and recreational (RWR) receptor locations, however this analysis has been included to evaluate potential future development.

All calculated risks at elevated receptor locations at 10 metres, 20 metres, 30 metres and 45 metres height are considered to be in the range of tolerable/acceptable based on the annual mean changes in $PM_{2.5}$ concentrations.

Changes in the maximum 24-hour concentration in the vicinity of the ventilation outlets are likely to be acceptable up to a height of 30 metres. At a height of 45 metres, the largest increases in concentration are considerably higher than at ground level, but at the relevant locations there are no existing or proposed buildings above this height.

The future development of land (including re-zonings) in the vicinity of the ventilation facilities that may involve multi-storey buildings above 30 metres in height would need to consider the air dispersion performance of the ventilation facilities. Roads and Maritime would assist local councils or the DP&E in determining any relevant land use considerations applicable to future development for inclusion in LEPs or development control plans, where required. This would include procedures for identifying the width and height of buildings that are likely to be either affected by the plume from the ventilation outlet or affect the dispersion of the plume from the ventilation outlet.

A discussion of potential impacts on future development in the vicinity of the ventilation facilities as related to elevated receptors is provided in **Table 14-8**

Table 14-8 Potential impacts on future development

Rockdale ventilation facility	Arncliffe ventilation facility
Development patterns and height restrictions for developments in this area are regulated under the Rockdale LEP 2011. Land in the immediate vicinity of the Rockdale ventilation facility is zoned industrial with a building height limit of 14.5 metres. The low density zoned residential land which surrounds the industrial zoned land has a building height limit of 8.5m. At this height there would be minimal influence from the ventilation outlets and the local air quality is influenced by emissions from the surface road which diminishes at heights towards 10m. A high density residential zoned area with a building height provision of 14.5 metres is located approximately 250 metres to the west of the ventilation facility. Another high density zoned residential area with a building height limit of 31 metres is located approximately 280 metres to the sites north east. As noted above, the health risks would be in the tolerable/acceptable range.	Development patterns and height restrictions for developments in this area are regulated under the Rockdale LEP 2011 and SREP 33. The areas to the site's immediate north and north east are zoned for low density residential development and have maximum building heights of 8.5 metres. At this height there is minimal influence from the ventilation outlets and the local air quality is influenced by emissions from the surface road which diminishes at heights towards 10m. However, the Bayside West Precincts 2036 Plan (2018) identifies a large portion of this area of land for future high density residential development (priority area for rezoning). Any future planning controls for this area would need to be developed (based on detailed modelling) to ensure air quality and health risks to elevated receptors are in the tolerable/acceptable range or better. . Further north towards Cahill Park, building heights are significantly higher and range between 17.5 metres and 29.5 metres in the high density residential zoned area and 46m in the mixed use zoned areas. This area is located approximately 260m away (at its closest point) and again the air quality and health risks are considered to be in the acceptable/tolerable range. There are no current building height controls for the land to the south/south east of the site under SREP 33. However the Bayside West Precincts 2036 Plan (2018) also identifies the surrounding land in this area for high density mixed use development (priority area for rezoning). Any future planning controls for this area would need to be developed (based on detailed modelling) to ensure impacts on the elevated receptors are in the tolerable/acceptable range.

14.5.3 Impacts to utilities

As detailed in **Chapter 7** (Construction), it is likely that utilities and services located within or close to the project, including electricity, gas, telecommunications (including optic fibre cables), and sewer and water mains, would need to be protected, relocated or realigned as part of construction of the project. This is particularly the case around areas of surface or shallow soil disturbance.

A preliminary assessment of impacts to major utilities identified the following key areas of interest:

- Surface works along President Avenue (and network integration works at the intersection of President Avenue and Princes Highway)
- Extension of cut and cover structure over West Botany Street

The potential land use impacts in these identified areas of interest are outlined in the following section.

Power supply during construction of the project would be provided by temporary substations located at C1 and C2.

Surface works along President Avenue

It is proposed that all existing services located in both of the verges and the roadway of President Avenue be relocated into a new services corridor immediately south of the President Avenue works, within Scarborough Park. This new service easement would not preclude Council use of the land, however it would preclude planting of trees and any sort of building development above it. Given the current use of the land as open space, utility related land use impacts at this location are considered to be low.

Should a new services corridor at this location not be acceptable, then all services currently within President Avenue (in both verges and the roadway) would be relocated to the new President Avenue verges and roadway, which would have a negligible impact on land use.

The widening for an additional right turn lane into President Avenue from Princes Highway as part of the project would impact a pad mounted substation located along the Princes Highway within the St George TAFE campus. It is proposed that this substation be relocated outside of the roadworks in consultation with the TAFE. Land use impacts at this location are considered to be moderate.

West Botany Street

A number of trunk utilities are located within West Botany Street. This includes an Ausgrid 33kV feeder running through the southbound lane, and a 350 mm secondary gas main in the footpath that continues on to President Avenue. The proposed utility treatment strategy at this location is to protect both of these assets during construction.

A 300 CI sewer running approximately along the back of the seven properties being considered for acquisition is also impacted. It is proposed that this sewer be avoided during the design and construction of the ancillary facilities. If required, the sewer can be relocated locally to the back of the property boundary.

Impacts at this location of the project are therefore considered to be negligible.

14.6 Management of impacts

Environmental management measures relating to land use and property are outlined in **Table 14-9.**

Table 14-9 Environmental management measures – land use and property

<table>
<tr><th>Impact</th><th>Reference</th><th>Environmental management measure</th><th>Timing</th></tr>
<tr><td>Acquisition of property required for the project</td><td>PL1</td><td>Prior to the commencement of works, a toll-free Acquisition Assistance Line is to be established and maintained for a period of up to six months following completion of the final acquisition for the project. The Acquisition Assistance Line is to provide ongoing dispute resolution, a counselling program and contact information for relevant services for relocated persons.</td><td>Prior to construction</td></tr>
<tr><td>Creation of residual land</td><td>PL2</td><td>Residual land remaining following construction of the project would be confirmed to identify appropriate land use, taking into consideration the location, land use characteristics, area and adjacent land uses.</td><td>Construction</td></tr>
<tr><td>Ground settlement</td><td>PL3</td><td>Ground settlement at buildings, roads, parking areas and parks as a result of the project will be managed to comply with the following criteria unless more stringent criteria are subsequently determined by the project:
<table>
<tr><th>Surface and sub-surface structures</th><th>Maximum settlement</th><th>Maximum angular distortion</th><th>Limiting tensile strain* (percent)</th></tr>
<tr><td>Buildings – Low or non-sensitive properties
(i.e. ≤up to 2 levels and carparks)</td><td>30 mm</td><td>1 in 350</td><td>0.1</td></tr>
<tr><td>Buildings – High or sensitive properties (i.e. ≥ 3 levels and heritage items)</td><td>20 mm</td><td>1 in 500</td><td>0.1</td></tr>
<tr><td>Roads and parking areas</td><td>40 mm</td><td>1 in 250</td><td>N/A</td></tr>
<tr><td>Parks</td><td>50 mm</td><td>1 in 250</td><td>N/A</td></tr>
</table>
* As defined in Burland et al. ‘Building response to tunnelling – Case Studies from construction of the Jubilee Link Extension’, London, Thomas Telford (2001).</td><td>Detailed design
Construction</td></tr>
<tr><td></td><td>PL4</td><td>Prior to the commencement of construction, pre-construction Building Condition Surveys will be offered in writing, to the owners of properties where there is a potential for construction activities to cause cosmetic or structural damage. If accepted, a comprehensive written and photographic condition report would be produced by an appropriate professional prior to relevant works commencing.</td><td>Prior to construction</td></tr>
<tr><td>Utility impacts</td><td>PL5</td><td>Interface agreements will be entered into with relevant owners of infrastructure and utility services likely to be impacted by construction of the project. The agreements will likely identify:
Minimum separation distances and appropriate settlement criteria for utility infrastructure
Settlement monitoring requirements during construction
Contingency actions in the event that settlement limits are exceeded.</td><td>Prior to construction</td></tr>
</table>

Impact	Reference	Environmental management measure	Timing
Impacts to the Bardwell Valley Golf Club	PL6	Work with the Bardwell Valley Golf Club to determine staging of construction works and construction method to minimise impact on the activities and operation of the Golf Club.	Construction

14.7 Environmental risk analysis

An environmental risk analysis was undertaken for property and land use and is provided in **Table 14-10** below.

A level of assessment was undertaken commensurate with the potential degree of impact the project may have on that issue. This included an assessment of whether the identified impacts could be avoided or minimised (for example, through design amendments). Where impacts could not be avoided, environmental management measures have been recommended to manage impacts to acceptable levels.

The residual risk is the risk of the environmental impact after the proposed mitigation measures have been implemented. The methodology used for the environmental risk analysis is outlined in **Appendix O** (Methodologies).

Table 14-10 Environmental risk analysis – Property and land use

Summary of impact	Construction/ operation	Management and mitigation reference	Likelihood	Consequence	Residual risk
Acquisition of private property for the project.	Construction	PL1	Likely	Moderate	Low
Residual land	Construction	PL2	Certain	Moderate	Low
Change in land use at Rockdale Bicentennial Park and Memorial Fields from public recreation to transport infrastructure	Operation	PL1	Certain	Minor	Medium
Ground movement resulting in damage to buildings, structures or utility infrastructure	Construction and Operation	PL4, PL5	Unlikely	High	Low
Impacts to utilities	Prior to Construction	PL6	Likely	Moderate	Low
Disruption to use of Bardwell Valley Golf Club	Construction	PL7	Certain	Moderate	Low

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15 Social and economic

This chapter assesses the potential social and economic impacts of the project, and how the desired performance outcomes have been met. The assessment aims to provide an understanding of the community context within which the project would be undertaken, considering community perceptions, while recognising the diversity of stakeholder interests and values. **Table 15-1** sets out the SEARs relevant to social and economic impacts, and identifies where the requirements have been addressed in this EIS.

Table 15-1 SEARs - Social and economic

Assessment requirements	Where addressed
Socio-economic, Land Use and Property	
1. The Proponent must assess social and economic impacts (of all phases of the project) in accordance with the current guidelines (including cumulative construction and operational impacts of the proposal and other major projects in the vicinity of the project) and in consultation with relevant land owners (such as those land owners whose property is being acquired or local residents who would be directly affected by road widening or loss of on street parking).	Refer to section 15.1 for discussion of the assessment approach in accordance with current guidelines. Refer to section 15.3 and section 15.4 for assessment of potential social and economic impacts of each phase of the project. Refer to Chapter 14 (Property and land use) for assessment of property acquisition.
2. The Proponent must assess impacts from construction and operation on potentially affected properties, businesses, and recreational space users, including amenity impacts (including from cumulative and extended construction time frames and construction fatigue, particularly where use of current road project construction facilities are proposed), traffic congestion, property acquisitions/ adjustments, future land uses, restricted access, parking and business disruption, relevant statutory rights, and community severance and barrier impacts resulting from the project.	Refer to section 15.3 and section 15.4 for assessment of potential social and economic impacts of the project. Refer to Chapter 14 (Property and land use, Section 14.4 and 14.5) for assessment of property acquisition and land use.
3. The Proponent must identify and assess the need for temporary and permanent relocation during construction of community facilities such as sports fields and playgrounds.	Refer to section 15.3.1 and section 15.4.1 for assessment of property acquisition and temporary occupation of land. Potential impacts on social infrastructure, including sports fields and playgrounds, are assessed in section15.3.1 and section 15.4.5.
4. The Proponent must assess potential impacts on the Muddy Creek constructed channel such as damage due to subsidence.	Refer to section 15.4.3 for an assessment of potential amenity and community wellbeing impacts associated with potential impacts to Muddy Creek. Refer to Chapter 17 (Groundwater and geology) for an assessment of subsidence impacts on Muddy Creek.
5. The Proponent must assess potential impacts on utilities directly affected by the project (including communications, electricity, gas, fuel, stormwater, potable water and sewerage) and identify management options for impacted utilities, including its relocation or adjustment.	Refer to Chapter 14 (Property and land use) for assessment of impacts on utilities. Refer to section 15.3.1 and section 15.4.1 for potential social and economic implications of impacts to utilities. Utility impacts on businesses are assessed in section 15.3.6 and section 15.4.6.

Assessment requirements	Where addressed
Socio-economic, Land Use and Property	
6. A draft Community Consultation Framework must be prepared identifying relevant stakeholders, procedures for distributing information and receiving/ responding to feedback and procedures for resolving stakeholder and community complaints during planning, design, construction and operation. Key issues that must be addressed in the draft Framework include, but are not limited to: a) traffic management (including property access, pedestrian access and parking at sports fields); b) landscaping/urban design matters including preservation/ provision of active transport corridors, environmental amenity, sports fields, playgrounds and passive recreational space; c) adjustment or relocation of utilities; d) construction activities including out of hours work; and e) noise and vibration mitigation and management.	Appendix B (Draft community consultation framework) Refer to Chapter 3 (Consultation) for details of consultation undertaken for the project. A summary of feedback received during consultation is provided in section 15.2.5. Refer to section 15.1.3 for discussion of business surveys undertaken to inform the social and economic assessment.

15.1 Assessment approach

15.1.1 Overview

The social and economic impact assessment has been prepared to assess the impacts of the project in accordance with the *Environmental Impact Assessment Practice Note – Social and economic assessment* (EIA-N05) (Practice Note)[1].The Practice Note guides the assessment level and process for social and economic impact assessments and outlines the requirements for establishing the social and economic baseline. In accordance with the Practice Note, the following methodology has been undertaken:

- Desktop assessment including review of the social and economic impact assessments from previous F6 Extension investigations to scope issues and identify the scale and magnitude of potential impacts
- Definition of the study area (a description of the study area is provided in **section 15.1.2**)
- Identification and consultation with local communities and stakeholders who could be affected by the project (refer to **Chapter 3** (Consultation) and **section 15.2.5**)
- Development of a baseline profile of the existing social and economic environment for the study area, based on information available from the Australian Bureau of Statistics (ABS), relevant local, regional and State policies and plans, as well as the outcomes of consultation undertaken for the project
- Assessment of the potential construction, operation and cumulative impacts of the project on social and economic matters, including an assessment of the significance of these impacts (as discussed in **section 15.1.4**)
- Identification of management measures for managing and monitoring the potential social and economic impacts of the project.

The social and economic impact assessment is also informed by the outcomes of various other technical reports prepared for the project, including the assessment of impacts to air quality, traffic and transport, noise and vibration, urban design, property and land use, landscape and visual and human health impacts.

[1] NSW Roads and Maritime Services (2013) Environmental Impact Assessment Practice Note – Social and economic assessment (EIA-N05).

15.1.2 Study area

The study area for the assessment of social and economic impacts has been chosen based on the project's area of social influence and the need to consider both local community impacts and those likely to occur on a broader or more regional scale, such as economic and employment opportunities created by the project. The most significant social impacts, particularly those to social cohesion, community wellbeing and amenity values, are anticipated to occur in proximity to the project's footprint.

The study area for the social and economic impact assessment encompasses the project footprint and comprises the following geographic boundaries, defined by ABS as Statistical Area Level 2s (SA2s):

- Arncliffe-Bardwell Valley
- Kogarah
- Rockdale-Banksia
- Monterey-Brighton-Le-Sands-Kyeemagh.

Where SA2 data was not available in certain ABS survey results, the Kogarah-Rockdale Statistical Area Level 3 (SA3) was used as a proxy for the study area. The study area is shown in **Figure 15-1**.

It is acknowledged that on 9 September 2016 amalgamation of the Rockdale and Botany Bay local government areas (LGAs) resulted in the formation of the Bayside LGA[2], and on 12 May 2016 the former Kogarah LGA merged with Hurstville LGA to form the Georges River LGA[3]. As part of the desktop assessment undertaken, local community plans and policies were reviewed for the former LGAs of Rockdale City Council and Kogarah City Council, as updates to these plans for the new amalgamated LGAs are yet to be published. In some instances, data is presented for the former Rockdale and Kogarah LGAs where other study area data is unavailable.

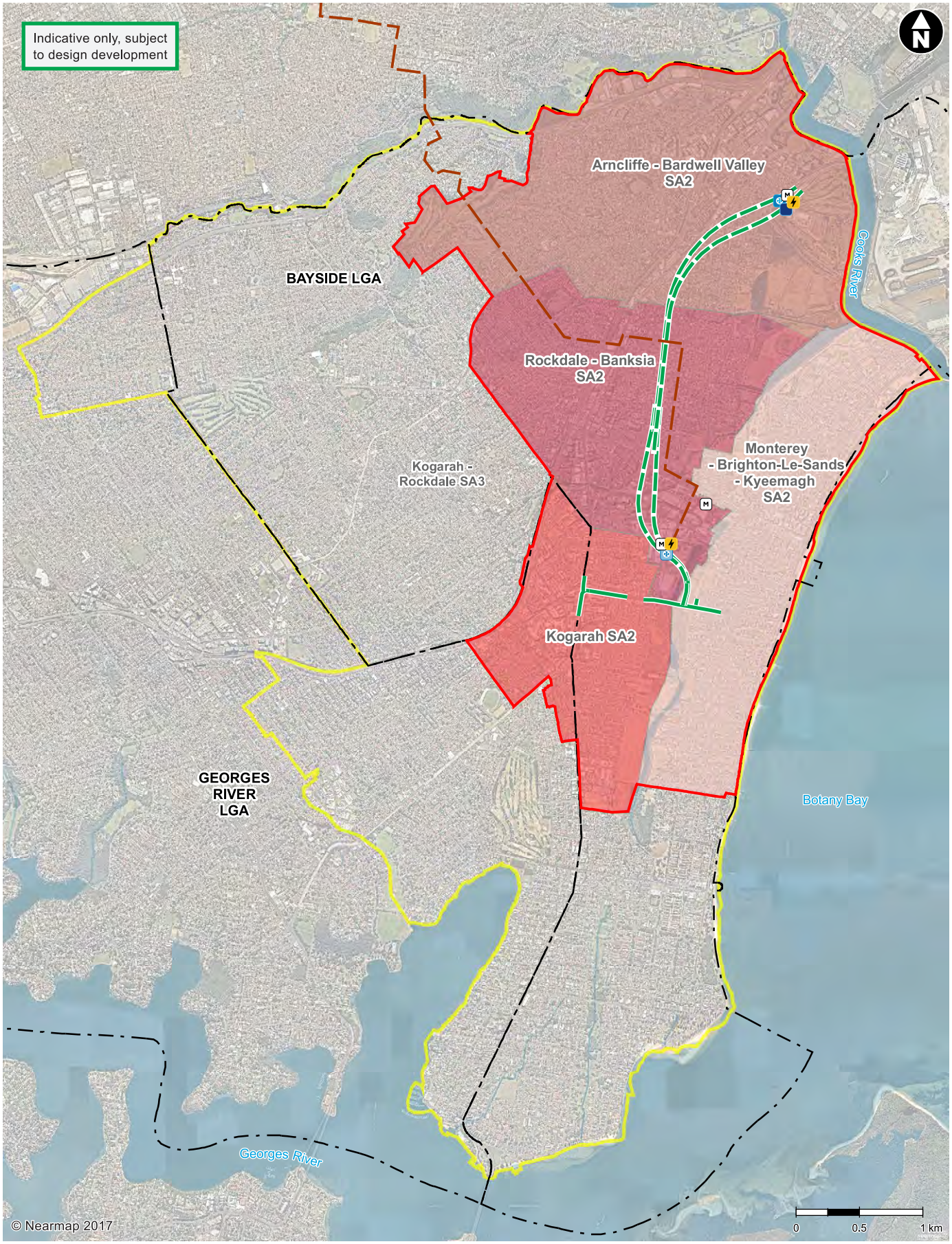
Demographic data for the Greater Sydney metropolitan area have been provided for comparison with the baseline profile for the study area, where relevant.

The study area for the assessment of social and economic impacts resulting from the permanent power supply connection was broader and did not follow the method for the main project. This is because the permanent power supply connection is expected to have negligible and short term impacts compared to the main project. The permanent power supply connection traverses through the suburbs of Kogarah, Rockdale, Arncliffe, Bardwell Valley, Bardwell Park, Earlwood and Canterbury.

15.1.3 Community and stakeholder consultation

The social and economic assessment has been informed by stakeholder and community consultation undertaken for the project. Consultation activities undertaken for the project are detailed in **Chapter 3** (Consultation). Feedback received during project consultation has been analysed, along with local community plans, to provide insights into community identity, values and goals. A summary of these outcomes is provided in **section 15.2.5**.

[2] NSW Government (2018) Bayside Council https://www.strongercouncils.nsw.gov.au/new-councils/bayside-council/
[3] NSW Government (2018) Georges River Council https://www.strongercouncils.nsw.gov.au/new-councils/georges-river-council/



LEGEND

- The project in tunnel
- The project on surface
- Permanent power supply line
- Local governement area
- Social and economic study area
- Arncliffe - Bardwell Valley SA2
- Kogarah SA2
- Monterey - Brighton-Le-Sands - Kyeemagh SA2
- Rockdale - Banksia SA2
- Kogarah - Rockdale SA3
- Substation
- Water treatment facility
- Arncliffe ventilation facility*
- Rockdale ventilation facility
- Motorway operations complex

* Under construction as part of the New M5 Motorway project

Figure 15-1 Study area for the social and economic impact assessment

15.1.4 Assessment of significance

The assessment framework that was used to determine the significance of social and economic impacts is shown in **Figure 15-2**.

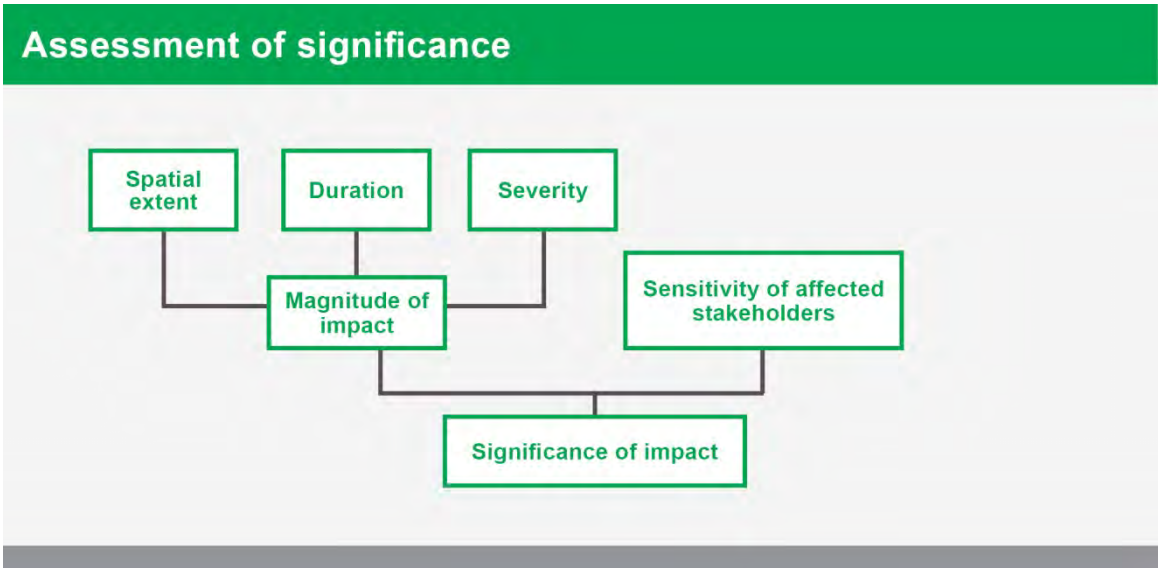


Figure 15-2 Framework for assessment of significance of social and economic impacts

Significance of each potential social impact was assessed as a function of the magnitude of the impact, based on the spatial extent, duration and severity of that impact, and the sensitivity of potentially affected stakeholders. The criteria were established based on:

- **Spatial extent:** the geographic area affected by the impact, considering the number or proportion of people affected
- **Duration:** the timeframe over which the impact would occur
- **Severity:** the scale or degree of change from the existing condition as a result of the impact
- **Sensitivity:** the susceptibility or vulnerability of people, receptors or receiving environments to adverse changes caused by the impact, or the importance placed on the matter being affected.

Table 15-2 was used to identify the magnitude of an impact, with regard to the spatial extent, duration and severity of that impact.

Table 15-2 Example of magnitude levels and their constituent factors

Magnitude	Example
Negligible	No discernible positive or negative changes caused by the impact. Change from the baseline remains within the range commonly experienced by receptors.
Low	A discernible change from baseline conditions. The impact is to a small proportion of receptors over a limited geographical area and mainly within the vicinity of the project. The impact may be short term or some impacts may extend over the life of the project.
Moderate	A clearly noticeable difference from baseline conditions. The impact is to a small to large proportion of receptors and may be over an area beyond the vicinity of the project. Duration may be short term to medium or some impacts may extend over the life of the project.
High	A change that dominates over existing baseline conditions. The change is widespread or persists over many years or is effectively permanent.

Table 15-3 was used to identify the sensitivity of potentially affected stakeholders, based on the ability of stakeholders to adapt to change, their vulnerability, the level of concern raised in feedback during community and stakeholder consultation or change to community identity, values, or goals.

Table 15-3 Example of sensitivity levels and their constituent factors

Sensitivity	Example
Negligible	No vulnerability and able to absorb or adapt to change. Issues not raised in feedback during community and stakeholder consultation, or would not result in change to community identity, values, or goals.
Low	Minimal areas of vulnerabilities and a high ability to absorb or adapt to change. Issues rarely raised in feedback during community and stakeholder consultation, or minor change to community identity, values, or goals.
Moderate	A number of vulnerabilities but retains some ability to absorb or adapt to change. Issues raised in feedback during community and stakeholder consultation, or moderate change to community identity, values, or goals.
High	Multiple vulnerabilities and/or very little capacity to absorb or adapt to change. Issues raised in feedback from a number of community members and stakeholders during consultation or significant change to community identity, values, or goals.

The assessment matrix provided in **Table 15-4** has been used to determine the significance of each social impact as a function of the magnitude of the impact and the sensitivity of potentially affected stakeholders.

Table 15-4 Significance of social and economic impacts

		Magnitude			
		High	Moderate	Low	Negligible
Sensitivity	High	High	High-Moderate	Moderate	Negligible
	Moderate	High-Moderate	Moderate	Moderate-Low	Negligible
	Low	Moderate	Moderate-Low	Low	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

15.2 Existing Environment

This section provides an overview of the social and economic characteristics of the study area with regard to demographic profiles, community values, social infrastructure, business and transport services. Sensitive receptors identified in this section are indicative and not exhaustive.

Social infrastructure and land use zoning within proximity to the project surface works, including the construction ancillary facilities and associated road works on President Avenue, are shown on **Figure 15-9** to **Figure 15-11**.

15.2.1 Demographic profile

The demographic profile of the study area, relating to the social and economic characteristics of the study area as defined in **section 15.1.2**, is informed by statistics sourced from the ABS Census 2016, Australian Statistics Business Indicators[4] and the Bureau of Transport Statistics[5]. This forms the social and economic baseline against which potential impacts are assessed.

Population and age distribution

The population and age distribution characteristics of the study area are detailed in **Table 15-5** and shown in **Figure 15-3**.

[4] Australian Bureau of Statistics (2016) Australian Statistics Business Indicators.
[5] Bureau of Transport Statistics (2015) Household Travel Survey Highlights 2014/2015.

In 2016, the median age in the study area at 34 years was generally lower than that of Greater Sydney (36 years), with a higher proportion of residents in the young working family demographic. This demographic, along with the statistics presented in **Table 15-5**, provide an indication of the types of community services and facilities of importance to local residents of this age group and demographic (e.g. employment, education, entertainment, sporting and recreational facilities, childcare).

The Monterey-Brighton-Le-Sands-Kyeemagh area had a much higher median age at 41 years compared with the study area average. This is due to a higher percentage of residents over 60 years of age compared with other SA2s within the study area (refer to **Table 15-5**). An older demographic suggests a greater demand for community services and facilities such as health care services, recreational facilities, community clubs and groups, as well as ease of access to these services.

Table 15-5 Population and age distribution

Statistical Area Level 2	Population and age distribution characteristics (2016)
Arncliffe-Bardwell Valley	• Population of 21,448 • Median age of 31 • A lower proportion of residents were under the age of 15 years (14 per cent) than Greater Sydney (19 per cent) • A higher proportion of residents within the young working family demographic of 15 – 44 years (46 per cent) than Greater Sydney (34 per cent).
Kogarah	• Population of 11,311 • Median age of 33 • A lower proportion of residents were under the age of 15 years (16 per cent) than Greater Sydney (19 per cent).
Rockdale-Banksia	• Population of 19,961 • Median age of 33 • A lower proportion of residents were under the age of 15 years (14 per cent) than Greater Sydney (19 per cent) • A higher proportion of residents within the young working family demographic of 15 – 44 years (41 per cent) than Greater Sydney (34 per cent).
Monterey-Brighton-Le-Sands-Kyeemagh	• Population of 13,969 • Median age of 41 • A lower proportion of residents were under the age of 15 years (16 per cent) than Greater Sydney (19 per cent) • An older age profile than Greater Sydney, with a median age of 41 years compared to 36 years for Greater Sydney.
Study Area Total	• Population of 66,689 • Median age of 34 • A lower proportion of residents were under the age of 15 years (15 per cent) than Greater Sydney (19 per cent) • A higher proportion of residents within the young working family demographic of 15 – 44 years (40 per cent) than Greater Sydney (34 per cent).

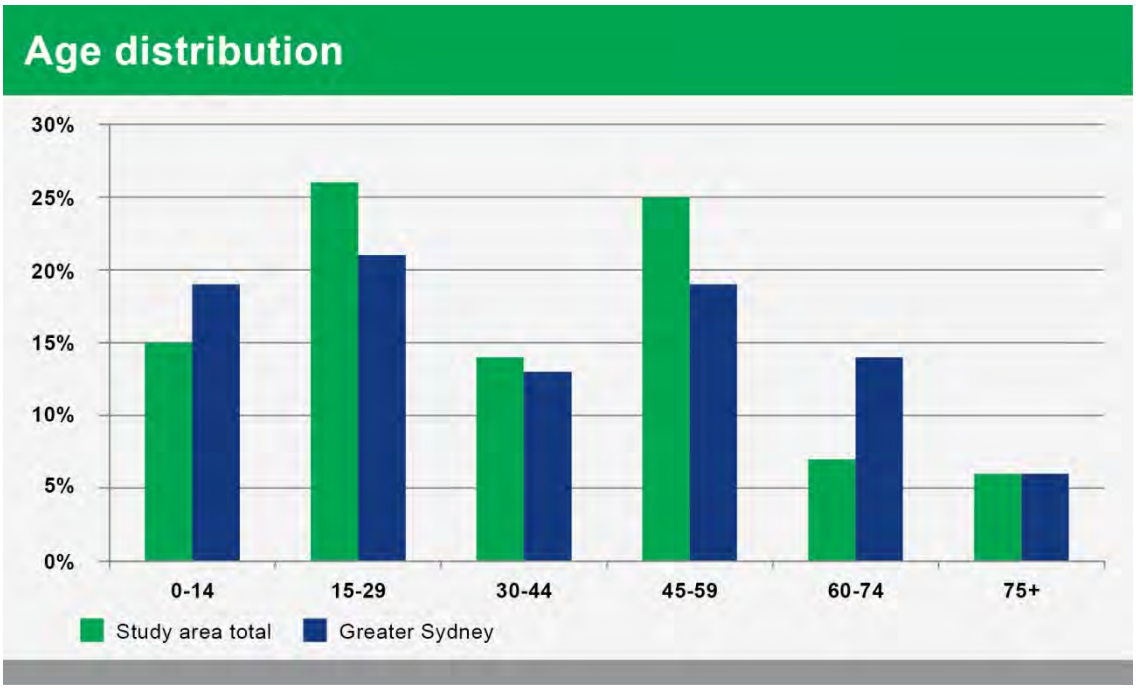


Figure 15-3 Age distribution of the study area compared with Greater Sydney[6]

Population growth

The New South Wales 2016 State and Local Government Area Population Projections[7] estimate a population of 155,450 people in the former Rockdale LGA by 2036, which represents a 1.6 per cent annual growth rate. This is in line with the projected growth rate for Greater Sydney (1.6 per cent). Population projections for the Georges River LGA estimate a population of 182,100 by 2036, representing 1.0 per cent annual growth. Such growth is anticipated to be accommodated through increased development density in the Arncliffe, Banksia, Rockdale and Kogarah areas, as well as the proposed Cooks Cove development. This growth provides opportunities to leverage development investment to improve the overall quality and character of the local area. Strategic planning for growth of these areas is discussed in **Chapter 14** (Property and land use).

Cultural and language diversity

The study area's cultural diversity indicators are outlined in **Figure 15-4**. The study area hosts a diverse range of cultural backgrounds and ethnicities. In 2016, over half (52 per cent) of the people in study area were born overseas, with 58 per cent speaking a language other than English. The study area therefore has a higher concentration of cultural diversity compared with Greater Sydney (37 per cent and 36 per cent respectively). This indicates that there is likely to be a high demand for a range of cultural facilities to support multiple multicultural backgrounds and religious denominations, with community members likely to participate in a range of culturally diverse activities.

The study area is home to Chinese and Nepalese communities and serves as Greek, Macedonian and Lebanese cultural hubs. The Aboriginal and Torres Strait Islander population within the study area (around 0.7 per cent) was low compared to Greater Sydney (1.5 per cent).

[6] ABS Census 2016
[7] NSW Government (2016) New South Wales 2016 State and Local Government Area Population Projections

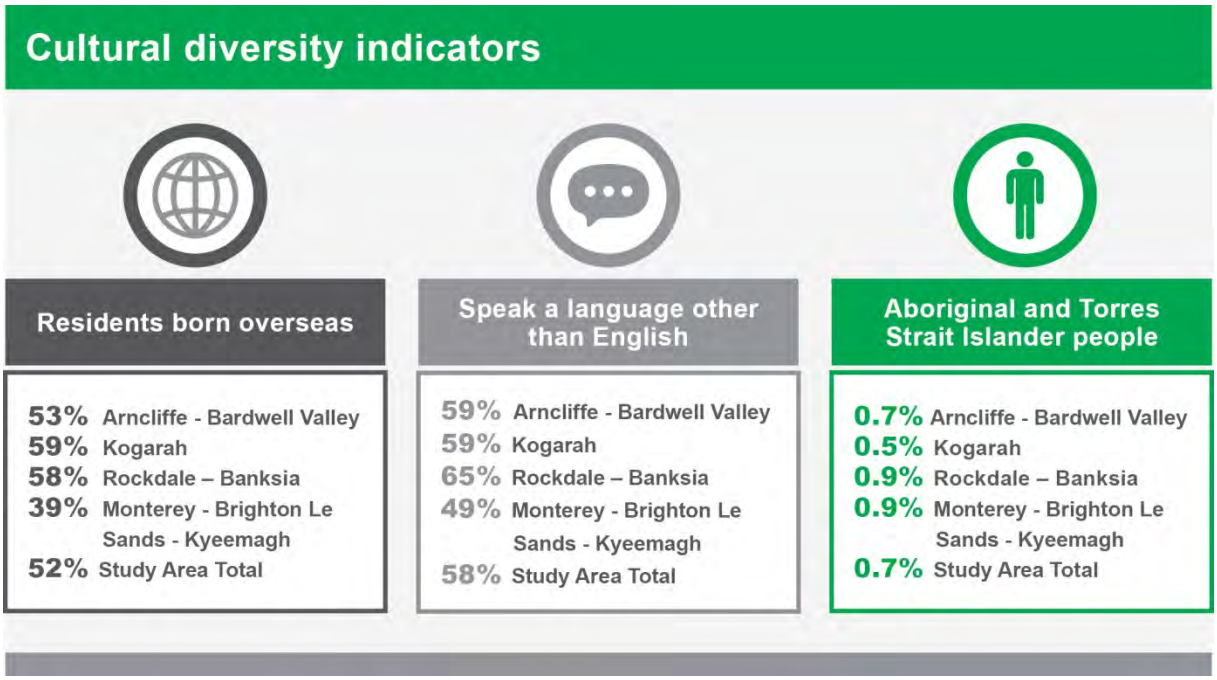


Figure 15-4 Cultural diversity indicators

Socioeconomic indices for areas (SEIFA)

SEIFA broadly defines relative socio-economic advantage and/or disadvantage in terms of people's access to material and social resources, and their ability to participate in society.

The SEIFA Index of Relative Socio-economic Disadvantage (IRSD) is a general socio-economic index that summarises a range of information about the economic and social conditions of people and households within an area[8]. A higher score indicates relatively lower disadvantage and a lower score indicates relatively high disadvantage. For example, an area could have a low score if there are (among other things) many households with low income, many people with no qualifications, or many people in low skill occupations[8].

The study area precincts of Monterey-Brighton-Le-Sands-Kyeemagh and Arncliffe-Bardwell Valley have index scores of five[9]. Rockdale-Banksia has a slightly lower index score of four and Kogarah has a slightly higher index score of six. On average, the study area has lower IRSD scores compared with the former Rockdale LGA (seven) and the Georges River LGA (eight) , indicating relatively greater disadvantage compared with the broader LGAs.

Housing

In 2016, there were around 51,353 private dwellings in the Kogarah - Rockdale SA3, with an occupancy rate of 92.7 per cent. Of these, 42.9 per cent were separate houses, lower than the Greater Sydney average (56.9 per cent), and 43.2 per cent were flat or apartment style dwellings, higher than the Greater Sydney average (28.1 per cent).

In 2016, 30.9 per cent of occupied private dwellings were owned outright, slightly higher than Greater Sydney (29 per cent), and 28.8 per cent were owned with a mortgage, lower than Greater Sydney (33 per cent). The Kogarah-Rockdale SA3 had a higher proportion of rented properties, with 36.8 per cent of occupied private dwellings rented, compared to Greater Sydney (27 per cent).

Of those households in the Kogarah-Rockdale SA3 with a mortgage, 8.7 per cent of households were making mortgage repayments greater than or equal to 30 per cent of household income. Of those households in the Kogarah-Rockdale SA3 who rented, 16 per cent were making rental payments greater than or equal to 30 per cent of household income.

[8] ABS (2018) IRSD http://stat.data.abs.gov.au/Index.aspx?DataSetCode=ABS_SEIFA_LGA
[9] SEIFA indexes described herein present the decile ranks for each area within Australia.

Employment

Figure 15-5 shows the percentage of residents aged over 15 who were employed across the study area in 2016. These include:

- Arncliffe-Bardwell Valley: 51.2 per cent
- Kogarah: 50.9 per cent
- Rockdale-Banksia: 50.6 per cent
- Monterey-Brighton-Le-Sands-Kyeemagh: 46.9 per cent
- **Total study area: 50.1 per cent.**

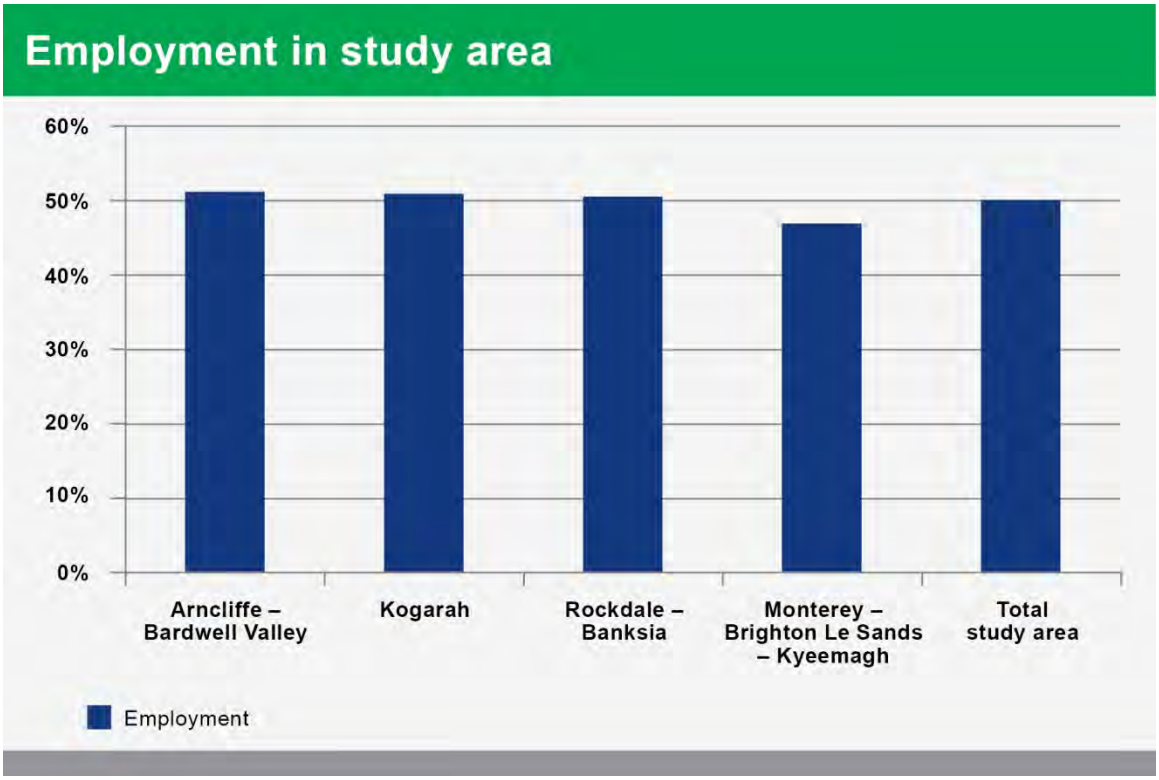


Figure 15-5 Employment in the study area

Of those employed in the Kogarah-Rockdale SA3, 3.7 per cent worked in Hospitals (except Psychiatric Hospitals) and 3.7 per cent worked in Cafes and Restaurants. Other major industries of employment included Banking (2.8 per cent), Computer System Design and Related Services (2.6 per cent) and Building and Other Industrial Cleaning Services (2.4 per cent).

Journey to work

In 2016, around 64 per cent of residents in the Kogarah-Rockdale SA3 commuted to work by private vehicle[10], a higher proportion than Greater Sydney (58 per cent)[11]. Around 31 per cent travelled to work by public transport, as shown in **Figure 15-6**, including 28.5 per cent by train and 2.5 per cent by bus. Walking or cycling represented 4.4 per cent of resident's travel to work, in line with the Greater Sydney average (4.7 per cent).

Of those employed in the Kogarah-Rockdale SA3 for work, around 75 per cent travelled to the study area by private vehicle, around 12 per cent travelled by public transport (10.3 per cent by rail and 1.4 per cent by bus) and around 7 per cent walked or cycled to work in the study area.

[10] Car – as driver, car – as passenger, truck, taxi, motorbike/scooter
[11] ABS (2016) Method of travel to work

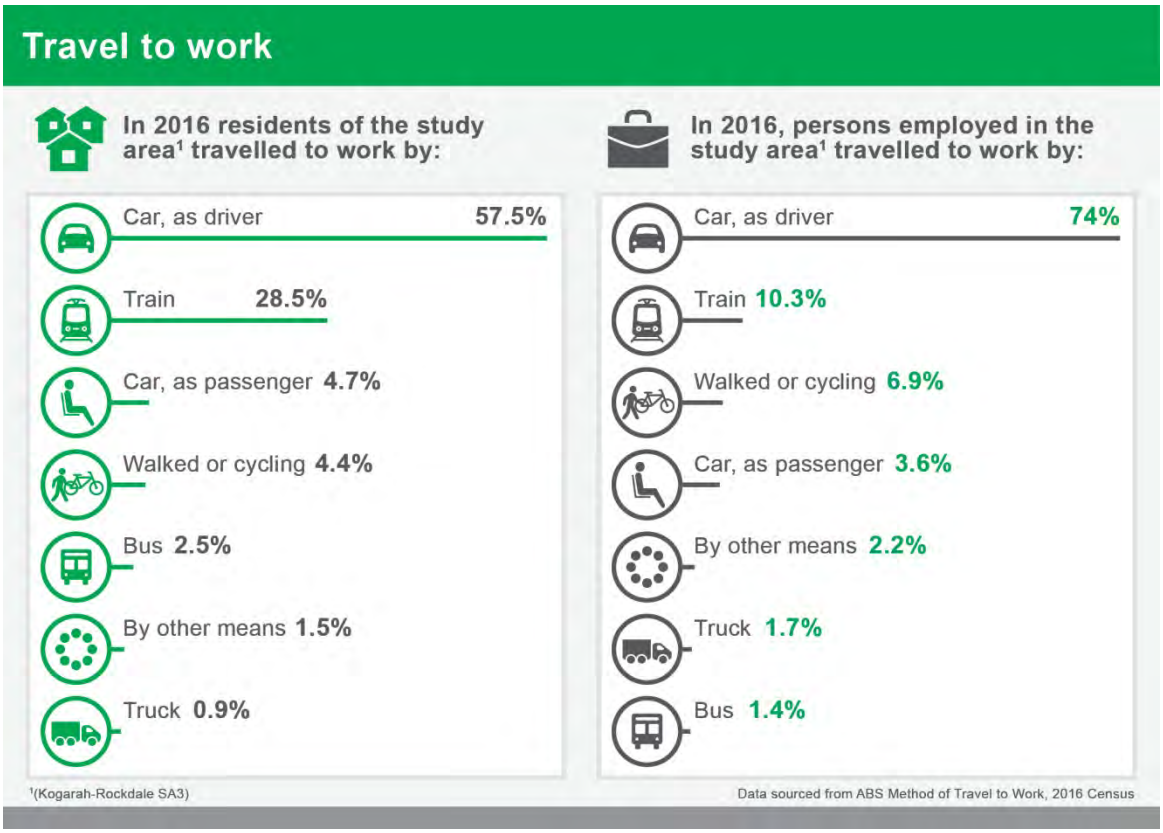


Figure 15-6 Method of travel to work in the study area

Place of work

Almost a quarter (23.9 per cent) of employed residents in the Bayside LGA live and work within the LGA. Of those residents who work outside the Bayside LGA, 30 per cent of all employed residents travelled to the City of Sydney for work, followed by Randwick (7.2 per cent), Georges River (5.8 per cent) and Inner West (4.0 per cent).

Of those employed in the Bayside LGA for work, the highest proportion travelled from their place of residence in the Sutherland LGA (11.3 per cent), followed by Canterbury-Bankstown (9.3 per cent) and Georges River (8.8 per cent).

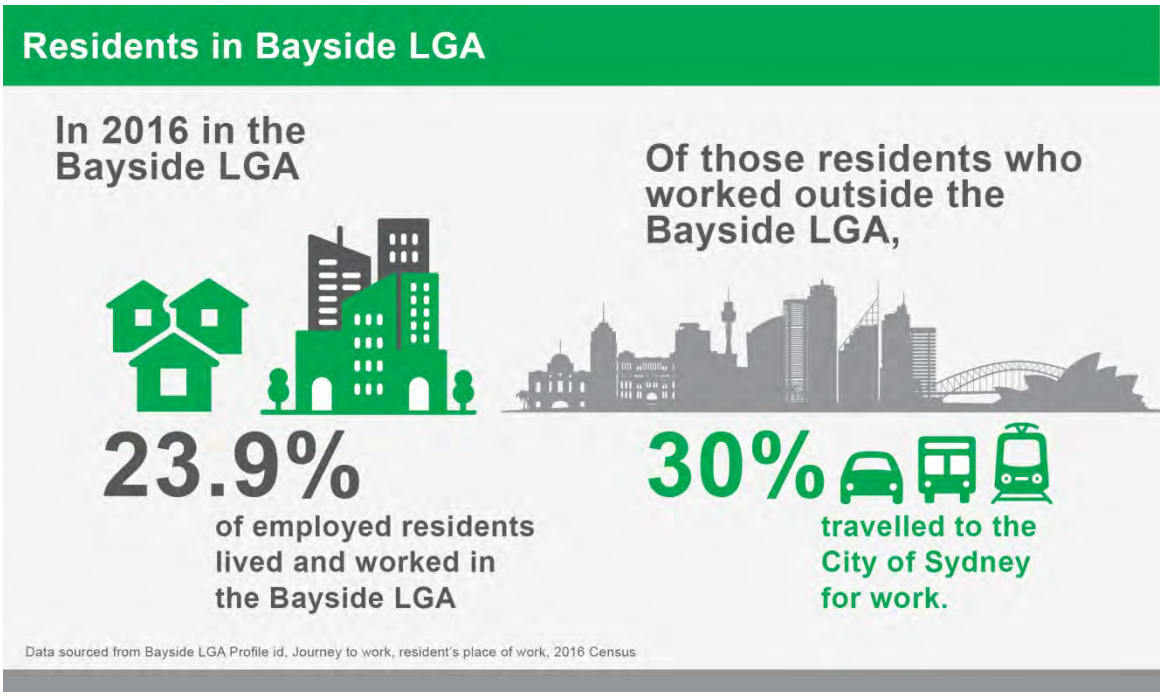


Figure 15-7 Bayside LGA residents' place of work and employed persons' place of work

Of the employed residents in the Georges River LGA, 22.6 per cent live and work within the Georges River LGA. Of those residents who work outside the Georges River LGA, 25.8 per cent of all employed residents travelled to the City of Sydney for work, followed by Bayside LGA (9.4 per cent), Canterbury-Bankstown (7.2 per cent) and Sutherland LGA (6.1 per cent).

Of those employed in the Georges River LGA for work, the highest proportion travelled from their place of residence in the Sutherland LGA (16.5 per cent), followed by Canterbury-Bankstown (11.2 per cent) and Bayside (10.4 per cent).

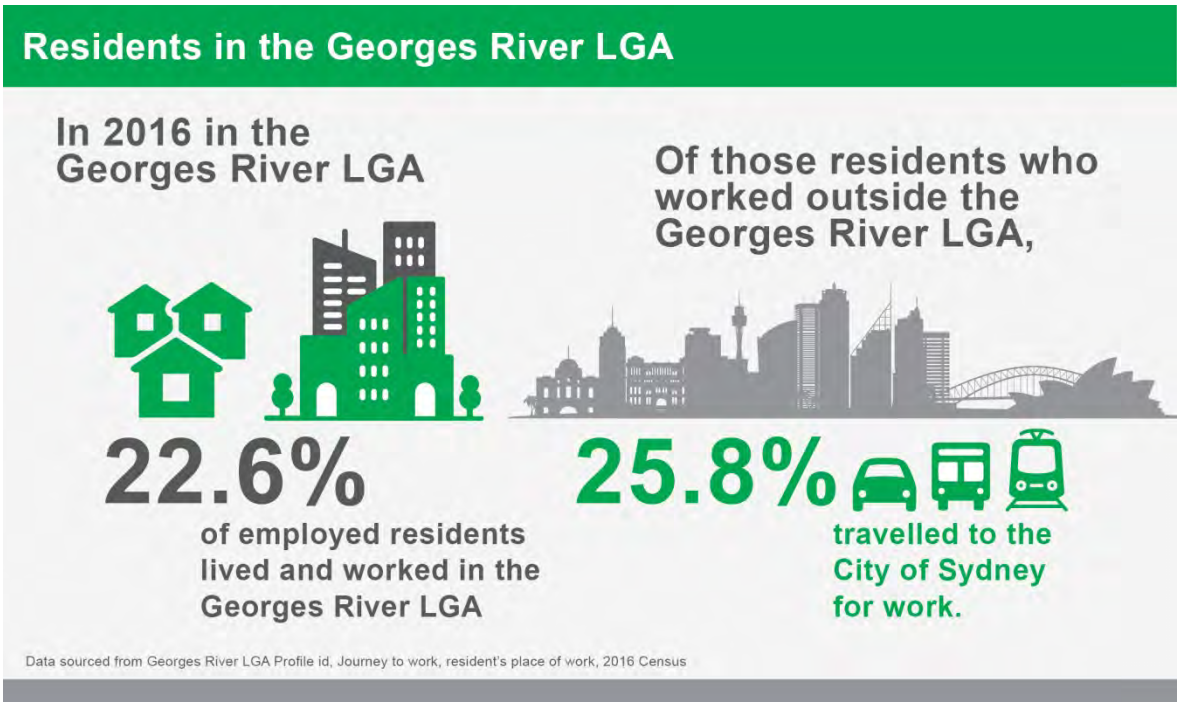


Figure 15-8 Georges River LGA employed persons' place of work

Vehicle ownership

In the study area, 82 per cent of households have one or more motor vehicles with the highest vehicle ownership rates occurring in Monterey-Brighton-Le-Sands-Kyeemagh, where 85 per cent of households own one or more vehicles and 29 per cent of households own two vehicles. The lowest vehicle ownership rates occur in Arncliffe-Bardwell Valley where 18 per cent of households own no motor vehicles, compatible with the Greater Sydney household average, as shown in **Table 15-6**.

Table 15-6 Vehicle ownership in the study area[12]

Number of motor vehicles per dwelling:	Arncliffe Bardwell Valley Precinct	Kogarah	Rockdale Banksia	Monterey Brighton-Le Sands Kyeemagh	Study Area Total	Greater Sydney
No motor vehicles	18 %	17 %	17 %	11 %	16 %	18 %
One motor vehicle	45 %	50 %	46 %	44 %	47 %	45 %
Two motor vehicles	24 %	23 %	23 %	29 %	25 %	24 %
Three motor vehicles	6 %	5 %	6 %	8 %	7 %	6 %
Four or more motor vehicles	3 %	2 %	3 %	4 %	3 %	3 %

[12] ABS Census 2016. Percentages exclude 'number of motor vehicles not stated'. As a result totals do not add to 100 per cent.

15.2.2 Social infrastructure

Social infrastructure comprises social services or facilities that are used for the physical, social, cultural or intellectual development or welfare of the community. Social infrastructure often includes educational facilities, childcare centres, hospital and medical facilities, aged care, sporting and recreational facilities, community halls, clubs, and libraries and the services, activities and programs that operate within these facilities. Open spaces, parks and sporting fields that support sport, recreational and leisure uses are also identified as social infrastructure.

Social infrastructure facilities generally operate at a local, district and/or regional level and are defined by the scale of the population catchment they serve. Social infrastructure can often be classified as a sensitive receptor and may be directly affected by the project.

This section identifies social infrastructure within proximity to the project's surface works and construction ancillary facilities. A distance of 400 metres is considered to be the reasonable maximum walking distance between residents and social infrastructure, including community services, areas of open space and recreation, and local businesses[13]. In an urban environment, walking a distance of up to 400 metres is also considered to be faster than driving[14].

Social infrastructure facilities outlined in this section are shown in **Figure 15-9** to **Figure 15-11**. Shading indicates the social infrastructure located within 400 metres of the project surface works and construction ancillary facilities. Potential impacts on social infrastructure are considered to be more explicitly felt within this 400 metre boundary.

[13] *State Environmental Planning Policy (Housing for Seniors or People with a Disability) 2004*

[14] Australian Government Department of Infrastructure and Transport (2013) Walking, Riding and Access to Public Transport: Supporting Active Travel in Australian Communities

Figure 15-9 Social infrastructure and land use zoning in proximity to the project – Arncliffe

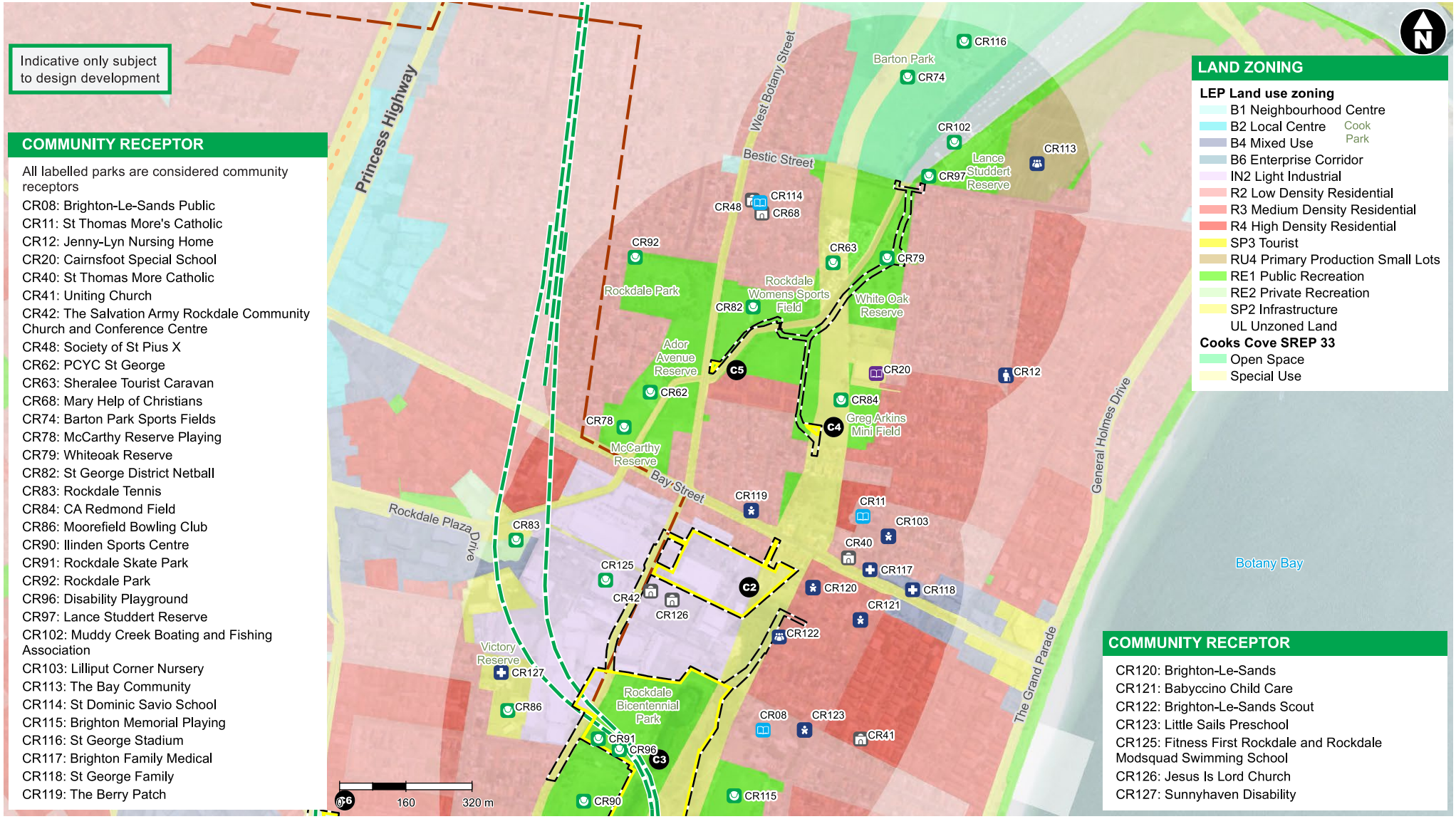


Figure 15-10 Social infrastructure and land use zoning in proximity to the project – Rockdale

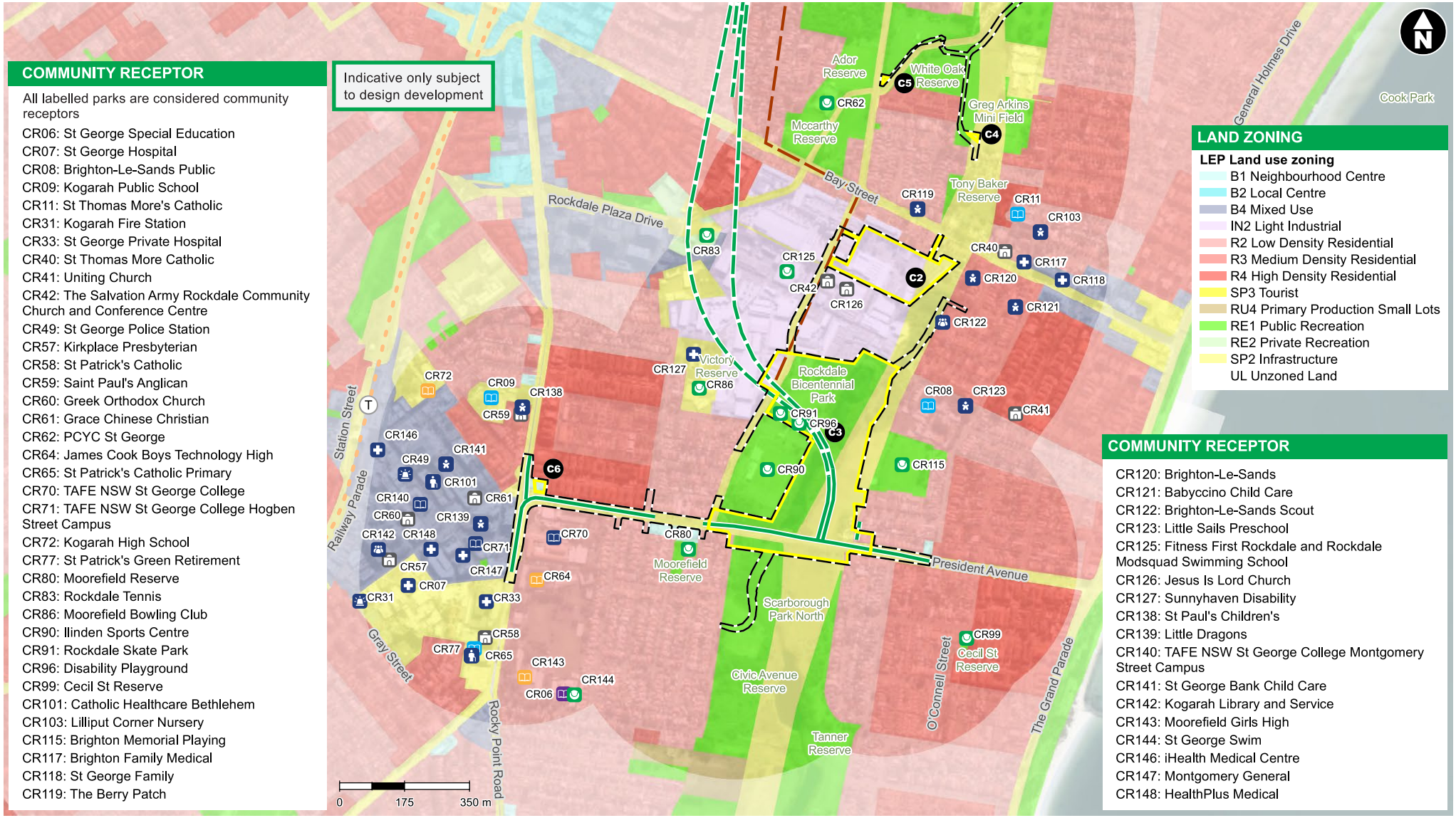


Figure 15-11 Social infrastructure and land use zoning in proximity to the project – Kogarah

Overview

The study area contains a variety of sensitive and recreational land uses, including a corridor of natural and open space which forms the northern part of the Rockdale Wetlands and Recreation Corridor. These areas of green public open space are highly valued by the local community.

The western portion of the study area is dominated by residential land uses. Commercial and retail precincts are concentrated along the existing A1 Princes Highway corridor with the majority of social infrastructure concentrated around the Arncliffe, Banksia, Rockdale and Kogarah local centres and train stations.

The eastern portion of the study area comprises predominantly residential land uses, with the majority of social infrastructure clustered in proximity to the Brighton-Le-Sands local centre.

Educational facilities

There are a wide range of educational facilities in the study area, including child care centres, primary schools, secondary schools, specialised schools and tertiary education facilities.

Child care centres and primary schools within the study area would mainly draw students from the local area, accommodating residents within a local catchment around each facility. High schools and tertiary education facilities are more likely to draw from a wider catchment, particularly where they are situated close to public transport services or provide specialised education services.

Figure 15-9 to **Figure 15-11** identify child care and educational facilities located within 400 metres of the project's surface works. These facilities are identified by type in **Table 15-7**.

Table 15-7 Educational facilities within 400 metres of the project's surface works

Educational facility type	Educational facility name
Child care	• Ira's Day Care, Arncliffe • The Berry Patch Preschool, Brighton-Le-Sands • Lilliput Corner Nursery School, Brighton-Le-Sands • Brighton-Le-Sands Kindergarten, Brighton-Le-Sands • Babyccino Child Care Centre, Brighton-Le-Sands • Little Sails Preschool and Day Care, Brighton-Le-Sands • Banbury Cottage Child Care Centre, Rockdale • St Paul's Children's Centre, Kogarah • St George Bank Child Care Centre, Kogarah • Little Dragons Academy, Kogarah
Primary school	• St Thomas More's Catholic School, Brighton-Le-Sands • Brighton-Le-Sands Public School, Brighton-Le-Sands • Kogarah Public School, Kogarah • St Patrick's Catholic Primary School, Kogarah
High school	• Kogarah High School, Kogarah • James Cook Boys Technology High School, Kogarah • Moorefield Girls High School, Kogarah • St George Girls High School, Kogarah
Combined primary and high school	• Cairnsfoot Special School, Brighton-Le-Sands (caters to students with moderate or severe intellectual disabilities, from kindergarten to year 12) • St George Special Education School, Kogarah (caters to students with severe physical and multiple disabilities, from kindergarten to year 12)
Tertiary education	• TAFE NSW St George College Main Campus, Kogarah • TAFE NSW St George College Montgomery Street Campus, Kogarah • TAFE NSW St George College Hogben Street Campus, Kogarah

Health, medical and emergency services facilities

There are a number of health and medical facilities within the study area as shown on **Figure 15-9** to **Figure 15-11**, including private and public hospitals, medical centres and general medical practices.

The study area includes the St George Hospital precinct at Kogarah, which is likely to attract people from across the region as patients for hospital and medical services, as a place of employment and as students to the tertiary and teaching hospital, as well as associated specialist and other medical services.

Medical centres and general medical practices are likely to attract people from within their respective local catchments for non-emergency medical care and general wellbeing.

Health and medical facilities located within 400 metres of the project's surface works include:

- Brighton Family Medical Centre, Brighton Le Sands
- St George Family Mediclinic, Brighton Le Sands
- Sunnyhaven Disability Services, Rockdale
- St George Hospital, Kogarah
- St George Private Hospital, Kogarah
- iHealth Medical Centre, Kogarah
- Montgomery General Practice, Kogarah
- HealthPlus Medical Centre, Kogarah.

Emergency services facilities located within 400 metres of the project's surface works include:

- Arncliffe Fire Station
- St George Police Station
- Kogarah Fire Station.

Aged care facilities

Aged care facilities, including retirement homes and nursing homes, are located within the study area, as shown on **Figure 15-9** to **Figure 15-11**.

Aged care facilities within 400 metres of the project's surface works, include:

- Jenny-Lyn Nursing Home, Brighton-Le-Sands
- Catholic Healthcare Bethlehem House, Kogarah
- St Patrick's Green, Kogarah.

Places of worship

Places of worship within the study area cater to a diverse range of religious and cultural backgrounds, as identified in **section 15.2.1**.

Figure 15-9 to **Figure 15-11** identify places of worship located within 400 metres of the project's surface works. These include:

- Masjid Darul Imaan Mosque, Arncliffe
- Society of St Pius X, Rockdale
- Mary Help of Christians Convent, Rockdale
- St Thomas More Catholic Church, Brighton-Le-Sands
- Uniting Church in Australia, Brighton-Le-Sands
- Salvation Army Rockdale Community Church and Conference Centre, Rockdale
- Jesus is Lord Church, Rockdale
- St Paul's Anglican Church, Kogarah

- Grace Chinese Christian Church, Kogarah
- Greek Orthodox Church, Kogarah
- St Patrick's Catholic Church, Kogarah
- Kirksplace Presbyterian Church, Kogarah.

Community service facilities

Social infrastructure which supports community services, including community centres, halls, function centres and public libraries provide opportunities for:

- Educational, recreational and health services and programs
- Community, cultural and social activities
- Places that build community connections and relationships
- Places that improve the inclusion of community members, especially within areas of high culturally and linguistically diverse communities.

Figure 15-9 to **Figure 15-11** identify the community service facilities located within 400 metres of the project's surface works. These include.

- Brighton Scout Hall, Brighton-Le-Sands, which is used for activities such as martial arts classes on weeknights and weekends
- Kogarah Public Library and Service Centre, Kogarah, which includes meeting rooms for hire.

Sporting and recreational facilities

The Rockdale Wetlands and Recreation Corridor is of high natural and social value to the local community. The area contributes to local amenity and the community's identity and sense of place, with community members actively engaged in volunteer programs for the restoration of wetland and key habitat areas as well as bird watching and walking groups, and sporting and recreational activities.

There are a number of passive and active spaces in the study area in the form of parks, reserves, playgrounds and sporting fields. Specialised sporting facilities include sports centres, bowling clubs, tennis courts, golf courses, basketball and netball courts, leisure centres, aquatic centres and skate parks. Car parking facilities, bus set down areas and cycle paths associated with or in proximity to these facilities provide valuable points of access.

Figure 15-9 to **Figure 15-11** identify sporting and recreational facilities within 400 metres of the project's surface works. These are summarised in **Table 15-8**. Facilities identified are public only and do not include private facilities.

Table 15-8 Sporting and recreational facilities within 400 metres of the project's surface works

Sporting and recreational facility type	Sporting and recreational facility name
Arncliffe	
Sporting centres and clubs	• Kogarah Golf Course, which comprises the Kogarah Golf Club and an 18 hole course. Part of the Kogarah Golf Course is currently being used for construction of the New M5 Motorway. • St George Rowing Club, Wolli Creek • Barton Park Driving Range, Arncliffe
Sporting fields and courts	• Cahill Park Sports Field and Cahill Park Tennis Courts, Wolli Creek • Barton Park sporting fields, Arncliffe • Banksia field, Arncliffe • Riverine Park baseball diamond

Sporting and recreational facility type	Sporting and recreational facility name
Reserves, parks and areas of open space	• Eve Street Reserve • Barton Park, Arncliffe (includes Landing Lights Wetland) • Riverine Park, Arncliffe
Playgrounds	• Riverine Park playground, Arncliffe (with play equipment and shade cloths)
Rockdale and Brighton-Le-Sands	
Sporting centres and clubs	• Muddy Creek Boating and Amateur Fishing Association, Kyeemagh (includes slipway, work wharves and boat ramp for members as well as club facilities. Hosts fishing competitions and family fishing days) • St George Police-Citizens Youth Club (PCYC), Rockdale (includes a gym, three squash courts, a main hall for martial arts and boxing academy classes, basketball, indoor soccer, gymnastics, volleyball, netball and baton twirling, and a drop in room with couches, table tennis, pool and fuseball facilities. The Tszyu Boxing Academy operates out of this facility) • Rockdale Tennis Club, Rockdale (includes 18 all-weather tennis courts, a bistro, function areas and club facilities, with off-street parking. Open 7 days per week) • Fitness First Rockdale and Rockdale Modsquad Swimming School (includes gym facilities and an indoor pool which is used for swimming school lessons, as well as off-street parking) • Moorefield Bowling and Sports Club, Rockdale (includes 2 bowling greens and club facilities with a bistro, function areas and dedicated off-street parking. Open Tuesday to Sunday) • Ilinden Sports Centre, Rockdale (Home to the Rockdale City Suns Football Club and includes a clubhouse and function rooms, an indoor and outdoor licenced canteen, as well as sporting fields and soccer fields for both training and playing purposes. This facility is highly valued within the local community, with strong community support for both viewing and playing soccer, as well as the availability of function rooms for local community and cultural events)
Sporting fields and courts	• St George Stadium and Barton Park sporting fields • C A Redmond Field, Rockdale (home of the Rockdale Rugby Union Club) • Greg Arkins Mini Field • McCarthy Reserve playing fields, Rockdale (includes off-street parking) • St George District Netball Association, Rockdale (includes 32 outdoor netball courts, canteen, control room and off-street parking; 11 junior and senior netball clubs are affiliated with the association and utilise the courts on weeknights and weekends) • Rockdale Tennis Club courts, Rockdale (includes 18 all-weather tennis courts) • Rockdale Skate Park at Rockdale Bicentennial Park, Rockdale (used by local high schools for sport activities) • Ilinden Sports Centre sporting fields and soccer fields, Rockdale (Rockdale City Suns Football Club exclusive use) • Bicentennial East soccer field, Rockdale (Rockdale City Suns Football Club, Brighton-Le-Sands Public School and community use) • Brighton Memorial Playing Fields, (caters to local and regional sporting clubs for both training and playing purposes, including St George Football Association and Rockdale City Suns Football Club, as well as daily use for school sports by Brighton-Le-Sands Public School and other local school groups)

Sporting and recreational facility type	Sporting and recreational facility name
Reserves, parks and areas of open space	• Lance Studdert Reserve, Kyeemagh • Whiteoak Reserve, Brighton-Le-Sands • Rockdale Park, Rockdale • Ador Avenue Reserve, Rockdale • McCarthy Reserve, Rockdale • Tony Baker Reserve, Brighton-Le-Sands • Victory Reserve • Rockdale Bicentennial Park, Rockdale
Playgrounds	• The Bay Community Garden, Kyeemagh • Sheralee Tourist Caravan Park, Rockdale • Lance Studdert Reserve playground (with play equipment) • Rockdale Park playground (with play equipment and shade cloths) • Whiteoak Reserve playground (with play equipment) • Rockdale Bicentennial Park disability playground, Rockdale (includes shade cloths and play equipment, as well as toilet facilities and off-street parking. This facility provides a popular recreational area for young families)
Kogarah	
Sporting centres and clubs	St George Swim Academy, Kogarah (indoor pool which is used for swimming school lessons)
Sporting fields and courts	No public facilities
Reserves, parks and areas of open space	• Scarborough Park North • Moorefield Reserve, Kogarah • Civic Avenue Reserve, which includes a fenced off dog park area • Civic Park • AS Tanner Reserve • Cecil St Reserve
Playgrounds	• Moorefield Reserve playground (with shaded play equipment) • Cecil Street Reserve playground (with shaded play equipment)

15.2.3 Employment centres

Strategic, district and local centres

In developing the *Greater Sydney Region Plan*[15], The Greater Sydney Commission identified that some centres make a substantially greater contribution to the economy of Greater Sydney than others. On this basis, the District Plans include a hierarchy of centres at a strategic, district and local level. These centres vary in terms of scale and contribution to Greater Sydney's job growth and productivity as well as service provision to local communities.

Local centres within the study area are generally clustered on the main transport routes (such as train stations) and provide either a specialist service to the broader area or a convenience service for the local community. There is one strategic centre within the study area (the Kogarah health and education super precinct), no district centres, and several local centres.

Table 15-9 identifies the hierarchy of commercial, health and education centres within the study area and provides an overview of some of the larger local centres in the study area.

[15] Greater Sydney Commission (2018) *A Metropolis of Three Cities - the Greater Sydney Region Plan*

Table 15-9 Key commercial, health and education centres in the study area

Centre name	Description
Strategic centre	
Kogarah health and education super precinct	Kogarah is the only identified Strategic Centre in the vicinity of the project and is the South District's only Health and Education Super Precinct. The super precinct was identified in the Greater Sydney South District Plan as a strategic area for employment and population growth within the South District. It is anchored by St George Hospital, a major tertiary and teaching hospital, St George Private Hospital and Sydney TAFE St George College. Roughly half of the precinct's employment is in health care and social assistance. It has significant commercial office space, including St George Bank's head office and Westpac Bank's GroupTech campus. The super precinct is zoned mixed use and infrastructure and is located adjacent to Kogarah Station.
Local centres	
Arncliffe local centre (Princes Highway between Subway Road and West Botany Street)	Zoning for the Arncliffe local centre is a combination of mixed use, enterprise corridor, and high density residential land use. The Arncliffe local centre comprises two petrol stations, automotive sales and service centres, food and beverage outlets, and light industrial uses such as the Plastix plastic fabrication company. The local centre is accessed by both Arncliffe Station in the north and Banksia Station in the south.
Banksia local centre (Princes Highway between Bestic Street and Subway Road)	The Banksia local centre is zoned as a local centre, and consists of light industrial and retail functions, including a self-storage facility, various auto stores, automotive sales lots and service centres, a sporting goods store, a funeral home, bars, and a bathroom fixture and tile supply store. The local centre is proximate to Banksia Station.
Rockdale employment area (between Bay Street and Princes Highway either side of West Botany Street)	The Rockdale employment area is zoned light industrial, but serves both light industrial and retail functions, such as larger footprint retail uses, including Bunnings, multiple gyms, automotive stores, and building supply stores.
Brighton-Le-Sands local centre	Brighton-Le-Sands is the premier mixed-use local centre on Botany Bay. It includes the Novotel hotel development and a number of five and six storey mixed use buildings with restaurants and retail outlets on the ground floor. In the eastern part of the centre, a number of residential buildings rise to about ten levels. Brighton-Le-Sands also includes a number of important local heritage items and tourist destinations along the beachfront on The Grand Parade.
Kogarah local centre (Kogarah Town Centre and other retail east of Kogarah Station)	The Kogarah local centre is located within the health and education super precinct near Kogarah Station and is anchored by the Kogarah Town Centre shopping mall which includes a large grocery store. The local area also offers cafes, food and beverage outlets, bank branches, and neighbourhood service retail functions. In addition to serving its adjacent housing and local businesses, the Kogarah local centre also serves other nearby suburbs for groceries and community services, such as the Kogarah Public Library and Service Centre.
Carlton/Kogarah local centre (Railway Parade between Garfield Street and Buchanan Street)	The Carlton/Kogarah local centre is zoned mixed use and is proximate to Carlton Station. The relatively small retail offering includes cafes, a convenience store, food and beverage outlets, and other neighbourhood services (hair and beauty salons, etc.)

Businesses

Business within the study area are generally clustered on the main transport routes (such as bus routes) and provide either a specialist service to the broader area or a convenience service for the local community. Business clusters considered in the social and economic assessment are listed in **Table 15-10**. Business receptors identified in this section are indicative and not exhaustive.

Table 15-10 Business clusters proximate to construction facilities

Construction site	Business cluster name	Business types
Arncliffe construction ancillary facility (C1)	Marsh Street and Innisdale Road	Hospitality services (Hotels) Petrol station Automotive retail (including car dealers, tire shops, mechanic centres, body shops, service centres)
Shared cycle and pedestrian pathways construction ancillary facilities (C4 and C5)	Ador Avenue at McCarthy Reserve	Recreational services (Gym, boxing academy and martial arts at St George PCYC)
	88 Bryant Street	Recreational services (Caravan park)
Rockdale construction ancillary facility (C2)	Rockdale employment area (between Bay Street and Princes Highway either side of West Botany Street)	Construction (Plumbing, electric, and building supply stores) Retail (Gyms/fitness) Retail (Garden centre) Retail (Pet store) Automotive retail (including car service centres, tire shops, service centres) Food/beverage (Bakery) Professional services (Industrial design) Recreational services (Bowling club)
	Brighton-Le-Sands Local centre (Bay Street and The Grand Parade)	Hospitality services (Hotels) Food/beverage (Restaurants, cafes, bottle shops) Retail (Health and beauty) Retail (Boutique clothing and home goods)
	Kogarah health and education super precinct	Health care (St. George Hospital and surrounding supporting medical businesses)
President Avenue construction ancillary facility (C3)	Rockdale employment area (between Bay Street & Princes Highway either side of West Botany Street)	Construction (Plumbing, electric, and building supply stores) Retail (Gyms/fitness) Retail (Garden centre) Car service centre and auto stores Food/beverage (Bakery) Retail (Pet store) Health care (Sunnyhaven Disability Services) Professional services (Industrial design) Recreational services (Bowling club)
	Brighton-Le-Sands Local centre (Bay Street and The Grand Parade)	Hospitality services (Hotels) Food/beverage (Restaurants, cafes, bottle shops) Retail (Health and beauty) Retail (Boutique clothing and home goods)

Construction site	Business cluster name	Business types
President Avenue intersection upgrade surface works	President Avenue at Oakdale Avenue	Petrol station Food/beverage (Bakery) Retail (Pet store, Boutique clothing and home goods)
	President Avenue at The Grand Parade	Retail (Furniture) Food/beverage (Boutique chocolate shop) Petrol Station
	President Avenue at Crawford Road	Retail (Boutique clothing) Food/beverage (Restaurant) Retail (Convenience store)
Princes Highway construction ancillary facility (C6) and Princes Highway/President Avenue intersection upgrade works	Either side of Princes Highway between South Street and Gladstone Street	Retail (Sweet shop, Chocolate shop, office furniture) Car wash Petrol Stations with Countdown / 7-Eleven Health (Nutritionist, St George Private Hospital) Professional services (Accountant)

In order to gain a better understanding of the main issues, potential impacts, perceptions and concerns of businesses the study area, a survey was offered to businesses located within 400 metres of the proposed Rockdale (C2) and President Avenue (C3) construction ancillary facilities, over three weeks in July and August 2018, totalling approximately 70 businesses. Of these, 37 businesses participated in the survey.

The collated results of the business impact survey are presented in **Appendix I** (Social and economic supporting information).

Business operations

Twenty-four per cent of businesses reported operating Monday to Friday, and additional 35 per cent operate Monday to Saturday. Thirty per cent are open Monday to Sunday (seven days a week).

The majority (at least 70 per cent) of respondents are open between 8:00am and 5:00pm. Between the hours of 10:00pm and 4:00am, 10 per cent of businesses said they are open.

Half of the businesses that participated in the survey said that their trade relies on prominent signage or visibility to passing customers. Seventy per cent said that customers/clients normally travel to the business by private car, and would therefore normally rely on on or off-street parking in the vicinity of these businesses. Eighty-one per cent of all businesses said that they have off-street parking, with the majority (64 per cent) having 10 car spaces or fewer.

All but one business said that they take or dispatch regular deliveries from their premises, with the majority (at least 70 per cent) saying they would usually receive deliveries between 7:00am and 5:00pm.

Construction

The survey found that 45 per cent of businesses expect a loss or significant loss in trade during construction, with only one business (a food and beverage business) expecting an increase in trade.

Disturbance and disruption (such as traffic or amenity impacts) and a reduction in business turnover were the most common negative impacts expected by respondents during construction.

When asked what could minimise the negative impacts on their business during construction, some recurring suggestions and concerns raised were:

- Effective management of traffic and maintenance of business access during construction (refer to **section 15.3.4** and **Chapter 8** (Traffic and transport))
- Effective management of air quality during construction (refer to **Chapter 9** (Air quality)
- Effective communication to the public and businesses (refer to **Chapter 3** (Consultation))

- Effective management of parking or provision of additional parking during construction (refer to **section 15.3.6**)
- Provision of additional signage for businesses during construction (refer to **section 15.3.6**).

Operation

Thirteen percent of businesses expected that they would experience an increase in trade during operation of the project and 51 per cent thought it would be about the same. Nineteen per cent expect their business to experience a loss in trade. One business expects there to be a significant increase in trade, and one other business expects there to be a significant reduction.

The most common adverse impacts expected to occur during operation were reductions in business turnover and impacts on customer parking and customer access. Businesses were also concerned about amenity impacts during operation (such as noise and air quality impacts as a result of the ventilation facility).

When asked what could minimise adverse impacts on their business during operation, some recurring suggestions were to ensure effective traffic and access management in order to minimise impacts to customers, staff and deliveries (refer to **section 15.4.4** and **Chapter 8** (Traffic and transport)).

Industry Value Added

Industry Value Added (IVA) is a metric that measures economic contribution by calculating the total value of goods and services produced by an industry, minus the cost of goods and services used in the production process.

Employment industries in the local government areas that include the study area, Bayside Council and Georges River Council, contributed around $18.4 billion (B) to the total IVA of NSW as follows:

- Bayside Council, which includes Sydney Airport, contributed around $13B IVA, with Transport, Postal, and Warehousing driven by airport activities making up $4.9B of that. Secondary industries are construction, manufacturing, and wholesale trade
- Georges River Council contributed around $5.4B IVA, driven primarily by the Finance and Insurance services and health care and social assistance, likely due to health care activities in and around St. George Hospital in Kogarah.

15.2.4 Access and connectivity

A detailed description of the existing transport and traffic environment in the study area is provided in **Chapter 8** (Traffic and transport) and **Appendix D** (Traffic and transport technical report).

Road and freight network

The key roads in the study area are identified on **Figure 8-1** of **Chapter 8** (Traffic and transport) and include:

- Princes Highway (A36) – a significant highway, extending from Sydney, NSW to Port Augusta, South Australia, passing through NSW, Victoria and South Australia. In the vicinity of the project, the Princes Highway has many signal controlled intersections and is frequently congested
- The Grand Parade – a state road that connects to General Holmes Drive near Bruce Street, Brighton-Le-Sands and to Sandringham Street, Sans Souci. The section of The Grand Parade between President Avenue and General Holmes Drive is part of the A1 road corridor between Waterfall and Mascot
- President Avenue – a state road that links The Grand Parade at Brighton-Le-Sands and the Princes Highway at Kogarah. It forms part of the A1 road corridor between Waterfall and Mascot.
- West Botany Street – a key north-south link that extends between the Princes Highway at Arncliffe and President Avenue at Kogarah
- Bay Street – a state road that extends between the Princes Highway at Rockdale and The Grand Parade at Brighton-Le-Sands. There are parking restrictions in certain locations along Bay Street.

Within the study area, the existing F6 reserved corridor has resulted in the preservation of a corridor of open space between the communities of Arncliffe, Banksia, Rockdale and Kogarah in the west and the communities of Kyeemagh and Brighton-Le-Sands along the coast in the east. This corridor is known as the Rockdale Wetlands and Recreation Corridor and has become the focal point for areas of open space, green space and active and passive sporting and recreational facilities within the study area. The Rockdale Wetlands and Recreation Corridor separates communities in the west from those in the east, with east-west movements limited to key roads such as Bestic Street, Bay Street and President Avenue. Princes Highway and West Botany Street provide the key north-south connections in the western portion of the study area and The Grande Parade provides north-south movements in the east.

The road network in the study area also services commercial and freight operators. As discussed in **Chapter 8** (Traffic and transport), the Princes Highway is a primary freight route, providing access for freight and commercial movements between the Sydney CBD and areas to the south and south-west. The Grande Parade, Bay Street and President Avenue currently comprise secondary freight routes, supporting connections through urban areas to commercial areas and the Sydney Airport and Botany Bay Precinct. These roads are currently experience high levels of congestion, which constrain freight, commercial and business movements through the study area.

Public transport

Public transport modes across the study area include rail and bus services. As discussed in **section 15.2.1**, almost a third (31 per cent) of residents within the study area travelled to work by public transport, with the majority travelling by train (28.5 per cent). For those employed in the study area, a much lower proportion travelled to work by public transport (around 12 per cent).

The study area is served by the Sydney Trains T4 Eastern Suburbs and Illawarra Line. The study area encompasses the Arncliffe, Banksia, Rockdale and Kogarah stations, which provide connections to Sydney Airport, the Sydney CBD and eastern suburbs to the north and east, and the Illawarra region to the south. In addition to passenger services, the Illawarra Line (also known as the South Coast Line) provides inter-urban passenger and freight rail services, with inter-urban passenger services providing connection between the South Coast and Sydney Terminal (Central station) and freight services operating to and from Port Kembla. Increasing demand for passenger services has resulted in capacity constraints for freight rail along the Illawarra Line.

Bus services in the study area are provided by State Transit and Transdev NSW bus operators. The bus routes provide a mixture of regional connections between activity centres, and local connections that complement the rail service provision. Bus services in the study area include:

- Bus route 422 travels to the Sydney CBD, with services available every 30 minutes in the AM and PM peak periods, departing from Kogarah. Bus route 422 includes stops along the Princes Highway, West Botany Street and Bestic Street, as well as a number of local streets within the study area
- Bus route 947 operates between Hurstville and Kogarah via Ramsgate and Dolls Point. Bus route 947 includes stops along President Avenue and Princes Highway within the study area and utilises the President Ave/ Princes Highway intersection at Kogarah
- Two loop services provide a local area connection for the suburbs of Kyeemagh and Dolls Point to Rockdale Station (route 479 and route 476, respectively). These loop services include stops along the Princes Highway, West Botany Street, Bay Street, Bestic Street and The Grande Parade, as well as a number of local streets within the study area
- Bus routes in the study area also provide connections to Bondi Junction to the east, Sans Souci and Miranda to the south, Hurstville to the west, and Kingsgrove, Roselands and Burwood to the north-west.

Bus services in the study area are affected by congestion on the existing road network. Long and unreliable bus travel times inhibit access to and from the study area, with only 150 metres of peak bus lanes operational in southern Sydney.

Active transport network

Around seven per cent of people employed in the study area chose to walk or cycle to work in 2016. This proportion is higher than the Greater Sydney average (4.7 per cent) and suggests good availability of pedestrian and cycle networks for access to the study area.

Cyclist connectivity

There are a number of cycle routes mapped within the study area, as shown on **Figure 8-8** in **Chapter 8** (Traffic and transport), with varying levels of difficulty. The most difficult routes are mapped along key roads in the study area, including Princes Highway, President Avenue, Bay Street and The Grande Parade, which comprise multi-lane roads and/or roads that carry high volumes of vehicles. These road corridors provide an environment that discourages cyclist activity and also creates a barrier for cycle movements, restricting crossings of these roads to major intersections.

The Cook Park Trail runs from San Souci to Wolli Creek along the Botany Bay beachfront for a distance of around 13 kilometres. This trail provides connection to Sydney's broader cycle network including the Cooks River cycleway and the Bourke Street cycleway off-road cycle routes which provide access to the north and west.

Not all train stations in the study area have recognised cycle links for accessing rail connections. Several stations have cycle links requiring cyclists to travel along routes that are of moderate or high difficulty.

The study area contains gaps in active transport corridors where there are no continuous off-road paths or dedicated lanes for cyclists. This means that for sections of their journey, cyclists must share busy roads with cars, trucks and buses. These missing active transport links discourage travel by bicycle between southern Sydney and areas to the north and west.

Pedestrian connectivity

The key roads in the study area, including President Avenue and Princes Highway, comprise multi-lane roads that carry high volumes of vehicles. While these roads typically include footpaths for pedestrian use, the high volume of traffic and the effect on amenity that this creates generally discourages pedestrian activity. These roads also create a barrier for pedestrian movement, with opportunities to cross restricted to the limited number of formal crossings and pedestrian overpass bridges.

Off-road pedestrian paths and walking trails in the study area include:

- The Cook Park Trail, which caters for pedestrians along the Botany Bay beachfront
- The Rockdale Wetlands Trail, which extends from Barton Park near Arncliffe to Clareville Park in Sans Souci
- The Scarborough Ponds Trail, which comprises a 6 km loop track around the Scarborough Ponds and the Rockdale Bicentennial Park ponds, and is part of the broader Rockdale Wetlands Trail.

15.2.5 Community identity, values and aspirations

The identification of community values and goals aids in the assessment of potential social and economic impacts by providing insight into how the community may perceive these impacts, and assists in the assessment of indirect impacts on community identity, cohesion and sense of place.

Community values are those that are shared by residents and visitors about a particular area, or about the enhancement of quality of life or sense of place. Physical aspects, such as heritage items, social infrastructure or local features (such as public art and trees) are generally highly valued by communities. Intangible elements such as neighbourhood identity, community safety, health and wellbeing, and community cohesion are also highly valued by communities.

Community cohesion refers to the connections and relationships between individuals and their neighbourhoods. Levels of community cohesion and sense of belonging are said to be good where communities have access to a diverse range of local and regional infrastructure, barriers to movement are minimised and there are a variety of meeting places which encourage strong support networks.

Community plans

A review of community strategic planning documents relevant to each LGA was undertaken to identify values and aspirations specific to each community. Local community plans were reviewed for the former Rockdale and Kogarah LGAs, as updates to these plans for the new amalgamated LGAs are yet to be published. A summary of the community identity, values and future aspirations for each LGA within the study area is provided below.

The Rockdale City Council Community Strategy Plan 2013-2025[16] identifies the community's needs, values, priorities and aspirations for the former City of Rockdale LGA (now part of Bayside LGA) to 2025. Key community values and aspirations identified in the plan are outlined in **Figure 15-12**.

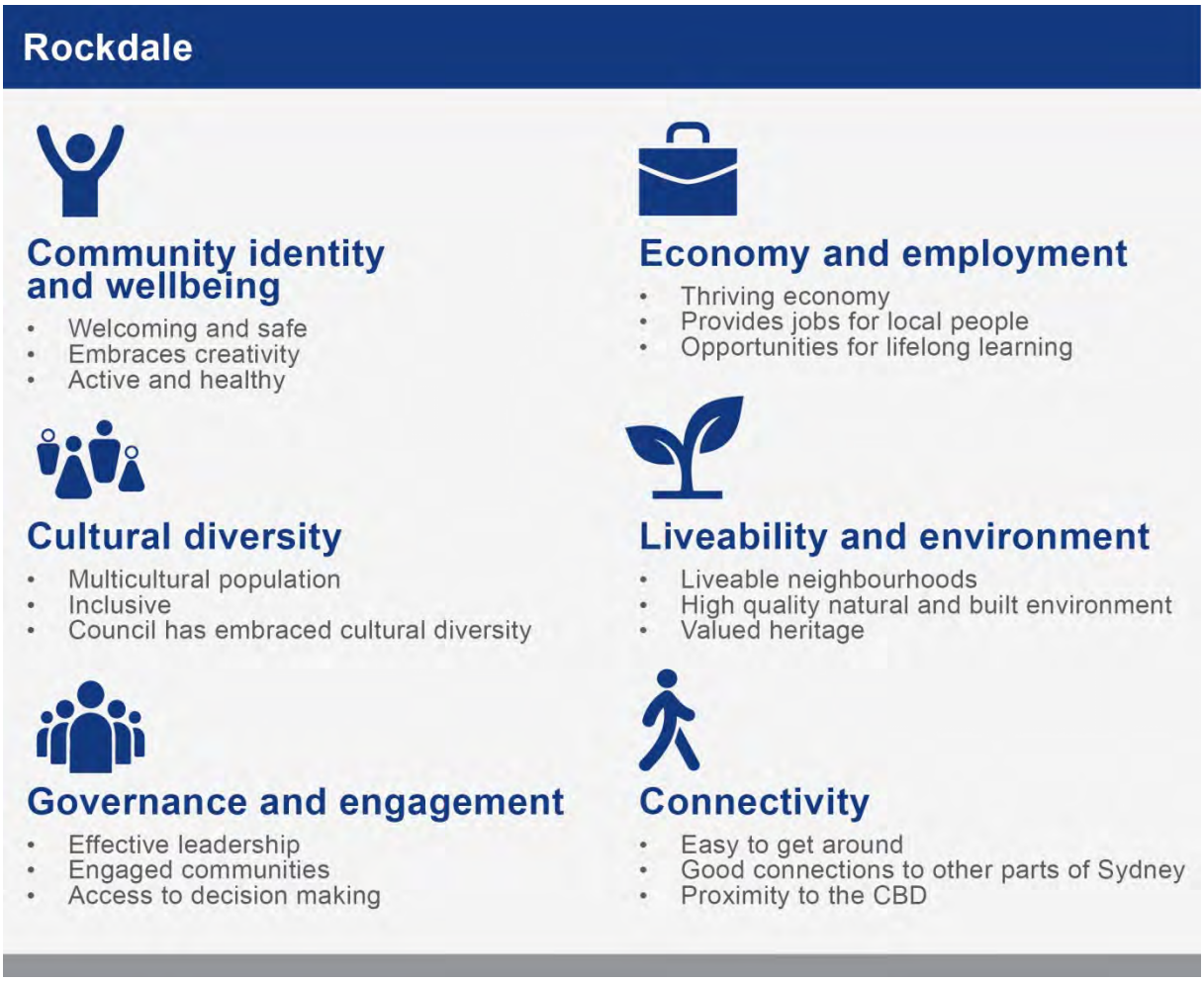


Figure 15-12 Strategic directions and aspirations for the former Rockdale LGA

The Kogarah City Council Community Strategic Plan 2030[17] identifies the strategic directions, values, aspirations and goals for the former Kogarah City LGA (now part of the Georges River LGA). Key strategic directions and community aspirations identified in the plan are outlined in **Figure 15-13**.

[16] Rockdale City Council (2013) Rockdale City Council Community Strategy Plan 2013-2025
[17] Kogarah City Council (2014) Kogarah City Council Community Strategic Plan 2030

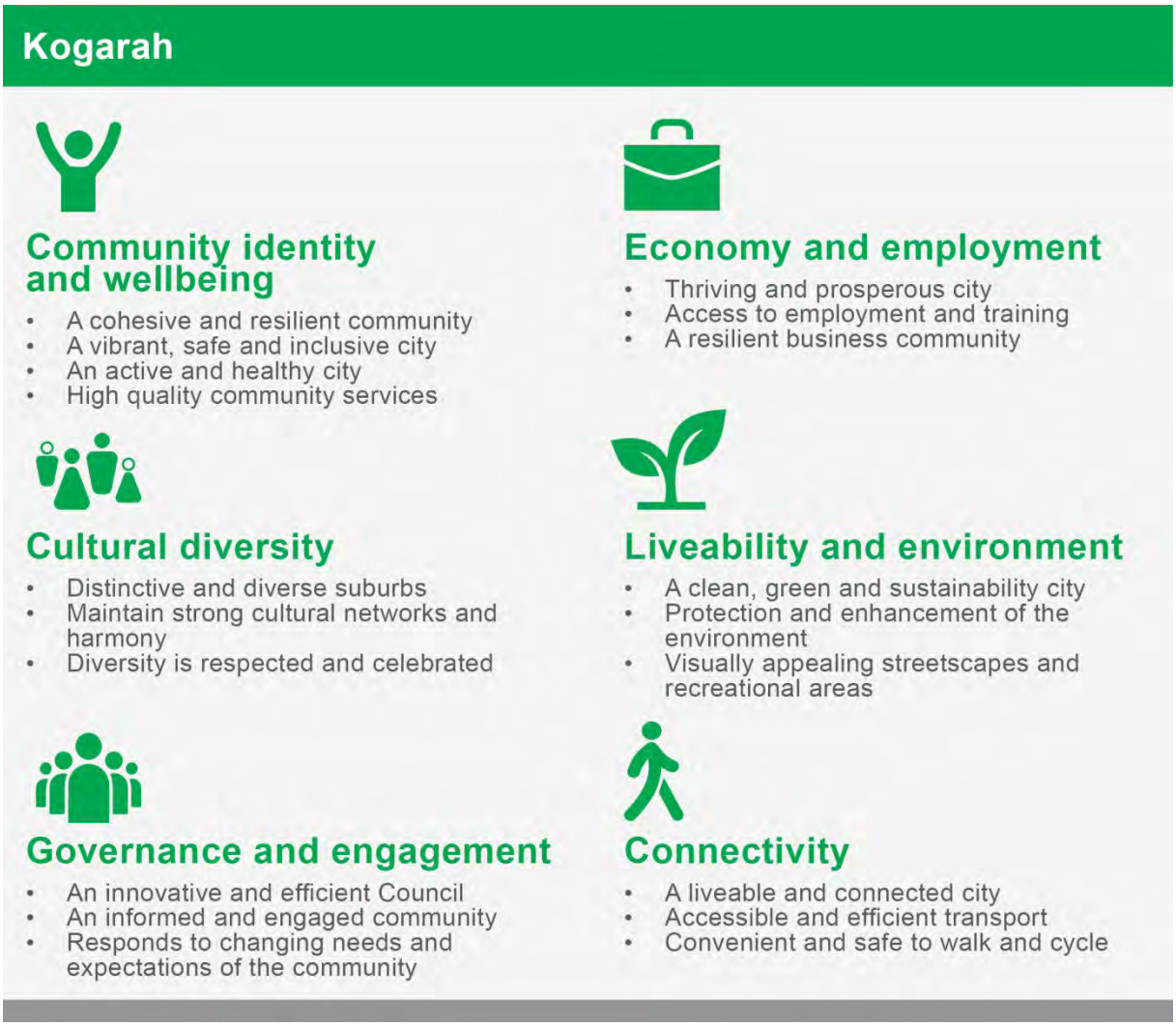


Figure 15-13 Strategic directions and aspirations for the former Kogarah LGA

Community consultation

Consultation with the community and key stakeholders has been conducted prior to, and during, the preparation of the EIS. Consultation activities undertaken for the project are detailed in **Chapter 3** (Consultation). Key issues and/or themes relevant to the assessment of social and economic impacts are summarised in **Table 15-11**.

Consultation with residents, businesses and the community is planned to continue throughout the planning, construction and operation of the project.

Table 15-11 Feedback provided by community and key stakeholders

Issue	Project stage		Detail
	Construction	Operation	
Property	✓		Concern about the scale of impacts to property, particularly the potential loss of homes and/or green space
	✓	✓	Concern about impacts on property values
	✓	✓	Concern about whether compensation would be offered to those properties affected by the project
Accessibility and parking	✓	✓	Concern about local traffic impacts and congestion due to increased traffic volumes on local roads
		✓	Concern about the project encouraging rat runs and dangerous driving behaviour
		✓	Concern about project cost and tolling
		✓	Concern about risk of increased collisions between vehicles and general decrease in road safety
	✓		Concern about the relocation of bus stops in the vicinity of the project
	✓	✓	Concern about the impact on access to green space and community facilities such as local sporting fields
	✓	✓	Concern about the removal of parking and the impacts this would have on side streets
	✓	✓	Concern about pedestrian safety due to increased traffic movements, particularly for children
	✓		Concern about road closures during construction affecting pedestrian, cycle and vehicle movements
		✓	Request to build cycling and pedestrian infrastructure to improve safety and connectivity for active transport users in the area
Amenity	✓	✓	Concern about the noise, vibration and pollution impacts of heavy vehicles and increased traffic
		✓	Concern that the project would decrease the liveability of the area
		✓	Concern about a decrease in the amenity of the existing public transport infrastructure in the area
		✓	Concern about the visual and amenity impacts of ventilation outlets and noise walls
	✓		Concern about the removal of trees and vegetation
	✓		Concern regarding the management of and disruption caused by spoil removal
	✓		Concern regarding the disturbance of contaminants
	✓		Concern about the amenity impacts (especially resulting from tunnelling) of construction including pollution, noise and vibration
		✓	Concern about air quality impacts of the project, including the health impacts of exhaust emissions
		✓	Concern about the health, safety and environmental impact of the ventilation outlets and suggestions that they should be filtered, particularly as they are in close proximity to playing fields and parks
		✓	Suggestion that the ventilation outlets be constructed within industrial areas and equally distanced along the project corridor, so that no residents are subjected to air pollution disproportionately

Issue	Project stage		Detail
	Construction	Operation	
Community facilities	✓		Concern about impacts on the dog park at Patmore Swamp
	✓		Concern about impacts to the Memorial Playing Fields, used by local schools and sporting groups
	✓		Concern over impacts to the local playgrounds and recreational facilities within Rockdale Bicentennial Park
	✓		Concern over the impact on Kogarah playing fields and local sporting clubs, including use of community facilities, membership and relocation logistics
	✓	✓	Concern about the cumulative impacts to open green space which would make exercising more difficult
	✓	✓	Concern about the impacts to Brighton-Le-Sands Public School (due to close proximity to the President Avenue intersection and tunnel portals) and Arncliffe Public School
	✓		Concern that the project would delay the reinstatement of Kogarah Golf Course
		✓	Proximity of ventilation facilities to playing fields and parks
		✓	Request for separate cycle paths, pedestrian bridges and extended cycle paths
Environment	✓	✓	Concern about the impacts to ecological values and water quality of the Rockdale Wetlands and Rockdale Bicentennial Park, including threatened and migratory species
	✓	✓	Concern about impacts to water quality and hydrology within Scarborough Park
	✓	✓	Concern about the impacts to areas and properties of historical significance, such as settlement as a result of tunnelling
Business impacts	✓	✓	Concern about impacts to local businesses including the loss of parking
	✓	✓	Concern about changes in access to local businesses
	✓	✓	Some concern that traffic congestion would affect business deliveries while others perceived business deliveries would be more efficient as a result of the project
	✓		Concern over the impact of road closures resulting in disruptions to businesses, particularly those relying on passing trade (e.g. vehicle related businesses)

15.3 Potential impacts – construction

This section outlines potential social and economic impacts, identified in the context of the social baseline discussed in **section 15.2**, as a result of the project's construction.

15.3.1 Acquisition of property and changes to land use

Property impacts, including details of property acquisitions, temporary occupation of land and settlement and subsidence impacts are discussed in **Chapter 14** (Property and land use). This section assesses the social and economic implications of property impacts on residential properties, businesses and social infrastructure. Social and economic impacts associated with permanent changes to land use and potential areas of residual land, are assessed in **section 15.4.1**.

The project primarily comprises a sub-surface motorway. Temporary occupation and permanent acquisition of property would be required to facilitate construction of the project, including tunnelling activities and the construction of surface infrastructure components and facilities. The project has been designed to minimise the need for land acquisition, where practical, and to limit the potential for severance and sterilisation of private properties.

In terms of privately owned properties, the project would require 12 full property acquisitions, and three partial property acquisitions. Of the properties identified as requiring full or partial acquisition, eight are residential properties, one is commercial, and six are industrial properties.

Partial areas of Council owned recreational land within Rockdale Bicentennial Park, Scarborough Park North, and Kogarah Golf Course, Arncliffe would also be acquired for the project. A partial strip of St George TAFE (owned by the Department of Education) would also be permanently acquired.

The project would also require existing leases on six properties (five residential properties on O'Neil Street and President Avenue, and one industrial property on West Botany Street) owned by Roads and Maritime to be extinguished for purposes of permanent infrastructure.

In addition to the properties affected by surface activities, subsurface (or substratum) acquisition would be required to accommodate the tunnels and entry and exit ramps. In most cases, subsurface acquisition is not expected to affect the continued existing use of property at the surface. However, the future development of land (including re-zoning) in the vicinity of the ventilation facilities that may involve multi-storey buildings above 20 metres in height would need to consider the air dispersion performance of the ventilation facilities. Roads and Maritime would assist local councils or DPE in determining any relevant land use considerations applicable to future development for inclusion in LEPs or development control plans, where required.

Residential properties

Direct impacts on residential properties would occur as a result of property acquisition during construction, as follows:

- Full acquisition of four residential properties on President Avenue (numbers 136, 140, 142, and 144) as part of the President Avenue intersection upgrade near O'Neil Street, Brighton-Le-Sands
- Full acquisition of one residential lot on England Street (number 15) as part of the shared cycle and pedestrian pathway works
- Partial acquisition of three residential properties on Princes Highway (numbers 726-728, 730, and 732) as part of the Princes Highway / President Avenue intersection upgrade, Kogarah.

Residential properties along President Avenue and O'Neil Street predominantly comprise one to two storey detached dwellings. Residents of these properties would be required to relocate and the dwellings would be demolished to accommodate project infrastructure. These impacts are likely to result in high levels of anxiety and stress for the affected residents. Purchasing and moving house can be one of the most significant events in a person's life. Similarly, finding a suitable rental property within restricted timeframes can also be stressful for households who rent. The duration of this process can potentially be extended due to the high demand for rental housing in proximity to the Sydney CBD. Impacts of the property acquisition process on health and wellbeing are discussed in further detail below. Given the permanent nature of residential property acquisitions and the potential effect on the health and wellbeing of individuals and households, the magnitude of property acquisition is considered to be high. The sensitivity of affected individuals and households is considered to be high based on the level of concern raised about impacts to property during community consultation for the project (refer to **Table 15-11**). As a result, the significance of full residential property acquisitions on the socio-economic environment is considered to be high.

The property on England Street proposed to be acquired is currently vacant, with no dwelling or other structures present. The rear of the property is also located within the existing F6 reserved corridor (land zoned as SP2 – Infrastructure). As such there would be no requirement for people to relocate and hence the socio-economic impact of this element of the proposal is considered to be negligible.

The affected residential properties on Princes Highway comprise three storey walk up apartment buildings, each containing around 12 units. Driveway and car park access to these apartment buildings is from Cross Lane to the rear and would not be affected by partial acquisition. Residents of these buildings may be inconvenienced through changes in pedestrian access to their properties from Princes Highway, as well as amenity impacts, for the duration of the construction works. Potential impacts associated with changes to amenity and access during construction are assessed in **section 15.3.3** and **section 15.3.4** respectively. The magnitude of partial acquisition on these residential properties is considered to be moderate given the inconvenience caused by changes to pedestrian access and the number of residential receptors potentially impacted. The sensitivity of affected individuals and households is considered to be moderate. As a result the significance of partial acquisition of residential properties on the socio-economic environment is considered to be moderate.

Businesses

Land required for construction of the project has been minimised through design, including the use of existing Roads and Maritime property for construction ancillary facilities, where possible. The existing Roads and Maritime depot, located east of West Botany Street and south of Bay Street, would be reconfigured for use as the Rockdale construction ancillary facility (C2). Access to this site for construction of the project would be gained from West Botany Street. The site would be reconfigured to accommodate construction of the project with part of the site retained for existing Roads and Maritime operations (refer **Figure 7-3**).

The project would also require the acquisition of eight business premises within the study area. These properties comprise retail, commercial and industrial businesses and are likely to serve local and district trade catchments. Direct impacts on business properties that would occur as a result of property acquisition during construction, include:

- Six full industrial property acquisitions on West Botany Street (numbers 427, 429, 433, 435, 437, and 439 - 441), west of Rockdale Bicentennial Park, to accommodate the Rockdale Motorway Operations Complex (south) (MOC3). Industrial property types affected by property acquisition in this location include a joinery and fitout business, a glass retail business, a clothing retail outlet, a tyre retailer which provides automotive services, a car detailing business and a vacant lot
- One full commercial property acquisition on the corner of Princes Highway and President Avenue, which comprises a 7-Eleven petrol station and an Ultra Tune mechanics service centre.

Where the project requires acquisition of land that a business currently occupies, it has the potential to affect the economic productivity and the viability of that business. Impacts of acquisition and the associated relocation of businesses can result in disruptions to business operation, including:

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

Affected businesses may choose to close down or relocate within the region. Where businesses choose to close down, this could result in the loss of income for employees and owners and a loss of economic input and output in the region. Where these businesses cater to the specific needs of residents or industries in the local community this may result in flow-on effects within the region.

The businesses located on West Botany Street identified above provide goods and services to commercial and industrial customers who are not necessarily located in the local area and whilst customers may source goods and services from these businesses, they would be expected to generally have alternative suppliers as part of normal business practice. The types of retail products and services listed above comprise goods which are commonly sold in most suburbs or local retail centres, including vehicle tyres and automotive services, glass manufacture for household purposes (e.g. shower screens), furniture (joinery services) and clothing. Local customers of these businesses are not expected to have to travel far to purchase such goods at alternative outlets. In addition, two of the lots proposed for full acquisition are vacant and do not currently support any business activity.

The magnitude of acquisition of these commercial and industrial properties is therefore considered to be low. The sensitivity of affected business stakeholders is considered to be high given the potential for disruption to business operations. As a result, the significance of acquisition of commercial properties on West Botany Street on the socio-economic environment is considered to be moderate. The potential for residual land at this location is assessed in **section 15.4.1**.

Acquisition of the 7-Eleven petrol station and the Ultra Tune mechanics service centre on the corner of Princes Highway and President Avenue would require the closure of these businesses. Given the nature of the Princes Highway corridor and the availability of alterative petrol stations and mechanics service centres, the magnitude of acquisition of this commercial property is therefore considered to be low. The sensitivity of affected business stakeholders is considered to be high given the potential for disruption to business operations. As a result, the significance of acquisition of the commercial property on the corner of Princes Highway and President Avenue on the socio-economic environment is considered to be moderate. The potential for residual land at this location is assessed in **section 15.4.1**.

Social infrastructure

Direct impacts on the following social infrastructure would occur as a result of property acquisition and occupation during construction:

- Acquisition of a partial strip of TAFE NSW St George for the widening of the intersection of Princes Highway and President Avenue
- Acquisition of approximately 1.1 hectares (30%) of Rockdale Bicentennial Park, owned by Bayside Council
- Acquisition of approximately 0.5 hectares of Scarborough Park North, owned by Bayside Council
- Acquisition of approximately 0.7 hectares of Kogarah Golf Course, Arncliffe, owned by Bayside Council.

In addition to the above, a number of construction ancillary facilities and work sites would be required for temporary use during construction and would need to be temporarily leased or occupied (refer to Table 14-6 in **Chapter 14** (Property and land use) for full details)). In relation to social infrastructure these include:

- Temporary partial lease of Kogarah Golf Course, Marsh Street, Arncliffe, owned by Bayside Council for the Arncliffe construction ancillary facility (C1)
- Temporary partial lease of Rockdale Bicentennial Park at 468 West Botany Street, Rockdale, owned by Bayside Council for the Tunnel Portal / President Avenue Intersection
- Temporary partial lease of 17 Bermill Street, owned by Bayside Council for the shared cycle and pedestrian pathways
- Temporary partial lease of Scarborough Park North at 112-132 President Avenue, Brighton-le-Sands and 137 President Avenue, Monterey, owned by Bayside Council for the shared cycle and pedestrian pathways.

These impacts are discussed further in the following sections.

TAFE NSW St George

A shallow (3-4 metres) strip of land along the Princes Highway frontage of the TAFE St George College campus, adjacent to the President Avenue intersection would be acquired to facilitate construction of the project. This would involve the relocation of an existing noise wall along this boundary, as well as an electrical substation and some undercover bicycle parking. A small number of vehicle parking spaces in this location may also be temporarily affected during construction. The temporary loss of the noise wall in this location may increase operational traffic noise impacts to the first row of buildings in this part of the campus, in addition to construction noise directly arising from the works. This may increase distraction or affect communication for students and teachers.

The electrical substation would be relocated elsewhere on campus prior to decommissioning. As such it is not expected there would be direct loss of power for the campus.

Similarly, bicycle parking is expected to be able to be accommodated elsewhere on the campus and as such the loss of this facility is expected to be low. No parking spaces are expected to be permanently lost and as such this impact is considered to below.

Students and teachers at the TAFE would be expected to have a moderate ability to adapt to the above changes. On this basis the overall socio-economic impact of the acquisition of this land is expected to be low.

No other educational facilities are expected to be directly affected through acquisition or temporary occupation during construction of the project.

Kogarah Golf Course

The Kogarah Golf Course is a private golf course with club facilities. Amenity is important to the club in attracting members and visitors. It is anticipated that the golf course would experience increased noise and vibration, decreased air quality and reduced visual amenity. Given the distance to the club facilities, these impacts would most likely affect users of the course as they move close to construction areas. These impacts may result in a reduction in turnover though the loss of memberships and a reduction in the use of club facilities. Special rates for membership are currently in place to account for the reduction in golf course facilities, from an 18-hole course to a nine hole course, to accommodate construction of the New M5 Motorway. Golf course users may choose to use other facilities during construction of the project as a number of alternate golf courses remain in the general vicinity of the project.

Continued occupation of this area of Kogarah Golf Course would be consistent with the current use of the site as a construction compound, however this would result in an extended duration of impact on the operation of the club, which would be required to continue to operate as a nine hole course for an additional four years. The magnitude of continued occupation of Kogarah Golf Course is therefore considered to be moderate. Given the current use of the site as a construction compound, the sensitivity of affected stakeholders, including owners, operators and users of Kogarah Golf Course, is considered to be low. As a result, the significance of continued occupation of Kogarah Golf Course on the socio-economic environment is moderate-low.

Rockdale Wetlands and Recreation Corridor

The existing F6 reserved corridor has resulted in the preservation of a corridor of open space between the communities of Arncliffe, Banksia, Rockdale and Kogarah in the west and the communities of Kyeemagh and Brighton-Le-Sands along the coast in the east. This corridor is known as the Rockdale Wetlands and Recreation Corridor and has become the focal point for areas of open space, green space and active and passive sporting and recreational facilities within the study area.

The project would require acquisition of an area of Rockdale Bicentennial Park, currently owned by Bayside Council. This area would be used to house the President Avenue construction ancillary facility (C3) and would result in a temporary change in land use from public open space/recreation to construction infrastructure (refer **Figure 15-11**). The works would temporarily restrict access to much of Rockdale Bicentennial Park (for around four years) and the recreational facilities located within the park including the Rockdale Skate Park and disability playground. The following facilities would be temporarily relocated during construction:

- Rockdale skate park
- Rockdale disability playground
- Bicentennial East soccer field.

These facilities would be temporarily relocated to a nearby area of open space to allow the community to continue to benefit from their use during the construction period.

The project has been designed to avoid potential property acquisition impacts to the Ilinden Sports Centre, however, a portion of the associated car park to the north of the facility would be acquired for the works as part of the President Avenue construction ancillary facility (C3). This would include acquisition of around seven parking spaces in the north east corner of the car park. Access to the Ilinden Sports Centre and the majority of the car park would be maintained throughout the construction period.

The Bicentennial East soccer fields, used by the Rockdale City Suns Football Club and Brighton-Le-Sands Public School for school sports days, would be temporarily relocated to a nearby area of open space. Other sporting fields at this location, including the Brighton Memorial Playing Fields, may be reconfigured at their current location to allow the community to continue to benefit from their use during the construction period. The potential reconfiguration of these sporting fields would be determined during detailed design of the project and would depend on the availability of access to these fields.

Construction of the shared pedestrian and cyclist path between Bestic Street and Bruce Street, to the east of West Botany Street would result in a temporary land use change from open space/recreation to construction. This change in land use during construction would have a low impact on local and regional land use, as it would largely take place on the peripheral edges of the fields and reserves. The works would not dissect any of the sports fields and so would allow for their continued use during construction. The physical works would also be minimal in nature and short term.

These impacts to the above elements of the Rockdale Wetlands and Recreation Corridor are likely to be perceived negatively by the local community and local Councils who value the active lifestyle and community wellbeing that these facilities support. It is noted that all changes to the facilities would be reinstated after construction ends, including the parking. A concept design for the reinstatement of Rockdale Bicentennial Park is included in **section 6.3** of **Chapter 6** (Project description). This concept plan would be refined during the development of an Urban Design and Landscape Plan would be prepared in consultation with Council, stakeholders and the community.

Although the development of the President Avenue construction ancillary facility (C3) would see a significant reduction in public open space/recreational land use at this location, recreational facilities affected by the works would be temporarily relocated to a nearby area, allowing the community to continue to benefit from use of these facilities during the construction period. As a result, the magnitude of property acquisition and occupation at Rockdale Bicentennial Park is considered to be moderate. The sensitivity of affected users of these recreational areas and facilities is considered to be moderate given the likely users of the disability playground, including children with disabilities, and users of the Bicentennial East soccer fields, including the Rockdale City Suns Football Club and Brighton-Le-Sands Public School. As a result, the significance of property acquisition and occupation at Rockdale Bicentennial Park on the socio-economic environment is considered to be moderate.

Bardwell Valley Golf Course

The construction of the permanent power supply connection, from Canterbury sub-transmission station to the Rockdale Motorway Operations Complex (south) (MOC3), would require under boring through Bardwell Valley Golf Course. At this stage it is expected that impacts would be limited to discrete construction areas and would not require the closure of any particular holes. As such the overall magnitude of impact would be negligible.

On the basis that this site is not currently subject to any construction activity and is substantially separated from other parts of the project, the sensitivity of affected stakeholders, including owners, operators and users of the golf course, is considered to be high. As a result, the significance of the occupation of Bardwell Valley Golf Course on the socio-economic environment is negligible.

Impacts of property acquisition on community health and wellbeing

Acquisition and subsequent relocation of households, businesses and social infrastructure due to property acquisition can disrupt social networks and affect health and wellbeing through stress and anxiety.

A person's home, their place of work or study, and their preferred recreational facilities are often central to their daily routine, with the location of these influencing their travel patterns, and social, community and commercial interactions. When an individual is required to relocate, their daily routine and interactions can be disrupted, which may affect their mental health and result in feelings of disconnection and isolation.

The property acquisition process itself, including the need to relocate, can also elevate health risks through increased stress and anxiety. Vulnerable members of the community, including the elderly, those suffering an illness or disability, or those that have difficulty speaking English may be more adversely affected in these scenarios.

Impacts associated with property acquisition may be reduced and/or managed through the application of a process of consultation and compensation that is designed to be equitable to existing property owners. For those affected by property acquisition, management measures would be implemented to minimise potential social and economic impacts, including:

- Affected households would have access to a counselling service that assists people through the property acquisition process and, where necessary, would provide referrals to more specialised experts
- A property acquisition factsheet that outlines the process and provides further information for concerned residents is to be prepared and made available online and in hard copy at project information centres
- An independent service is to be provided to vulnerable households (e.g. elderly, those suffering an illness) to assist with relocation. Assistance could include, finding a suitable house for relocation (purchase or rent), arranging removalists, disconnecting services and attending appointments with solicitors or other representatives
- A community relations support toll-free telephone line is to be established to respond to any community concerns or requests for translation services.

All acquisition required for the project would be undertaken in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991* (NSW), the *Land Acquisition Information Guide* (NSW Government 2014) and the land acquisition reforms announced by the NSW Government in 2016 (2016 reform).

Although property acquisition would result in permanent changes for affected residents and businesses, the number of properties to be acquired as part of the project is small. Local customers of affected businesses would not have to travel far to find alternative sources of goods and services and social infrastructure affected by the project would be temporarily relocated or reconfigured to allow continued use of these facilities by the community. The overall magnitude of property acquisition is therefore considered to be moderate. The compensation process is anticipated to help to alleviate the severity of impacts on individual residents and business interests. The overall sensitivity of affected residents, businesses and social infrastructure stakeholders is considered to be moderate. As a result, the overall significance of property acquisition on the socio-economic environment is moderate.

15.3.2 Changes to the demographic profile

Construction of the project may influence the demographic profile of the study area through changes to the social makeup of the area, primarily by employment of the construction workforce and the acquisition of property.

An influx of workers employed for construction of the project, would result in an increase in persons employed in the study area and an increase in persons travelling to the study area for work. Based on a four-year construction period, the project is expected to create around 3,250 direct (on site) job years[18] from 2021 to 2024, which is equivalent to 812 full time equivalent jobs per year. Furthermore, around 2,050 indirect (off-site) full time equivalent jobs would be generated in a typical construction year.

The construction workforce would comprise trades and construction personnel, subcontractor construction personnel and engineering, functional and administrative staff. As discussed in **Chapter 7** (Construction), the size of the workforce would vary across the working day with a reduction in personnel required for the night shift.

The construction workforce is expected to be sourced from across the Greater Sydney region. Given the duration of the construction program (expected to take around four years), some of the construction workforce may choose to relocate to the study area to be close to work. However, this trend is expected to be limited given the accessibility of the project site by private vehicle and public transport. Parking for the construction workforce would be provided onsite at the construction ancillary facilities and workers would be encouraged to travel to and from site via public transport, where possible, to reduce potential impacts on local street parking and the potential for congestion on local roads. Assessment of the potential impacts on parking during construction is included in **section 15.3.4**.

The study area is projected to experience significant population growth over the next 20 years, with urban development and renewal planned to accommodate this growth. Assessment of socio-economic impacts associated with property acquisition is provided in **section 15.3.1**.

Given the size of the local population, as identified in **section 15.2.1**, the construction workforce and the number of property acquisitions required as part of the project is not expected to result in a substantial change to the local demographic profile. As a result, the magnitude of this effect is considered to be low. Given the established nature of the local community and the predominantly young working family demographic, the sensitivity of the affected stakeholders is considered to be moderate. As a result, the overall social and economic significance of the project's impact upon the demographics of the study area is considered to be moderate-low.

15.3.3 Amenity and community wellbeing impacts

Amenity refers to the quality of a place, its appearance, feel and sound, and the way its community experiences the place. Amenity contributes to a community's identity and its sense of place. Aesthetic qualities are an important part of amenity, but the broader concept of amenity is determined also by the physical design of a place and the human activity that takes place within it. A place that has 'amenity' is regarded as pleasant and attractive, as well as convenient and comfortable[19].

Impacts upon amenity include factors that affect the ability of a resident or visitor to enjoy their home and daily activities. For example, noise, vibration, changes to views or changes to air quality would be considered amenity impacts. Changes in amenity may also conflict with community values, contributing to a loss of or change in a community's sense of place, and subsequently a community's perceived identity.

[18] One job for one year is one 'job year'.
[19] Handy, S. (2002) Amenity and Severance

Construction of the project has the potential to affect amenity as a result of changes to the following factors:

- Traffic
- Noise and vibration
- Air quality and odour
- Urban design and visual amenity.

Feedback received during consultation identified a number of concerns from the local community and businesses regarding impacts to amenity during construction (see **Table 15-11**). Key concerns included the presence of construction vehicles, the removal of vegetation, construction noise, vibration and air quality impacts.

The following sections describe potential impacts to amenity and community wellbeing during project construction for affected stakeholders in proximity to each of the construction ancillary facilities and project surface works locations. Further detail regarding project construction, and the construction activities that would be undertaken at these locations, is provided in **Chapter 7** (Construction).

Arncliffe construction ancillary facility (C1)

The Arncliffe construction ancillary facility (C1) would be located above and below ground within Kogarah Golf Course on Marsh Street in Arncliffe. This site would utilise land currently occupied by the New M5 Motorway construction ancillary facility. The site is around 78,000 square metres and would be used for tunnelling activities and fit out of the Arncliffe Motorway Operations Complex.

The project would result in the continued use of the site as a construction ancillary facility for a period of around four years. The optimal use of the site as a construction ancillary facility for the project would be determined during detailed design, based on lessons learnt from construction of the New M5 Motorway. The project would seek to utilise site infrastructure used for construction of the New M5 Motorway to minimise deconstruction and reconstruction activities associated with the project and thereby reduce potential amenity impacts on nearby receptors.

Traffic

Traffic has the potential to result in changes to amenity, with increased traffic associated with increased noise and air quality impacts, as well as the visual presence of more vehicles on the road. An increase in traffic volume also impacts upon local travel, including trip duration, wait times at intersections, road safety and access to properties and community infrastructure. The Arncliffe construction ancillary facility (C1) is a large site and provides opportunity to designate part of the site for the marshalling of trucks, and parking for the construction workforce, if required. The traffic and transport assessment (refer to **Chapter 8** (Traffic and transport)), identifies that no impacts to the local road network are anticipated at the facility as heavy and light vehicle access and egress would be taken directly to and from arterial roads, including Marsh Street and the existing M5 Motorway. These roads are considered to have sufficient capacity to accommodate the increase in vehicle movements anticipated as part of the project's construction. Construction impacts on the regional road network would include increased traffic congestion, resulting in potential delays and changes to the accessibility of local areas and the efficiency of freight, commercial vehicles and public transport movements.

During construction activity, it is forecast that there would be a relatively minor worsening in level of service in the AM peak at the intersection of Marsh Street and M5 East ramps (from LoS C to LoS D), and the Marsh Street / Flora Street / C1 access (from LoS A to LoS B). To minimise effects on the operation of this intersection, spoil would be removed outside of peak traffic periods where possible. These construction works would be subject to careful traffic management to maintain the functionality of the surrounding roads. Such measures would be documented in a CTAMP.

The duration of construction traffic impacts at the Arncliffe construction ancillary facility (C1) would be medium term, with the worst case impacts associated with spoil haulage from tunnelling expected to occur for around three years of the anticipated four year construction period. Given the existing road network surrounding the facility, comprising a number of arterial roads, the introduction of construction traffic for the project is not anticipated to result in a significant change.

As a result, the magnitude of construction traffic impacts at the Arncliffe construction ancillary facility (C1) is considered to be low. The sensitivity of affected residents and businesses is considered to be moderate, given the existing exposure to traffic along Marsh Street and the M5 Motorway. While tunnelling and spoil management would be undertaken 24 hours a day, seven days a week, spoil would be stockpiled during night time periods for movement offsite during the day. Any spoil removal outside standard construction hours would meet the relevant noise criteria. As a result, the significance of construction traffic impacts at the Arncliffe construction ancillary facility (C1) on the socio-economic environment is considered to be moderate-low.

Noise and vibration

Exposure to noise and vibration has the potential to:

- Create annoyance
- Interfere with daily activities or the enjoyment of these activities
- Interfere with concentration and memory, particularly with regard to children's school performance and business activity that depends on quiet environments
- Disrupt sleep and rest patterns
- Create or exacerbate health concerns such as hearing impairments and cardiovascular health (elevated blood pressure).

The potential for noise and vibration during construction was identified as a key concern for the local community and businesses, as discussed in **section 15.2.5**.

Noise catchment areas (NCAs) were identified to group similar land uses and receptor types surrounding the project and assist in the identification of potential noise impacts. NCAs are identified in **Figure 11-1** and **Figure 11-2** and described in detail in **Chapter 11** (Noise and vibration) and **Appendix G** (Noise and vibration technical report).

NCAs in proximity to the Arncliffe construction ancillary facility (C1) include NCA1, NCA2 and NCA3, which primarily comprise residential land uses, with some commercial land uses located north and west of NCA1. Social infrastructure in proximity to the facility, as identified on **Figure 15-9**, includes a number of active and passive recreational areas, as well as a child care centre in NCA1 and the Arncliffe Fire Station in NCA3. Potential project-related noise impacts in proximity to facility would be affected by the existing noise environment which is influenced by proximity to Sydney Airport and major roads such as Princes Highway and Marsh Street.

As discussed in **Chapter 11** (Noise and vibration), during standard construction hours, exceedances of noise management levels (NMLs) are predicted to occur in NCA1 for only two construction scenarios; the establishment of temporary noise attenuation measures and the rehabilitation and landscaping of areas not occupied by the project. These construction activities would be temporary and short term in duration. It is also noted that the establishment of temporary noise attenuation measures would provide a substantial benefit in mitigating other potential noise impacts throughout construction. No exceedances of NMLs are predicted for tunnelling activities during standard construction hours at the Arncliffe construction ancillary facility (C1).

Where works are required outside of standard construction hours, including tunnelling works (which would be undertaken on a 24 hour basis), a substantial number of exceedances of NMLs are predicted to occur in NCA1, NCA2 and NCA3. These exceedances are attributed to the close proximity of the Arncliffe construction ancillary facility (C1) to a number of residential receptors and the low background noise levels during evening and night time periods. However, no exceedances of the sleep disturbance criteria or awakening reaction criteria are predicted for out of hours works at this site. Feasible and reasonable mitigation measures would be implemented to manage noise impacts during construction, in accordance with 'standard practice' for projects of this scale. These would be detailed in the Construction Noise and Vibration Management Plan (CNVMP) to be prepared for the project.

As the project involves tunnelling, ground-borne noise and vibration impacts may be experienced during construction. However, ground-borne noise is only likely to be an issue where tunnelling occurs at depths of less than 30 metres below ground. Given that the Arncliffe construction ancillary facility (C1) would utilise tunnel dive structures constructed as part of the New M5 Motorway, and that project tunnelling activities at the facility would occur at depths of between 65 metres to 80 metres below ground, ground-borne noise impacts for receptors in proximity to the facility would be negligible.

Where noise exceedances occur there is the potential for adverse effects upon the socio-economic environment. During standard construction hours, this would be particularly felt by people that work from home, shift workers, the elderly, households with young children or businesses (and their customers) that are more dependent on quieter environments to work, rest and relax. Noise impacts may also affect the use and enjoyment of active and passive recreational areas in proximity to the Arncliffe construction ancillary facility (C1), including Kogarah Golf Course, Cahill Park, the Cahill Park Tennis Courts, Eve Street Reserve, Barton Park and Barton Park Driving Range.

As background noise levels are lower during night-time periods, the potential impact of construction activity on the amenity of night-time environments may be greater. Construction works undertaken during evening and night time periods are likely to affect a greater proportion of residential receptors, particularly those in proximity to the Arncliffe construction ancillary facility (C1), as well as businesses and community services that operate during these periods or on shift work arrangements, such as the Arncliffe Fire Station.

The duration of construction noise impacts around the Arncliffe construction ancillary facility (C1) would be medium term, though it is recognised that these would be intermittent based on the occurrence of specific construction activities. The severity of noise level exceedance would vary across the study area, with noise impacts likely to increase in proximity to the facility. The magnitude of construction noise impacts on the socio-economic environment is therefore considered to be moderate. The sensitivity of affected stakeholders is considered to be moderate, given the number of residential receptors and the presence of a child care centre in proximity to the works. As a result, the significance of construction noise impacts at the Arncliffe construction ancillary facility (C1) on the socio-economic environment is moderate.

Air quality

Construction activities such as earthworks have the capacity to increase dust, air emissions and odour, and therefore affect amenity of the local environment. Nuisance dust generated from construction activities would commonly affect dwellings and sensitive premises that require a cleaner environment, such as the child care centre in proximity to the Arncliffe construction ancillary facility (C1). Where increased dust affects the amenity of a local area, there is the potential for adverse effects on the function and operating costs of businesses.

Increased dust can also reduce the capacity of the community to enjoy their local environment and can increase health risks for receptors, particularly those with respiratory and health issues such as asthma and allergies.

The air quality impact assessment, presented in **Chapter 9** (Air quality) and **Appendix E** (Air quality technical report), presents a risk assessment based on based on Institute of Air Quality Management (IAQM) guidance, including an assessment of the sensitivity of receptors in each location to potential air quality impacts. The criteria used to assess potential risks to air quality is provided in **Appendix E** (Air quality technical report).

The highest risks to air quality at the Arncliffe construction ancillary facility (C1) were associated with earthworks activities and the track out of spoil. The sensitivity of receptors to dust soiling impacts was identified as moderate given the number of residential receptors in proximity to the facility and the potential for exposure to elevated levels of dust. The sensitivity of receptors in proximity to the facility to human health impacts was identified as moderate. The risk of dust spoiling and human health impacts on receptors from earthworks and track out activities was assessed as moderate. The risk of dust and human health impacts from other construction activities at C1 was assessed as low.

Mitigation measures would be implemented to minimise the effects of construction dust on surrounding receptors, including minimising drop heights from machinery and using fine water sprays on dust generating equipment. These measures would be outlined in the Construction Air Quality Management Plan (refer to **Chapter 9** (Air quality)).

Based on the outcomes of the air quality risk assessment, and given the number of residential receptors that may be exposed to air quality impacts from project construction at the Arncliffe construction ancillary facility (C1), the magnitude of dust spoiling impacts on amenity and human health at the facility is considered to be moderate. The sensitivity of affected receptors is considered to be moderate, in line with the air quality assessment of sensitivity. As a result, the significance of air quality during construction on the socio-economic environment at the Arncliffe construction ancillary facility (C1) is moderate.

Urban design and visual amenity

The presence of construction vehicles on the road network, installation of construction hoardings, construction equipment, construction activities and acoustic sheds would affect the visual amenity of receptors in the vicinity of the Arncliffe construction ancillary facility (C1). As this site is currently used as a construction ancillary facility for the New M5 Motorway, construction of the project in this location would not represent a visual change. However, use of this site for construction of the project would result in ongoing visual impacts for receptors with views to the site, thereby affecting the visual amenity of these receptors.

Pedestrians and cyclists using the Cook Park Trail would be affected by construction activity through a reduction in their visual experience. However, it is acknowledged that this trail does pass under and adjacent to the existing M5 East Motorway near Marsh Street meaning the visual environment of users is already affected by road infrastructure. Cyclists and pedestrians using the paths and parkland around the Arncliffe construction ancillary facility (C1) may experience a reduction in visual amenity due to construction work occurring at this site.

The Arncliffe construction ancillary facility (C1) would be visible to users of the Kogarah Golf Course. The visual amenity of the landscape is important for these receptors as they value the green space that the golf course provides and the slow speed at which they move through the site would result in a high exposure to visual impacts. This would also affect community values as sporting and recreational facilities are highly valued by the local community.

As a result, and given the number of users of the social infrastructure that may be impacted from project construction at the Arncliffe construction ancillary facility (C1), the magnitude of amenity impacts is considered to be moderate and the sensitivity of affected stakeholders is considered to be moderate. As such, the significance of amenity effects of the Arncliffe construction ancillary facility (C1) on the socio-economic environment is moderate.

Rockdale construction ancillary facility (C2)

The Rockdale construction ancillary facility (C2) would be located above and below ground at West Botany Street in Rockdale, south of Bay Street. The site would be located on land currently occupied by a Roads and Maritime maintenance depot and would be used to support tunnelling, including construction of a decline tunnel and loading and removal of spoil.

Traffic

Construction vehicle access for the Rockdale construction ancillary facility (C2) would be via the West Botany Street entrance, with the existing access at Bay Street maintained for the Roads and Maritime depot access, in accordance with current operation of the site. Heavy vehicles would be loaded with spoil underground within the tunnels and would exit facility at West Botany Street.

Residential receptors, businesses and social infrastructure in proximity to the Rockdale construction ancillary facility (C2) would experience changes in amenity associated with increased noise and air quality impacts, as well as the visual presence of more vehicles on the road.

The traffic and transport assessment (refer to **Chapter 8** (Traffic and transport) identifies that no impacts to the local road network are anticipated at the Rockdale construction ancillary facility (C2) as heavy and light vehicle access and egress would be taken directly to and from arterial roads. Construction impacts on the regional road network would include increased traffic congestion, the accessibility of local areas and the efficiency of freight, commercial vehicles and public transport movements.

During construction activity, the most significant increase in average delay is seen at the already very congested intersection of West Botany Street and Bay Street, which is currently operating at a LoS F. To minimise effects on the operation of this intersection, spoil would be removed outside of peak traffic periods where possible.

During construction activity a new signalised intersection would be established at the Rockdale construction ancillary facility (approximately 100 metres south of Bay Street) for the duration of construction. These signals would operate on demand and therefore the impact on traffic movements would be low. In addition, general traffic management measures would be undertaken to maintain the functionality of the surrounding roads. Such measures would be documented in a CTAMP.

While spoil would generally be stockpiled during night time periods for movement offsite during the day the magnitude of construction traffic impacts at the Rockdale construction ancillary facility (C2) is considered to be low, given low relative increase in traffic associated with the project. The sensitivity of affected residents and businesses is considered to be moderate, given the given the existing busy nature of West Botany Street and to a lesser degree, Bay Street. As a result, the significance of construction traffic impacts at the Rockdale construction ancillary facility (C2) on the socio-economic environment is considered to be moderate-low.

Noise and vibration

NCAs in proximity to the Rockdale construction ancillary facility (C2) are shown on **Figure 11-1** and **Figure 11-2** of **Chapter 11** (Noise and vibration).

A substantial number of exceedances of the NMLs have been predicted due to the construction works associated with the Rockdale construction ancillary facility (C2), ranging between noticeable to highly intrusive. A number of residences have also been predicted to be highly noise affected as a result of some construction works, including the establishment of temporary noise attenuation measures, demolition and clearing of structures, cut and cover construction of the decline tunnel and the reconfiguration of the site to enable future use.

NCA7 comprises the residential, commercial and industrial areas surrounding the Bay Street corridor, and includes three child care centres and the St Thomas More Catholic Church (refer to **Figure 15-10**). Residential receptors in NCA7, the nearest residential receptors to the Rockdale construction ancillary facility (C2), are predicted to be the most highly affected by noise impacts from works undertaken at the facility. NCA7 is also predicted to exceed noise criteria during out of hours works, where required, including sleep disturbance.

Exceedances are attributed to the close proximity of the construction site to residences and the low existing background noise levels. Temporary noise attenuation measures would be established. Once installed, these noise attenuation measures would assist in reducing noise impacts on nearby receptors throughout the construction period.

As the project involves tunnelling, ground-borne noise and vibration impacts may be experienced during construction. Construction of the mainline tunnels below Banksia and Rockdale would occur at depths of between 40 metres to 80 metres below ground and as such ground-borne noise impacts for receptors in these areas are anticipated to be low to negligible. As tunnelling progresses towards the President Avenue surface connection, depth below ground would decrease to around 10 metres to 40 metres below ground. While ground-borne noise would increase as the tunnelling activities become shallower, this area is dominated by commercial and industrial receptors and as such sensitivity to ground-borne noise impacts is anticipated to be low.

Where noise exceedances occur there is the potential for adverse effects upon the socio-economic environment. Residential receptors in proximity to the Rockdale construction ancillary facility (C2) may experience construction fatigue impacts associated with the extended duration of the works and ongoing construction noise in this location. Noise mitigation and management measures discussed in **Chapter 11** (Noise and vibration) would be implemented to minimise impacts to nearby receptors.

Primary schools and child care centres in proximity to the Rockdale construction ancillary facility (C2), including students and staff of St Thomas More Catholic School (NCA5) and Brighton-Le-Sands Primary School (NCA9), may be affected by noise generated from the construction works at C2. Construction noise may affect services and activities undertaken at places of worship in proximity to the facility, including St Thomas More Catholic Church (NCA7), the Salvation Army Rockdale Community Church (NCA10) and Jesus is Lord Church (NCA10).

Noise impacts on amenity may also affect the use and enjoyment of active and passive recreational areas in proximity to the Rockdale construction ancillary facility (C2), including by sporting clubs and recreation areas within school grounds, as well as recreational users of McCarthy Reserve playing fields, Tony Baker Reserve, C A Redmond Field, Greg Arkins Mini Field, Rockdale Tennis Club courts and Kings Wetland. Indoor and enclosed facilities, such as the St George PCYC, Rockdale Tennis Club, Rockdale Modsquad Swimming School and gyms in proximity to the facility may also be affected by construction noise impacts, although the location of these facilities indoors is likely to provide some level of attenuation. Socio-economic impacts on schools, places of worship and sporting and recreational facilities are assessed in detail in **section 15.2.2**.

Although noise generated by construction would be intermittent based on the occurrence of specific construction activities, the duration of construction noise impacts at the Rockdale construction ancillary facility (C2) would be medium term. The severity of noise level exceedances vary across the study area, with noise impacts increasing in proximity to the facility and with residential receptors in NCA7 being the worst affected.

The magnitude of construction noise impacts on the socio-economic environment is therefore considered to be moderate. The sensitivity of affected stakeholders is considered to be high, given the number of residential receptors in proximity to the works and the potential for sleep disturbance, as well as the presence of sensitive receptors such as schools, child care centres and places of worship. As a result, the significance of construction noise impacts on the socio-economic environment at the Rockdale construction ancillary facility (C2) is high.

Air quality

Nuisance dust generated from construction activities at the Rockdale construction ancillary facility (C2) would affect dwellings and sensitive premises such as the child care centres, St Thomas More's Catholic Church and recreational facilities in proximity to the facility as identified on **Figure 15-10**.

Mitigation measures would be implemented to minimise the effects of construction dust on surrounding receptors, including minimising drop heights from machinery and using fine water sprays on dust generating equipment. These measures would be outlined in the Construction Air Quality Management Plan.

The magnitude of impacts from construction on air quality is therefore considered to be moderate. The sensitivity of affected stakeholders is considered to be high, given the number of residential receptors in proximity to the works. As a result, the significance of air quality impacts on the socio-economic environment at the Rockdale construction ancillary facility (C2) is high.

Urban design and visual amenity

The presence of more vehicles on the road, installation of construction hoardings, construction equipment and acoustic sheds would impact the visual amenity in the vicinity of the Rockdale construction ancillary facility (C2) during construction.

The Rockdale construction ancillary facility (C2) would be visible during construction from some residences and businesses located along West Botany Street and Bay Street.

The severity of impact on individual receptors would vary depending on the proximity from the construction ancillary facility. The severity of impact would be confined to locality level, while construction effects would result in a moderate change to existing conditions.

As a result, the magnitude of construction activity is considered to be low. The sensitivity of affected residents and businesses is considered to be moderate, given their location within an active industrial area. The significance of construction hoardings, construction equipment and acoustic sheds at the Rockdale construction ancillary facility (C2) on the socio-economic environment is considered to be moderate-low.

President Avenue construction ancillary facility (C3)

The President Avenue construction ancillary facility (C3) would be located above ground at Rockdale Bicentennial Park and the western side of West Botany Street.

Traffic

Residential receptors, businesses and social infrastructure in proximity to the President Avenue construction ancillary facility (C3) would experience changes in amenity associated with increased noise and air quality impacts, as well as the visual presence of more vehicles on the road.

The traffic and transport assessment (refer to **Chapter 8** (Traffic and transport) identifies that no impacts to the local road network are anticipated at the President Avenue construction ancillary facility (C3) as heavy and light vehicle access and egress would be directly to and from arterial roads. Construction impacts on the regional road network would include increased traffic congestion, the accessibility of local areas and the efficiency of freight, commercial vehicles and public transport movements.

During construction, a new signalised intersection would be established on West Botany Street for the duration of the program (located between the existing off street car parks at Bicentennial Park). These signals would operate on demand and therefore the impact on traffic movements would be low.

During construction along President Avenue the sign posted speed would be reduced to 40 km/hr. During this period two eastbound and two westbound lanes would be kept open during peak periods to maintain the functionally of the road (the outer lanes would be closed outside peak periods during site establishment). President Avenue would only need to be fully closed to traffic for up to three nights for the establishment of the shared pedestrian and cyclist bridge. These construction works would be subject to careful traffic management to maintain the functionality of the surrounding roads. Such measures would be documented in a CTAMP.

While spoil would generally be stockpiled during night time periods for movement offsite during the day, the magnitude of construction traffic impacts at the President Avenue construction ancillary facility (C3) is considered to be low. The sensitivity of affected residents is considered to be low, given that no access for residents would be substantially affected and that the road would remain open throughout. As a result, the significance of construction traffic impacts at the facility on the socio-economic environment is considered to be low.

Noise and vibration

NCAs in proximity to the President Avenue construction ancillary facility (C3) are shown on **Figure 11-1** and **Figure 11-2** of **Chapter 11** (Noise and vibration).

With the exception of the construction of the shared cycle and pedestrian pathways, construction noise levels generally meet the NMLs at most receptors during construction works at the President Avenue construction ancillary facility (C3). During the temporary stockpiling of spoil and fill materials a substantial number of receptors would experience exceedances of the NMLs.

Construction of the shared cycle and pedestrian pathways is predicted to be the worst case construction scenario for residential receptors. The exceedances are attributed to the close proximity of the construction site to residences. Also due to the length of the shared cycle and pedestrian pathways a large number of residential receptors are affected.

While there would be some noise management level exceedances, the short duration associated with the construction of the shared cycle and pedestrian pathways would minimise the overall impact to the affected community. While long-term mitigation is not justified in this area, and noise mitigation such as hoarding may be difficult due to the transient nature of the works, effective noise management measures would be the key to the successful minimisation of impacts in this area.

A large number of exceedances of the NMLs (ranging from noticeable to highly intrusive) and sleep disturbance criteria have been predicted due to the out of hours construction works associated with the President Avenue construction ancillary facility (C3). A small number of residences have been predicted to be highly noise affected as a result of the temporary stockpiling of spoil and fill materials night-time works. Residential receptors in NCA9 and NCA16 are also predicted to be impacted by sleep awakening events due to the stockpiling of spoil and fill materials. Noise barriers and/or hoarding were not included in the noise modelling of this scenario and could be a potential mitigation measure implemented to minimise the longer term impacts on residences.

The predicted exceedances are attributed to the close proximity of the construction site to residences and low background noise levels. Night-time construction of the shared cycle and pedestrian bridge over President Avenue is not expected to have longer term impacts as they would be carried out over a short period.

Social infrastructure in proximity to the President Avenue construction ancillary facility (C3), as identified on **Figure 15-10**, includes sporting and recreational facilities (such as Ilinden Sports Centre (NCA10) and the Memorial Playing Fields (NCA9)), Brighton Le Sands Scout Hall (NCA8), educational facilities including Brighton Le Sands Public School (NCA9) and Little Sails Pre-School (NCA9).

As the project involves tunnelling, ground-borne noise and vibration impacts may be experienced during construction. As tunnelling progresses towards the President Avenue surface connection, depth below ground would decrease to around 10 metres to 40 metres below ground, and then less than 10 metres as the tunnel approaches open slot.

Sensitive receptors (such as the Memorial Playing Fields and Ilinden Sports Centre) located within this area may be affected by ground-borne noise, however as discussed in **Chapter 11** (Noise and vibration), the maximum exceedance due to ground-borne noise would be up to 1 dB(A) during the night-time period. Tunnelling would typically progress at a rate of around seven metres per day. As a result, it is likely that ground-borne noise would be discernible for up to five days at each affected receptor, with exceedances occurring for up to two days. Tunnelling advance rates would reduce to two to five metres a day around the portals, which may increase the duration of exposure for receptors

in these areas. As tunnelling moves towards and away from each receptor the noise levels experienced would be lower.

Vibration can impact human comfort in a manner that occupants or users of buildings are inconvenienced or possibly disturbed. Managing the potential for such vibration to actually cause discomfort at sensitive receptor locations is based on ensuring suitable separation distances between the equipment and the receptor locations. The recommended safe working distances for vibration intensive plant are set out in Chapter 11 (Noise and vibration), Table 11-3. There would be low impact to human comfort where these standards are met. Where the safe working distances are not met, vibration monitoring would be undertaken at the most affected receptor and alternative equipment may be utilised. The assessment did not identify any receptors that would exceed the vibration criteria for human comfort.

Where noise exceedances occur there is the potential for adverse effects upon the socio-economic environment. Residential receptors in proximity to the President Avenue construction ancillary facility (C3) may experience construction fatigue impacts associated with the extended duration of the works and ongoing construction noise in this location. Noise mitigation and management measures discussed in **Chapter 11** (Noise and vibration) would be implemented to minimise impacts to nearby receptors.

Noise impacts on amenity may also affect the use and enjoyment of sporting activities and functions at Ilinden Sports Centre and the Memorial Playing Fields, as well the classes and activities undertaken at Brighton Le Sands Public School, Little Sails Pre School and Bright Le Sands Scout Hall. Socio-economic impacts on community facilities and sporting and recreational facilities are assessed in detail in **section 15.2.2**.

Although noise generated by construction would be intermittent based on the occurrence of specific construction activities, the duration of construction noise impacts at the President Avenue construction ancillary facility (C3) would be medium term. The severity of noise level exceedance varies across the study area, with noise impacts likely to increase in proximity to the works and residential receptors in NCA9 and NCA16 likely to be the worst affected.

The magnitude of construction noise impacts on the socio-economic environment is therefore considered to be moderate. The sensitivity of affected stakeholders is considered to be high, given the number of residential receptors in proximity to the works and the potential for sleep disturbance, as well as the presence of sensitive receptors, such as Brighton Le Sands Public School. As a result, the significance of construction noise impacts on the socio-economic environment at the President Avenue construction ancillary facility (C3) is high.

Air quality

Construction activities such as demolition and earthworks have the capacity to increase dust, air emissions and odour. This has the potential to affect local amenity due to the increase in dust in an environment. Increased dust can adversely affect the function and operating costs of businesses. Nuisance dust generated from construction activities may disturb sensitive receptors in the vicinity of the President Avenue construction ancillary facility (C3), including Brighton Le Sands Public School, and may affect the amenity and enjoyment of activities at the Memorial Plying Fields and Ilinden Sports Centre.

Increased dust can also reduce the capacity of the community to enjoy the environment and can increase health risks for receptors, particularly those with respiratory and health issues such as asthma and allergies. The human health impacts of air quality are assessed in section **15.4.3**.

Mitigation measures would be implemented to minimise the effects of construction dust on surrounding receptors, including minimising drop heights from machinery and using fine water sprays on dust generating equipment (refer to **Chapter 9** (Air quality)). These measures would be outlined in the Construction Air Quality Management Plan. Considering this, the residual impact of dust on local receptors is considered to be low (

The magnitude of impacts on air quality is therefore considered to be moderate. The sensitivity of affected stakeholders is considered to be high, given the number of residential receptors in proximity to the works, as well as the presence of sensitive receptors, such as Brighton Le Sands Public School. As a result, the significance of air quality impacts on the socio-economic environment at the President Avenue construction ancillary facility (C3) is high.

Urban design and visual amenity

The presence of more vehicles on the road, installation of construction hoardings, construction equipment, acoustic sheds would impact the visual amenity in the vicinity of the President Avenue construction ancillary facility (C3) during construction.

The visual amenity for road users, active transport users and adjacent residents would be reduced due to the removal of vegetation within Rockdale Bicentennial Park during the establishment of the President Avenue construction ancillary facility (C3). Cyclists and pedestrians using existing pathways and detours set up during construction would be subject to increased noise levels during their journey due to construction work occurring at this site.

During consultation, the community raised concern about the removal of trees and vegetation, as well as impacts to Rockdale Wetlands and Bicentennial Park. The community values protection and enhancement of the natural environment. The amenity provided by the vegetation and wetlands within Rockdale Bicentennial Park is therefore considered to be important to the community, and it would be sensitive to visual impacts at this site.

The removal of trees and the introduction of construction ancillary facilities could also reduce the privacy of some properties and reduce screening of construction activities.

The magnitude of impacts on urban design and visual amenity is therefore considered to be moderate. The sensitivity of affected stakeholders is considered to be high, given the number of residential and social infrastructure receptors in proximity to the works. As a result, the significance of urban design and visual amenity impacts on the socio-economic environment at the President Avenue construction ancillary facility (C3) is high.

West Botany Street cut and cover surface works (part of C3)

Figure 7-5 of **Chapter 7** (Construction) identifies the location of the cut and cover works in proximity to the President Avenue construction ancillary facility (C3). A cut and cover structure would be required north of President Avenue intersection through Rockdale Bicentennial Park, Rockdale Wetlands and West Botany Street for the tunnel dive structure. Construction activities associated with cut-and- cover structures would include excavation, together with the temporary diversion of the waterbody within Rockdale Bicentennial Park and West Botany Street.

Traffic

Construction of the tunnel dive and cut-and-cover structures would require the temporary diversion of West Botany Street. Once the roof is in place, the original alignment of West Botany Street would be reinstated and surface activity would resume as construction works continue below.

Traffic also has the potential to result in changes to amenity, with increased traffic associated with increased noise and air quality impacts, as well as the visual presence of more vehicles on the road.

The traffic and transport assessment (refer to Chapter 8 (Traffic and transport) identifies that parking would be unavailable along West Botany Street and the posted speed may be reduced during construction.

As a result, the magnitude of construction traffic impacts associated with the West Botany Street cut and cover surface works is considered to be low. The sensitivity of affected residents and businesses is considered to be moderate, given the low relative increase in traffic associated with the project. As a result, the significance of construction traffic impacts associated with the West Botany Street cut and cover surface works on the socio-economic environment is considered to be moderate-low.

Noise and vibration

NCAs in proximity to the West Botany Street cut and cover works are shown on **Figure 11-2** of **Chapter 11** (Noise and vibration).

A large number of minor exceedances of the NMLs have been predicted at receptors due to the construction works associated with the West Botany Street cut and cover surface works, ranging between noticeable and highly intrusive. A number of residences have also been predicted to be highly noise affected as a result of site establishment and landscaping. Residential receptors NCA9, NCA14 and NCA16 would be the most highly affected noise receptors. The exceedances are attributed to the close proximity of the construction site to residences. Both these scenarios would occur at the start and end of the construction activities and are not expected to be long term, minimising the potential impact.

Social infrastructure in proximity to the West Botany Street works, as identified on **Figure 15-10** and **Figure 15-11**, includes sporting and recreational facilities (including Victory Reserve (NCA10), Moorefield Bowling Club (NCA10), Ilinden Sports Centre (NCA10) and Memorial Playing Fields (NCA9)), educational facilities (including Brighton Le Sands Public School (NCA9) and Little Sails Pre School (NCA9)), and Sunnyhaven Disability Services (NCA10).

A large number of exceedances of the NMLs (ranging from noticeable to moderately intrusive) and sleep disturbance criteria have been predicted due to the out of hours construction works associated with West Botany Street cut and cover works. Residential receptors in NCA11 are also predicted to be impacted by sleep awakening events due to the relocation of utilities. The predicted exceedances are attributed to the close proximity of the construction site to residences and low background noise levels. The relocation of utilities and establishment and commissioning of the bentonite plant are not expected to have longer term impacts due to the short duration of the works.

As the project involves tunnelling, ground-borne noise and vibration impacts may be experienced during construction. As tunnelling progresses towards the President Avenue surface connection (i.e. the West Botany Street cut an cover works), depth below ground would be around 10 metres to 40 metres below ground. Given the predominantly commercial and industrial nature of receptors in this area, sensitivity to ground-borne noise is anticipated to be low. However, sensitive receptors located within this area, including Brighton Le Sands Public School and Sunnyhaven Disability Services, may be affected by ground-borne noise particularly as this facility provides short term respite care for families and carers of people with a disability. As discussed in **Chapter 11** (Noise and vibration), the maximum exceedance due to ground-borne noise would be up to 1 dB(A) during the night-time period. Tunnelling would typically progress at a rate of around seven metres per day. As a result, it is likely that ground-borne noise would be discernible for up to five days at each affected receptor, with exceedances occurring for up to two days. As tunnelling moves towards and away from each receptor, the noise levels experienced would be lower.

As discussed in **Chapter 11** (Noise and vibration), vibration can impact human comfort in a manner that occupants or users of buildings are inconvenienced or possibly disturbed. Managing the potential for such vibration to actually cause discomfort at sensitive receptor locations relies on ensuring suitable separation distances between the equipment and the receptor locations. The recommended safe working distances for vibration intensive plant are set out in **Chapter 11** (Noise and vibration), **Table 11-3**. There would be low impact to human comfort where these standards are met. Where the safe working distances are not met, vibration monitoring would be undertaken at the most affected receptor and alternative equipment may be utilised. The assessment did not identify any receptors that would exceed the vibration criteria for human comfort.

Residential receptors in proximity to the West Botany Street cut and cover works may experience construction fatigue impacts associated with the extended duration of the works and ongoing construction noise in this location. Noise mitigation and management measures discussed in **Chapter 11** (Noise and vibration) would be implemented to minimise impacts to nearby receptors.

Activities or classes undertaken at Sunnyhaven Disability Services, Brighton Le Sands Public School and Little Sails Pre School may be affected by noise generated from the construction works. Noise impacts on amenity may also affect the use and enjoyment of sporting activities and functions at Ilinden Sports Centre, Moorefield Bowling Club and Memorial Playing Fields. Socio-economic impacts on community facilities and sporting and recreational facilities are assessed in detail in **section 15.2.2**.

Although noise generated by construction would be intermittent based on the occurrence of specific construction activities, the duration of construction noise impacts at West Botany Street would be medium term. The severity of noise level exceedance varies across the study area, with noise impacts likely to increase in proximity to the works and residential receptors in NCA9, NCA14 and NC16 likely to be the worst affected.

The magnitude of construction noise impacts on the socio-economic environment is therefore considered to be moderate. The sensitivity of affected stakeholders is considered to be high, given the number of residential receptors in proximity to the works and the potential for sleep disturbance, as well as the presence of sensitive receptors such as Brighton Le Sands Public School, Sunnyhaven Disability Services and sporting and recreational facilities. As a result, the significance of construction noise impacts at the West Botany Street cut and cover surface works on the socio-economic environment is high.

Air quality

Construction activities such as demolition and earthworks have the capacity to increase dust, air emissions and odour. This has the potential to affect local amenity due to the increase in dust in an environment. Increased dust can adversely affect the function and operating costs of businesses. Nuisance dust generated from construction activities may disturb sensitive receptors such as those located at Brighton Le Sands Public School. Dust may also impact the amenity and enjoyment of activities undertaken at Ilinden Sports Centre, Moorefield Bowling Club and the Memorial Playing Fields.

Increased dust can also reduce the capacity of the community to enjoy the environment and can increase health risks for receptors, particularly those with respiratory and health issues such as asthma and allergies. The human health impacts of air quality are assessed in section **15.4.3**.

Mitigation measures would be implemented to minimise the effects of construction dust on surrounding receptors, including minimising drop heights from machinery and using fine water sprays on dust generating equipment. These measures would be outlined in the Construction Air Quality Management Plan. Considering this, the residual impact of dust on local receptors is considered to be low (refer to **Chapter 9** (Air quality)).

The magnitude of impacts on air quality is therefore considered to be moderate. The sensitivity of affected stakeholders is considered to be high, given the number of sensitive receptors in proximity to the works. As a result, the significance of air quality impacts as part of West Botany Street cut and cover works on the socio-economic environment is high

Urban design and visual amenity

The presence of more vehicles on the road, construction equipment and the installation of construction hoardings would reduce the visual amenity in the vicinity of the West Botany Street cut and cover surface works. The reduction in visual amenity could affect the enjoyment and use of recreational facilities in proximity to these works.

The duration West Botany Street cut and cover works would be temporary. As a result, the magnitude of construction activity is considered to be moderate. The sensitivity of affected residents and the presence of sensitive receptors is considered to be moderate, given the existing industrial nature of views along West Botany Street. As a result, the significance of construction hoardings and, construction equipment associated with the West Botany Street cut and cover surface works on the socio-economic environment is considered to be moderate.

President Avenue intersection upgrade surface works (part of C3)

The project would involve upgrade and widening works along President Avenue to ensure safe and efficient connections with the road infrastructure proposed as part of the project, and to cater for additional future traffic demand. These works would include:

- Widening sections of President Avenue to three lanes eastbound and westbound
- Addition of slip lanes to provide a connection to the intersection with the project
- Raising President Avenue about three metres at the location of the President Avenue intersection
- Creating cul-de-sacs to close existing local road intersections with President Avenue including Moorefield Avenue and O'Neill Street
- Conversion of Civic Avenue to allow left in/left out movements only at President Avenue.

Traffic

Traffic has the potential to result in changes to amenity, with increased traffic giving rise to elevated noise and air quality impacts, as well as the visual presence of more vehicles on the road.

During the President Avenue intersection upgrade surface works access to and from Civic Avenue would be closed. This access would be re-opened as 'left in' and 'left out' only following the intersection upgrade works. Access to and from President Avenue at Moorefield Avenue and O'Neil Street would be permanently closed as part of these works. These construction works would be subject to general traffic management to maintain the functionality of the surrounding roads. Such measures would be documented in a CTAMP.

Traffic staging would allow the maintenance of existing through traffic (two eastbound and two westbound) along President Avenue during the intersection upgrade. Whilst the improvements to President Avenue are being undertaken, the sign posted speed would be reduced to 40 km/hr.

As a result of these works, the magnitude of construction traffic impacts during the President Avenue intersection upgrade surface works is considered to be low. The sensitivity of affected residents is considered to be moderate, given the availability of alternative routes at either end of President Avenue. The significance of construction traffic impacts at the President Avenue construction ancillary facility (C3) on the socio-economic environment is considered to be moderate-low.

Noise and vibration

NCAs in proximity to the President Avenue intersection upgrade are shown on **Figure 11-1** and **Figure 11-2** of **Chapter 11** (Noise and vibration).

A large number of exceedances of the NMLs have been predicted due to the construction works associated with the President Avenue intersection upgrade works, ranging between noticeable and highly intrusive. A number of residences have also been predicted to be highly noise affected as a result of the demolition of houses and existing pavement, construction of the temporary widening pavement, relocation of services, installation of stormwater infrastructure, pavement works and final asphalting and line marking. This is attributed to the close proximity of the construction works to residences.

Residences within NCA14 and NCA16 are the most impacted receptors, with certain receptors within these areas predicted to be highly noise affected across almost all construction scenarios related to the President Avenue intersection upgrade. These impacts would however only be short term during construction.

Social infrastructure in proximity to the President Avenue intersection upgrade works, as identified on **Figure 15-10**, includes Moorefield Avenue Reserve (NCA14), Ilinden Sports Centre (NCA10), Scarborough Park North (NCA15), and Civic Avenue Reserve (NCA15).

A large number of exceedances of the NMLs (ranging from noticeable to highly intrusive) and sleep disturbance criteria have also been predicted due to the construction works associated with the President Avenue intersection upgrade. A significant number of highly intrusive exceedances have been predicted in NCA16. Residential receptors in NCA9, NCA14, NCA16 and NCA17 are also predicted to be impacted by sleep awakening events. The predicted exceedances are attributed to the close proximity of the construction site to residences and low background noise.

The night-time construction works required for the President Avenue intersection upgrade are not expected to have long term impacts due to the short duration of the works. Nonetheless, an effective communication plan and noise management measures would be important to ensure that impacts are minimised for affected sensitive receptors.

As discussed in **Chapter 11** (Noise and vibration), vibration can impact human comfort in a manner that occupants or users of buildings are inconvenienced or possibly disturbed. Managing the potential for such vibration to actually cause discomfort at sensitive receptor locations is based on ensuring suitable separation distances between the equipment and the receptor locations. The recommended safe working distances for vibration intensive plant are set out in **Chapter 11** (Noise and vibration), **Table 11-3**. There would be low impact to human comfort where these standards are met. Where the safe working distances are not met, vibration monitoring would be undertaken at the most affected receptor and alternative equipment may be utilised. The assessment did not identify any receptors that would exceed the vibration criteria for human comfort.

Where noise exceedances occur there is the potential for adverse effects upon the socio-economic environment. Residential receptors in proximity to the President Avenue intersection upgrade surface works may experience construction fatigue impacts associated with the extended duration of the works and ongoing construction noise in this location. Noise mitigation and management measures discussed in **Chapter 11** (Noise and vibration) would be implemented to minimise impacts to nearby receptors.

During standard construction hours, this would be particularly felt by people that work from home, shift workers, the elderly, households with young children or businesses (and their customers) that are more dependent on quieter environments to work, rest and relax. Noise impacts may affect the use and enjoyment of recreational areas in proximity to the works, including Moorefield Avenue Reserve, Ilinden Sports Centre, Scarborough Park North and Civic Avenue Reserve. Socio-economic impacts on sporting and recreational facilities are assessed in detail in **section 15.2.2**.

Although noise generated by construction would be intermittent based on the occurrence of specific construction activities, the duration of construction noise impacts at the President Avenue intersection would be medium term. The severity of noise level exceedance varies across the study area, with noise impacts likely to increase in proximity to the works and residential receptors in NCA14 and NC16 likely to be the worst affected. The magnitude of construction noise impacts on the socio-economic environment is therefore considered to be moderate. The sensitivity of affected stakeholders is considered to be high, given the number of residential receptors in proximity to the works and the potential for sleep disturbance, as well as the presence of sensitive receptors such as sporting and recreational facilities. As a result, the significance of construction noise impacts at the President Avenue intersection works on the socio-economic environment is high.

Air quality

Construction activities such as demolition and earthworks have the capacity to increase dust, air emissions and odour. This has the potential to affect local amenity due to the increase in dust in an environment. Increased dust can adversely affect the function and operating costs of businesses. Nuisance dust generated from construction activities may also impact the amenity and enjoyment of activities undertaken at Moorefield Avenue Reserve, Ilinden Sports Centre, Scarborough Park North and Civic Avenue Reserve.

Increased dust can also reduce the capacity of the community to enjoy the environment and can increase health risks for receptors, particularly those with respiratory and health issues such as asthma and allergies. The human health impacts of air quality are assessed in section **15.4.3**.

Mitigation measures would be implemented to minimise the effects of construction dust on surrounding receptors, including minimising drop heights from machinery and using fine water sprays on dust generating equipment (refer to **Chapter 9** (Air quality)). These measures would be outlined in the Construction Air Quality Management Plan.

The magnitude of impacts on air quality is therefore considered to be moderate. The sensitivity of affected stakeholders is considered to be high, given the number of residential receptors in proximity to the works. As a result, the significance of air quality impacts for the President Avenue intersection upgrade on the socio-economic environment is high.

Urban design and visual amenity

Residential receptors and stakeholders utilising social infrastructure in proximity to the President Avenue intersection upgrade surface works would experience changes in amenity during the construction works.

Construction of the President Avenue intersection upgrade surface works would directly impact upon the locally listed heritage item, Patmore Swamp. A 30 metre wide portion of the swamp along the whole of the President Avenue frontage would be acquired and the shared cycle and pedestrian pathways constructed. This is likely to be negatively perceived and affect a number of stakeholders as heritage items are highly valued by the community. The Swamp and wetland corridor contribute to the amenity and character of the area.

In addition, the removal of vegetation, installation of construction hoardings and construction equipment would reduce the visual amenity in the vicinity of the President Avenue intersection upgrade works. This has the potential to result in the reduction of use and enjoyment of sporting and recreational facilities in the vicinity of the works, including Ilinden Sports Centre and Scarborough Park North.

As a result, the magnitude of construction activity associated with the President Avenue intersection upgrade surface works is considered to be moderate. The sensitivity of affected residential receptors and the presence of sensitive receptors is considered to be high, given their proximity to the works and the views over Scarborough Park north and Rockdale Bicentennial Park. As a result, the significance of construction hoardings, construction equipment associated with the President Avenue intersection construction works on the socio-economic environment is considered to be high-moderate.

Princes Highway construction ancillary facility (C6) and associated intersection works

The project would include widening of President Avenue and Princes Highway at their intersection to provide additional turning lanes and to increase the intersection's capacity and performance, as follows:

- Upgrade from a two lane signalised right turn to a three lane signalised right turn from northbound Princes Highway to eastbound President Avenue. The additional northbound right turn lane would have 110 metres of storage and would provide additional intersection capacity for northbound vehicles on Princes Highway turning right onto President Avenue
- Upgrade from three lanes southbound on Princes Highway with a shared straight/ left turn lane to four lanes including a dedicated, signalised, left turn from Princes Highway southbound onto President Avenue eastbound. The new southbound left turn lane would have 70 metres of storage.

The additional lanes would require realignment of the intersection and alterations to the traffic signal phasing at the intersection.

During intersection works, the Princes Highway construction ancillary facility (C6) would be utilised for on-site office facilities, heavy and light vehicle and machinery parking, workshops and the laydown of construction materials.

Traffic

The Princes Highway construction ancillary facility (C6) and construction of the Princes Highway/President Avenue intersection upgrade surface works would result in increased congestion on arterial roads, noise and air quality emissions and reduced amenity as a result of construction traffic.

Temporary closure of part of the kerbside southbound lane of Princes Highway and part of the kerbside eastbound lane of President Avenue would be required during the Princes Highway/President Avenue intersection upgrade works. These lanes would be reopened following the upgrade works. Driveway access would also be temporarily blocked during utilities relocation and pavement widening works. These construction works would be subject to general traffic management to maintain the functionality of the surrounding roads. This would include advance notification of residents about periods where driveway access may be temporarily blocked. Such measures would be documented in a CTAMP.

Traffic movements in and out of C6 would be limited by the small size of the site and the restriction of access to a single driveway adjoining President Avenue. Traffic generated by the movement of vehicles in and out of this facility is expected to be offset by that removed when the existing service station is decommissioned. These traffic movements would be negligible in comparison to the existing traffic volumes on Princes Highway.

As a result of these works, the magnitude of construction traffic impacts during the President Avenue intersection upgrade surface works is considered to be low. The sensitivity of affected residents is considered to be moderate, provided advance notification is provided. The significance of construction traffic impacts at C6 and the President Avenue/Princes Highway intersection works on the socio-economic environment is considered to be moderate-low.

Noise and vibration

NCAs in proximity to the Princes Highway/President Avenue intersection upgrade surface works are shown on **Figure 11-1** and **Figure 11-2** of **Chapter 11** (Noise and vibration).

A large number of exceedances of the NMLs have been predicted due to the construction works associated with the Princes Highway/President Avenue intersection upgrade works. A number of residences have also been predicted to be highly noise affected as a result of all construction scenarios.

The large number of highly noise affected receptors is attributed to the close proximity of the construction works to residences.

Residences in NCA14 are the most impacted receptors with highly noise affected receptors being predicted across almost all construction scenarios related to the Princes Highway/President Avenue intersection upgrade surface works. Generally the works would be progressive so that not all receptors would be affected at any one time or for the full duration of the works.

Social infrastructure in close proximity to the Princes Highway/President Avenue intersection upgrade works, as identified on **Figure 15-9**, includes educational facilities (TAFE NSW St George College and Hogben Street Campuses (NCA14), James Cook Boys Technology School (NCA14), Moorefield Girls High School (NCA14) and St George Special Education School (NCA14)), child care facilities (Little Dragons Academy (NCA13) and St Paul's Children Centre (NCA12)), places of worship (Saint Paul's Anglican Church (NCA12) and Grace Chinese Christian Church (NCA13)) and health and medical facilities (St George Private Hospital (NCA13) and Montgomery General Practice (NCA13)).

A large number of moderate and major exceedances of the NMLs and sleep disturbance criteria have been predicted for out of hours works. These exceedances affect between 11 and 219 properties across the subject NCAs. The magnitude of the NML exceedances vary between 5 dB(A) up to a maximum of 34 dB(A). Residential receptors in NCA12 and NCA14 are predicted to be affected by sleep awakening events in all out of hours construction works associated with the intersection upgrade.

The predicted exceedances are attributed to the close proximity of the construction ancillary facility to residences. It is essential that night time works are undertaken at this location due to the need to minimise the impact of the works upon traffic at the intersection of two major arterial roads. The works are not expected to have long term impacts due to the temporary nature of the works. Nonetheless, an effective communication plan and noise management measures would be important to ensure that impacts are minimised for affected sensitive receptors.

As discussed in **Chapter 11** (Noise and vibration), vibration can impact human comfort in a manner that occupants or users of buildings are inconvenienced or possibly disturbed. Managing the potential for such vibration to actually cause discomfort at sensitive receptor locations is based on ensuring suitable separation distances between the equipment and the receptor locations. The recommended safe working distances for vibration intensive plant are set out in **Chapter 11** (Noise and vibration), Table 11-3. There would be low impact to human comfort where these standards are met. Where the safe working distances are not met, vibration monitoring would be undertaken at the most affected receptor and alternative equipment may be utilised. The assessment did not identify any receptors that would exceed the vibration criteria for human comfort.

Where noise exceedances occur there is the potential for adverse effects upon the socio-economic environment. Noise mitigation and management measures discussed in **Chapter 11** (Noise and vibration) would be implemented to minimise impacts to nearby receptors.

During standard construction hours, this would be particularly felt by people that work from home, shift workers, the elderly, households with young children or businesses (and their customers) that are more dependent on quieter environments to work, rest and relax. Classes and activities undertaken at adjacent educational facilities may be affected by noise generated by construction works. Medical facilities, and services undertaken at places of worship, may also be affected or disturbed by the works.

Although noise generated by construction would be intermittent based on the occurrence of specific construction activities, the duration of construction noise impacts at the Princes Highway/President Avenue intersection would be medium term. The severity of noise level exceedance varies across the study area, with noise impacts likely to increase in proximity to the works and residential receptors in NCA12 and NCA14 likely to be the worst affected. The magnitude of construction noise impacts on the socio-economic environment is therefore considered to be moderate. The sensitivity of affected stakeholders is considered to be high, given the number of residential receptors in proximity to the works and the potential for sleep disturbance such as educational and medical facilities and places of worship. As a result, the significance of construction noise impacts at the Princes Highway/President Avenue intersection upgrade works and C6 on the socio-economic environment is high.

Air quality

Construction activities such as earthworks have the capacity to increase dust, air emissions and odour. This has the potential to affect local amenity due to the increase in dust in an environment. Increased dust can adversely affect the function and operating costs of businesses. Nuisance dust generated from construction activities may disturb the amenity and perceived cleanliness in the vicinity of the businesses located at this intersection, as well as the adjacent educational facilities and nearby places of worship.

Increased dust can also reduce the capacity of the community to enjoy the environment and can increase health risks for receptors, particularly those with respiratory and health issues such as asthma and allergies. The human health impacts of air quality are assessed in section **15.4.3**.

Mitigation measures would be implemented to minimise the effects of construction dust on surrounding receptors, including minimising drop heights from machinery and using fine water sprays on dust generating equipment (refer to **Chapter 9** (Air quality)). These measures would be outlined in the Construction Air Quality Management Plan.

The works at the Princes Highway construction ancillary facility (C6) will require excavation to remove underground fuel tanks and other minor earthworks. The potential magnitude of impact is considered to be moderate. The sensitivity of affected stakeholders is considered to be high, given the number of residential receptors in proximity to the works. As a result, the significance of air quality impacts for the Princes Highway construction ancillary facility and associated works upon the socio-economic environment is high.

Urban design and visual amenity

The Landscape and visual assessment in **Chapter 13** (Landscape and visual) acknowledges that the built form along the Princes Highway varies in age, height, architectural style and materials creating an eclectic streetscape character. The built form along President Avenue in this area consists mainly of residential walk up apartments. Within C6, the existing 7-Eleven service station and associated UltraTune mechanic's garage constitute a visually diverse and intentionally noticeable visual element of the local area. The demolition of this site and replacement with the construction ancillary facility would result in a similar visually obtrusive element, albeit one exhibiting a far more temporary character. The construction character introduced to this area would be somewhat absorbed into the highly urban and mixed character of the landscape character zone.

The presence of the construction ancillary facility, the removal of vegetation, installation of construction hoardings and construction equipment would reduce the visual amenity for nearby residents and for users of educational and health care facilities in the vicinity of this facility (including the TAFE St George College campus and the St George Private Hospital). Elevated views from high rise buildings along President Avenue and Princes Highway would also include the President Avenue construction ancillary facility (C3) in the background of views.

The works and the associated proposed construction facility would be present throughout the construction period only and are therefore considered temporary. As a result, the magnitude of this construction activity is considered to be low. Given the high traffic volumes through the intersection, the dominating character of the Princes Highway and the diverse built form, the sensitivity of affected residents is considered to be low. The significance of visual amenity impacts in this area on the socio-economic environment is considered to be low.

Shared cycle and pedestrian pathway east construction ancillary facility (C4)

Residential receptors, businesses and stakeholders utilising social infrastructure in proximity to the shared cycle and pedestrian pathway east construction ancillary facility (C4) would experience changes in amenity associated with increased noise and air quality impacts, as well as the visual presence of more vehicles on the road. Social infrastructure in the vicinity of the facility, as identified on **Figure 15-10**, includes Greg Arkins Mini Field (NCA5) and CA Redmond Field (NCA5).

The traffic and transport assessment (refer to **Chapter 8** (Traffic and transport) identifies that whilst the shared cycle and pedestrian pathway east construction ancillary facility (C4) requires access to and from a local road (Bruce Street), the site would generate minimal construction vehicle volumes and operate for a short period of construction. Therefore, no significant impacts to the local road network are anticipated at the facility. Construction impacts on the regional road network would include increased traffic congestion, the accessibility of local areas and the efficiency of freight, commercial vehicles and public transport movements.

Whilst a large number of receptors would be likely to be affected by construction works associated with the shared cycle and pedestrian pathways east construction ancillary facility (C4), the NML exceedances would be mostly minor (refer to **Chapter 11** (Noise and vibration)). However receptors within NCA5 would experience noise levels resulting in moderate to major exceedances. The works are assumed to occur without hoarding or noise barriers.

Construction activities such as earthworks have the capacity to increase dust, air emissions and odour. This has the potential to affect local amenity due to the increase in dust in an environment. The installation of construction hoardings and construction equipment would also reduce the visual amenity in the vicinity of this site. Both visual and air quality impacts have the potential to impact the enjoyment and use of the sporting and recreational facilities in proximity to the shared cycle and pedestrian pathways east construction ancillary facility (C4), including CA Redmond Field and Greg Arkins Mini Field.

As a result, the magnitude of construction activity is considered to be low. The sensitivity of affected stakeholders (including park users and residents) is considered to be moderate, given the location of residential receptors and social infrastructure in the area. As a result, the significance of construction hoardings, construction equipment associated with shared cycle and pedestrian pathways east construction ancillary facility (C4) on the socio-economic environment is considered to be moderate-low.

Shared cycle and pedestrian pathways west construction ancillary facility (C5)

Residential receptors, businesses and stakeholders utilising social infrastructure in proximity to the shared cycle and pedestrian pathways west construction ancillary facility (C5) would experience changes in amenity associated with increased noise and air quality impacts, as well as the visual presence of more vehicles on the road. Social infrastructure in the vicinity of the facility, as identified on **Figure 15-10**, includes PCYC St George (NCA5), Ador Avenue Reserve (NCA5) CA Redmond Field (NCA5) and St George District Netball Association (NCA4).

The traffic and transport assessment (refer to **Chapter 8** (Traffic and transport) identifies that no impacts to the local road network are anticipated at the shared cycle and pedestrian pathways west construction ancillary facility (C5), as heavy and light vehicle access and egress would be directly to and from an arterial road, West Botany Street. Construction impacts on the regional road network would include increased traffic congestion, the accessibility of local areas and the efficiency of freight, commercial vehicles and public transport movements.

A large number of exceedances of the NMLs have been predicted due to pavement works associated with the shared cycle and pedestrian pathways west construction ancillary facility (C5) (refer to **Chapter 11** (Noise and vibration)). The exceedances range between noticeable and clearly audible for all NCAs with the exception of NCA5 which ranges between noticeable and highly intrusive. The works are assumed to occur without hoarding or noise barriers. Noise impacts may affect the use and enjoyment of sporting and recreational facilities in proximity to the Shared cycle and pedestrian pathway west construction ancillary facility (C5).

Construction activities such as earthworks have the capacity to increase dust, air emissions and odour. This has the potential to affect local amenity due to the increase in dust in an environment. The installation of construction hoardings and construction equipment would also reduce the visual amenity in the vicinity of this site. Both air quality and visual impacts could ultimately result in a reduction in the enjoyment of activities and use of sporting and recreational facility in proximity to the shared cycle and pedestrian pathways west construction ancillary facility (C5), including St George District Netball Association, Ador Avenue Reserve and CA Redmond Field.

As a result, the magnitude of construction activity is considered to be low. The sensitivity of affected stakeholders (including park users, residents and businesses) is considered to be moderate, given the location of residential receptors and social infrastructure in the area. The significance of construction hoardings, construction equipment associated with the shared cycle and pedestrian pathways west construction ancillary facility (C5) on the socio-economic environment is considered to be moderate-low.

Permanent power supply route

There would be some localised disturbance during construction of the permanent power supply route. The power line would be located within the existing road reserve or underbored, in consultation with the relevant authority, with the exception of where it would cross Bardwell Valley Golf Course and along the edge of Silver Jubilee Park.

Impacts relating to noise and vibration, air quality and visual amenity may affect the way local residents, businesses and workers experience their environment.

These works would also include temporary traffic and access impacts where works are carried out adjacent to or within the road corridor.

These amenity impacts would be short term in duration and move progressively along the route. Impacts would also be minimised as far as practicable with the implementation of appropriate management measures. As a result, the magnitude of construction impacts upon local amenity is considered to be low. The sensitivity of affected stakeholders (including golf course and park users, residents and businesses) is considered to be moderate, given the location of residential receptors and social infrastructure in the area. On this basis the overall impact upon the socio-economic environment is expected to be low.

Traffic

The construction of the permanent power supply connection is likely to result in the following traffic impacts:

- Disruption to motor vehicle and cyclist traffic in active construction locations, including some one-way flows, temporary traffic diversions and alterations to speed limits, resulting in increased travel times
- Temporary disruptions to driveway access for up to 24 hours in certain locations, placing restrictions on the ability of residents, business owners, employees and customers to access private properties
- Progressive loss and later reinstatement of on-street parking as the project advances, with local parking impacts likely to be limited to both sides of street sections of up to 75 metres in length for a period of up to two weeks
- Temporary disruptions and detours to pedestrians along footpaths and other walking routes intersecting with the route and work sites
- 24 hour access would be maintained for emergency vehicles throughout all construction areas.

The magnitude of socio-economic impacts associated with loss of traffic and access amenity would be expected to be moderate. The sensitivity of residents and businesses along the route would be moderate, with the overall socio-economic significance being moderate.

Noise and vibration

The construction of the permanent power supply would occur mainly during standard construction hours. Using standard construction scenarios based upon Roads and Maritime guidance, the works are predicted to result in exceedances at nearby residences up to 36 dB(A) where noisy equipment is being used (such as a concrete saw). Bardwell Valley Golf Course and Silver Jubilee Park users may also be temporarily affected by noise and vibration impacts whilst the area is underbored.

Sensitive receptors are likely to be highly affected when the works are directly opposite the receptor location. The severity of the exceedances is due to the small offset distance. As the works move further away from receptors, and noisy construction activities are completed, noise levels would reduce significantly. High noise impacts at any one receptor are unlikely to last for more than a few days for each sensitive receptor.

During standard construction hours, this would be particularly felt by people that work from home, shift workers, the elderly, households with young children or businesses (and their customers) that are more dependent on quieter environments to work, rest and relax. Classes and activities undertaken at adjacent educational facilities may be affected by noise generated by construction works.

Where noise exceedances occur there is the potential for adverse effects upon the socio-economic environment. Noise mitigation and management measures discussed in **Chapter 11** (Noise and vibration) would be implemented to minimise impacts to nearby receptors.

Noise generated by construction would be intermittent based on the occurrence of specific construction activities and the overall duration of construction noise impacts along the permanent power supply connection route would be short term. The magnitude of construction noise impacts on the socio-economic environment is therefore considered to be negligible. The sensitivity of affected stakeholders is considered to be moderate, considering the number of residential receptors in proximity to the works, but also that they are located along arterial or local roads which are subject to an existing moderate or low level of road traffic noise and other road works. As a result, the significance of construction noise impacts along the permanent power supply connection route on the socio-economic environment is negligible.

Air quality

Construction activities such as earthworks have the capacity to increase dust, air emissions and odour. This has the potential to affect local amenity due to the increase in dust and vehicle emissions in the local environment. Increased dust can adversely affect the function and operating costs of businesses. Nuisance dust generated from construction activities may disturb the amenity and perceived cleanliness in the vicinity of the businesses located along the route of the permanent power supply connection, as well as adjacent recreational facilities.

Trenching or under boring during construction of the permanent power supply line would require very minor earthworks, which would be backfilled at the end of each day. It is not expected to be a significant source of dust and it not included in this assessment of construction.

Urban design and visual amenity

The landscape character and visual impact assessment in **Chapter 13** (Landscape and visual) outlines that the power supply would require temporary works within the road reserves and through open spaces. This would include some partial road and footpath closures to accommodate temporary trenching works. The works would also include construction of surface level power lines, attached to existing infrastructure, at the Bardwell Valley Golf Course and along the edge of Silver Jubilee Park and to cross the T4 and T8 railway lines. Trees within the corridor would be retained.

This assessment concludes there would be a negligible to low character impact arising from the construction of the permanent power supply. Accordingly the socio-economic impact would also be deemed to be negligible.

15.3.4 Access and connectivity impacts

Construction of the project has the potential to result in impacts to the local traffic network associated with the establishment of traffic management measures, the introduction of spoil haulage and other heavy vehicles and physical alterations to local roads. This may reduce the performance of the road network. To minimise impacts, construction compound haulage routes have been selected to reduce the use of local roads and for movements to concentrate outside peak periods where possible.

An increase in traffic volume also impacts upon local travel, including trip duration, wait times at intersections, road safety and access to properties, businesses and social infrastructure.

Road and freight network

Construction of the project, including the permanent power supply, would require temporary traffic detours, road occupation, temporary changes to road markings or temporary road closures, as well as the presence of construction vehicles for spoil haulage and the movement of other heavy and light vehicles. In addition, access to properties may be temporarily disrupted.

These activities can result in changes to traffic movements and congestion on the local road network, which in turn can:

- Reduce in the amenity of an environment, with idling vehicles generated noise and air emissions, affecting human health and business amenity
- Reduce roadside safety, particularly in areas near schools (such as Brighton-Le-Sands Public School), child care centres, aged care facilities and public transport stops
- Increase stress and anxiety for road users
- Reduce access to residences, social infrastructure and businesses.
- Increase peak spreading or result in modal shifts for commuters
- Affect freight and commercial vehicle transport costs and efficiency
- Affect commuter travel times and general access and connectivity to surrounding areas or employment centres.

No impacts to the local road network are anticipated at the Arncliffe construction ancillary facility (C1), the Rockdale construction ancillary facility (C2), the President Avenue construction ancillary facility (C3) and shared cycle and pedestrian pathways west construction ancillary facility (C4), as heavy and light vehicle access and egress would be directly to and from arterial roads. Whilst the shared cycle and pedestrian pathways east construction ancillary facility (C4) requires access to and from a local road (Bruce Street), the site would generate minimal construction vehicle volumes and operate for a short period.

In most instances, modifications to the local road network would be temporary with temporary construction access off local roads reinstated upon completion of construction. While properties along these roads may experience a marginal increase in travel time, the variance from what is currently experienced is unlikely to be substantial and would result in a low negative impact on the social and economic environment. Construction impacts on the regional road network have the potential to impact local accessibility and the efficiency of freight and public transport movements.

Construction traffic volumes are expected to be low when compared to existing traffic volumes on key arterial roads connecting to the construction ancillary facilities. The greatest increases are forecast to occur on the M5 East Motorway to the west of Princes Highway and on West Botany Street, south of Bay Street. Detailed traffic management plans would be implemented which would include measures to manage the additional volumes of heavy vehicles travelling along these and other arterial roads.

Whilst the CTAMP would assist in reducing impacts associated with changes and alterations to the road network, inefficiencies would still be experienced by road users. The construction impacts have the capacity to affect a large number of people and businesses both locally and regionally. Although the effects would be temporary, a noticeable and substantial change from the existing environment is anticipated. As such, the effect on the social and economic environment is a moderate negative.

Overall, the magnitude of construction impacts is considered to be moderate as the construction activity would potentially affect the efficiency of road networks across the broader region. Based on the availability of alternative routes in the area, sensitivity is considered to be moderate. The overall significance on access and connectivity with regard to the social and economic environment would be moderate.

Public transport

The existing traffic lanes and movements on President Avenue, West Botany Street and Princes Highway would be maintained during peak periods, allowing bus services to continue. There would however be temporary relocation of some bus stops along President Avenue and some temporary closures of local streets that may require minor route diversions. Any alterations to bus services would be undertaken in consultation with Transport for NSW, the bus operators and Bayside Council. The Project would however seek to retain the same access provisions as currently provided at all bus stops.

Bus stops are located at the following locations within the construction boundary:

- President Avenue at O'Neill Street, Brighton-Le-Sands
- President Avenue at West Botany Street, Kogarah
- President Avenue at Traynor Avenue, Kogarah
- President Avenue at Cross Street, Kogarah
- President Avenue opposite TAFE Sydney, Kogarah
- Two stops at James Cook Boys Technology High School, Kogarah – located along the southbound side of Princes Highway.

The relocation of bus stops would not impact on the operation of bus services, however it may result in some passengers having to walk a short distance further to access a temporary bus stop. For the bus stops which are required to be relocated, the distance from existing bus stops would be minimised.

Bus customers near construction ancillary facilities and other construction works (especially the President Avenue construction ancillary facility and permanent power supply route) may experience a reduction in amenity while waiting for buses and increased bus travel times due to potential traffic congestion. Impacts on bus services and the broader public transport network are likely to be low and would be managed in consultation with Transport for NSW, the bus operators and Bayside Council, with relevant information being communicated to users.

Bus passengers and commuters travelling to train stations may experience temporary traffic disruptions or delays during construction.

Overall, given the duration of the construction works and the potential for the works to affect the efficiency of public transport within the area, the magnitude of construction impacts is considered to be moderate. Sensitivity is considered to be moderate based on the nature of the existing local public transport system. The overall significance of public transport impacts on the socio-economic environment would be moderate.

Active transport network

Changes to the existing pedestrian and cyclist network have the potential to affect commuter departure times, travel durations, movement patterns and accessibility.

Activities that would impact the active transport network include:

- Closing or detouring the pedestrian pathways along either side of President Avenue during construction. This would be temporary and would occur one side at a time with appropriate diversions put in place
- Temporary blocking of the walking path that circumnavigates Rockdale Bicentennial Park during construction of the cut-and-cover structure. A diversion would be put in place
- Maintenance of the pedestrian path between West Botany Street and Kings Road with temporary potential relocation to the northern extent of the park area
- Closure of the pedestrian bridge over Rockdale wetlands for the duration of the construction works in the area. Temporary access would be provided during construction following consultation with Bayside Council
- Temporary closure or diversion of pedestrian pathways along either side of a small length of the Princes Highway during the intersection upgrade works.

These changes include impacts to the popular recreational pedestrian and cyclist paths at Rockdale Bicentennial Park used by both locals and visitors. The changes may increase pedestrian wait times and increase journey to work times for active transport commuters. While the opportunity to walk or cycle in the study area would be maintained, the alterations and changes may detract from the experience of the pedestrian and cyclist environment and potentially deter people from enjoying an active lifestyle or feeling connected with their community.

Depending on the length and terrain of alternative routes, people may be more inclined to take a shorter, less safe option, than diverting along a recommended detour route. At the extreme, this may increase the chance of pedestrian and cyclists coming into conflict with vehicles or may encourage people to break road rules.

Around seven per cent of persons employed in the study area chose to walk or cycle to work in 2016. This proportion is higher than the Greater Sydney average (4.7 per cent) and suggests good availability of pedestrian and cycle networks for access to the study area.

To reduce the impact on pedestrian and cyclist connections, a strategy for the maintenance of pedestrian and cyclist access throughout construction would be provided as part of the CTAMP, which would be prepared during detailed design. Any changes to pedestrian and cyclist routes would ensure safety and maintenance of access for all levels of mobility, while minimising detour distances.

Overall, the extent of impact upon active transport would be local, the duration would be medium term and the severity would be low, resulting in a moderate magnitude of impact. Active transport users in the area have few desirable alternative routes resulting in a moderate level of sensitivity. As such, the significance of the active transport impacts on the socio-economic environment would be moderate-low.

Parking

Parking along President Avenue would become progressively unavailable during active construction periods. This loss of parking would occur in stages and the spaces lost would not occur at the same time. The on-street parking areas that would be affected are:

- O'Neill Street, next to Rockdale Bicentennial Park (about 16 spaces)
- Civic Avenue (northbound), near President Avenue (about 10 spaces)

- West Botany Street (northbound and southbound), between French Street and northern boundary of the President Avenue construction ancillary facility (C3) (about 16 spaces and 19 spaces).

The above on-street parking areas would be reinstated following completion of construction. The following on-street parking areas would be removed during construction and reinstated during non-peak periods following construction:

- President Avenue (eastbound), between Princes Highway and Traynor Avenue (about 53 spaces)
- President Avenue (westbound), between Traynor Avenue and Princes Highway (about 46 spaces).

The removal of these parking spaces would reduce the availability of on-street parking for businesses located along President Avenue, and for adjacent sporting and recreational facilities such as Ilinden Sports Centre, Memorial Playing Fields and Scarborough Park North. This would also increase demand for parking on nearby streets. Should construction workers from the President Avenue construction ancillary facility (C3) also utilise on-street parking, the demand for parking in this area would increase further. Local residents would then be competing with business customers, park users and construction workers for parking. The footprint of the President Avenue construction ancillary facility (C3) would also encompass an existing car park (operated by Rockdale Council with approximately 60 spaces) in the north western corner of Rockdale Bicentennial Park (access from West Botany Street). The car park is currently used by a moderate number of vehicles associated with users of the park and patrons of the adjacent industrial area. Impacts on park users would be negligible as the parking would be removed along with the use of the park during construction. Impacts on patrons of adjacent businesses would be moderate.

Residential streets in close proximity to all construction ancillary facilities are likely to experience an increase in construction worker parking. Elderly people, those with a disability or families with young children, who may have difficulty walking greater distances, would be particularly affected if they are required to park further away from their destinations.

The construction of the permanent power supply route would require the temporary occupation of some on-street parking on roads along the route. Given the residential nature of most of the route it is expected that alternative nearby parking would be available for most residents and businesses.

The Construction Traffic and Access Management Plan (CTAMP) would include a car parking strategy detailing measures to manage parking impacts in nearby streets. This would be developed prior to the establishment and use of construction ancillary facilities.

Overall, parking would be affected at a local extent, would be of medium term duration and would be of a low severity, resulting in a moderate magnitude of impact. Sensitivity is considered to be moderate based on the location of alternative parking areas. As such the significance of parking impacts on the socio-economic environment would be moderate.

15.3.5 Changes to utilities

Changes to utilities and services located within or close to the project may be required during construction. This may include protection, relocation or realignment of electricity, gas, telecommunications (including optic fibre cables), sewer or water mains. **Chapter 14** (Property and land use) and **Figure 14-10** provides an assessment of potential impacts on utilities that may be affected by the project.

The nature and extent of utility changes would be confirmed during the project's detailed design and any changes to utility services required by the project would be identified in consultation with utility service providers. Should potential disruptions to services be required consultation with affected residents, businesses or social infrastructure operators would be undertaken.

Disruptions to utilities have the potential to result in a range of impacts upon resident, businesses and social infrastructure providers/operators. This could include loss of operation of business critical machinery or equipment, impacts upon residential household routines, interruptions to classes at education facilities and cancellation of scheduled night time sporting activity. Certain emergency services or businesses may also be required to call upon backup power supplies or communication arrangements.

The construction of the permanent power supply route is likely to interact with other utilities along the route between Canterbury and Rockdale. In most cases these would not be disturbed by the construction of the power supply, though it certain cases short disruptions to some services may occur.

Construction activities associated with utility works may also affect the accessibility of businesses, residences and social infrastructure, particularly where roadside excavations are required. These may affect business visibility, passing trade and local amenity (noise, air quality, visual environment). Such impacts would be expected to be limited and localised to discrete work areas.

Overall, utility relocation works would be of a local extent, short duration and low severity (if managed correctly). As such the magnitude of impact is expected to be moderate. The sensitivity of users to the loss of services would be high, though sensitivity to reduced amenity or business visibility would be expected to be moderate-low. The overall socio-economic significance on utilities and services would be moderate.

15.3.6 Business and industry impacts

Businesses across the study area may be affected during construction by temporary changes in passing trade, access and travel time (for employees, customers, and deliveries), parking and impacts to local amenity. Depending on the nature of the business, the actual impact on business revenue would vary.

Where possible, the location of businesses along the corridor has been considered during the design of the project so that potential impacts are avoided or minimised.

Passing trade

Passing trade refers to customers who choose to visit a business because they see it when walking or driving past, or as a matter of convenience when en route to another destination, rather than an intentional trip with that business as the desired destination.

During construction, including the construction of the permanent power supply, vehicle and pedestrian flows along current routes may change and influence the level of passing trade. Some businesses could benefit as passing trade is redirected towards their business. Others might be disadvantaged as traffic is diverted away or they are otherwise affected by indirect impacts (e.g. from noise, dust, reduces visibility, changes to access, parking availability).

Certain businesses may also see an improved level of passing trade as a result of the introduction of the construction workforce in the area. This would likely benefit businesses such as food/beverage providers (i.e. bakeries, restaurants, cafes, and bottle shops), hospitality services (i.e. hotels), and petrol stations. This would generate increased business revenue, directly benefiting the social and economic environment.

Half of the businesses surveyed said that they rely on prominent signage or visibility to passing customers. Businesses also suggested that the provision of additional signage would assist in minimising negative impacts during construction. A Business Management Plan will be prepared for the project to reduce the overall effects on potentially affected businesses and commercial operations, including management measures to maintain appropriate visibility of businesses (such as additional signage), or alternative arrangements for times when access and visibility cannot be maintained. These would be determined in consultation with the owners of the identified businesses.

Overall, the extent of business impacts would be local, the duration would be moderate and the severity would vary depending on the number and type of businesses affected. On this basis the overall magnitude is considered to be moderate. The sensitivity of businesses to the loss of customers would be moderate given that at least some businesses rely on passing trade as a key source of revenue. The overall socio-economic significance on passing trade would be moderate.

Access and travel time

As discussed in **Chapter 8** (Traffic and transport) and in **section 15.2.4** there would be changes to road and intersection layouts and additional traffic would be generated during the construction of the project. Businesses may be affected by temporary traffic changes, such as congestion or diversions, which may affect access for employees or deliveries. These changes would likely affect employee and customer travel time and the efficiency of business services.

Overall, the extent of impacts upon access and travel time is expected to be local, duration would be medium term and severity vary depending on the number and type of businesses affected. Based on the availability of alternative routes in the area sensitivity is considered to be moderate. The overall socio-economic significance on access and connectivity would be moderate.

Parking

The outcomes of the business impact survey (refer to **Appendix I** (Social and economic supporting information) indicated employees and customers of some businesses located along West Botany Street utilise the existing car park in the north western corner of Rockdale Bicentennial Park. Parking availability was a key concern raised by businesses and it was suggested that the provision of additional parking would assist in minimising the negative impacts of the project during construction.

The removal of parking or increased demand and competition for car parking would affect nearby businesses' deliveries and/or services and parking convenience for workers and customers (especially elderly customers, those with a disability or families with young children). Reduced parking can influence customers to use an alternative service or visit a different business.

The CTAMP would include a car parking strategy detailing measures to manage parking impacts in adjacent streets. This would be developed prior to the establishment and use of construction ancillary facilities. The CTAMP would help reduce impacts to parking and subsequent impact to businesses and the social and economic environment generally.

Whilst the car park in the north western corner of Rockdale Bicentennial Park would be unavailable during construction, car parking demand would be monitoring and options for replacement parking would be discussed with the relevant stakeholders (such as Bayside Council).

Overall, the extent of construction impacts on parking for businesses (both on-street and within parking areas) would be local, with the duration moderate. The severity would vary depending on the number and type of businesses affected. Sensitivity is considered to be moderate based on the location of alternative parking areas. As such the socio-economic significance of the changes to the parking during construction would be moderate.

Servicing and deliveries

Businesses rely on deliveries and dispatch of goods to support the sale of products and/or services, as well as relying on services from other businesses such as refuse collection. These activities may sometimes be required multiple times per day.

Temporary changes to the existing road network, including street closures, the relocation and/or removal of car parking and/or loading zones along street frontages, and the location of construction ancillary facilities could collectively restrict or reduce servicing, delivery and dispatch opportunities.

This can detrimentally affect businesses resulting in time and vehicle related costs and lost revenue for businesses.

Overall, the extent of impacts upon servicing and deliveries is expected to be local, duration would be moderate and severity vary depending on the number and type of businesses affected. Given servicing and loading need to be undertaken at or close to the business, sensitivity is considered to be high. As such the socio-economic significance of the changes to servicing and deliveries during construction would be high- moderate.

Amenity

Many businesses such as accommodation providers, restaurants, cafes, and health and beauty businesses rely to an extent upon high levels of local amenity. This includes aspects such as low traffic, low background noise and the presence of positive visual environments including street vegetation and green spaces. The construction of the project has the potential to disrupt amenity values for certain areas, particularly around construction ancillary facilities and other construction locations. This impact is discussed in further detail in **section 15.3.3**.

The severity of impact on amenity on individual businesses would vary depending on the nature of their business and the proximity to construction activities. Businesses that rely on a high level of amenity would be particularly affected during construction.

The impact of changes to local amenity would be different for businesses at each end of the project. At Arncliffe, impacts to local amenity have already occurred and are ongoing as part of the construction of the New M5 Motorway. Mitigation of amenity impacts at this location has already been implemented as part of the New M5 Motorway project. The project would also apply mitigation measures for this purpose.

A list of businesses in proximity to the Arncliffe construction ancillary facility (C1) is provided below (**Table 15-12**).

Table 15-12 Businesses in proximity to the Arncliffe construction ancillary facility (C1)

Location	Business Name	Business Type	Proximity
Wolli Creek	Kogarah Golf Course	Sporting facility	Adjacent to C1
Wolli Creek	Mercure Sydney International Airport	Hotel	Around 130 metres from C1
Wolli Creek	QMS Hotel	Hotel	Around 120 metres from C1
Wolli Creek	Piccolina Espresso	Restaurant/café	Around 130 metres from C1
Wolli Creek	Integrity Legal Specialists	Legal services	Around 130 metres from C1
Wolli Creek	St Mark Dental and Medical Group	Medical centre	Around 130 metres from C1
Wolli Creek	Rowers on Cooks River	Rowing Club with restaurant/bar	Around 300 metres from C1
Wolli Creek	Vink Printing Group	Printer	Around 50 metres from C1
Kyeemagh	Muddy Creek Boating and Amateur Fishing Association (MCBAFA)	Fishing club	Around 50 metres from shared cycle and pedestrian pathways

Businesses in proximity to the Rockdale (C2), President Avenue (C3) and Princes Highway construction ancillary facility (C6) are detailed in **Table 15-14**.

Table 15-13 Businesses in proximity to the Rockdale (C2), President Avenue (C3) and Princes Highway (C6) construction ancillary facilities

Location	Business Name	Business Type	Proximity
Brighton-le-sands	Sammy's Restaurant	Restaurant/Café	Adjacent to surface road works/upgrades
Brighton-le-sands	Styles by the Bay	Hair salon	Adjacent to surface road works/upgrades
Brighton-le-sands	Convenience store	Supermarket/food store/convenience store	Adjacent to surface road works/upgrades
Brighton-le-sands	Gourmet Butchers of Monterey	Supermarket/food store/convenience store	Adjacent to surface road works/upgrades
Kogarah	Evangenline k Hairdressing	Hair salon	Adjacent to surface road works/upgrades
Kogarah	Liondos Unique Corporate Wear	Retail	Adjacent to surface road works/upgrades
Kogarah	Benny and the Pets	Veterinarian	Adjacent to surface road works/upgrades
Kogarah	MHS Dentistry	Health Services	Adjacent to surface road works/upgrades
Kogarah	Sydney Elite Massage Therapy	Health Services	Adjacent to surface road works/upgrades
Kogarah	KC The Sports Chiropractor	Health Services	Adjacent to surface road works/upgrades
Kogarah	Pino's Dolce Vita Fine Foods	Supermarket/food store/convenience store	Adjacent to surface road works/upgrades
Kogarah	Benny and the Pets / Kogarah Veterinary Hospital	Veterinarian	Adjacent to surface road works/upgrades
Kogarah	Sugarloaf patisserie	Restaurant/café	Adjacent to surface road works/upgrades

Location	Business Name	Business Type	Proximity
Kogarah	President Avenue Fruit World	Supermarket/food store	Adjacent to surface road works/upgrades
Kogarah	Caltex Petrol Station	Petrol station	Adjacent to surface road works/upgrades
Kogarah	7 Eleven Petrol Station + Ultra Tune Mechanics	Petrol station and mechanics	Adjacent to surface road works/upgrades
Kogarah	Fardoulis Chocolates	Food store	Adjacent to surface road works/upgrades
Kogarah	Fardoulis Sweets and Nuts	Food store	Adjacent to surface road works/upgrades
Kogarah	Papandreas Rajani & Co.	Financial services	Adjacent to surface road works/upgrades
Kogarah	Southern Sydney Dietetics	Health Services	Adjacent to surface road works/upgrades
Kogarah	Sydney Labour	Labour hire	Adjacent to surface road works/upgrades
Kogarah	CA Partners	Financial services	Adjacent to surface road works/upgrades
Kogarah	Genius Loan Solutions Pty Ltd	Financial services	Adjacent to surface road works/upgrades
Kogarah	Rockdale Office Furniture	Furniture store	Adjacent to surface road works/upgrades
Kogarah	Wash My Ride	Car wash	Adjacent to surface road works/upgrades
Kogarah	Caltex Woolworths	Petrol station/ convenience store	Adjacent to surface road works/upgrades
Rockdale	Sheralee Tourist Caravan Park	Caravan park	Around 30 metres from shared cycle and pedestrian pathways
Rockdale	Best Value T-Shirt Printing	Custom T-shirt store	Adjacent to C2
Rockdale	Soccer Shirts international	Soccer store	Adjacent to C2
Rockdale	Sydney Collision Repairs	Auto Repairs	Adjacent to C2
Rockdale	Anytime Fitness	Gym	Adjacent to West Botany Street works
Rockdale	John R Turk Electrical Rockdale	Electrical wholesaler	Adjacent to West Botany Street works
Rockdale	The Lunch Box Kafe	Café	Around 20 metres from West Botany Street works
Brighton-le-sands	Brighton Pacific	Hotel	Adjacent to C2
Rockdale	Ventia Boral Amey Joint Venture	Road construction	Adjacent/within to C2
Rockdale	King Land Massage	Massage company	Adjacent to West Botany Street works
Rockdale	Multiple businesses at 'The Rockdale Centre' (entrance from W Botany Street)	Multiple	Adjacent to West Botany Street works
Rockdale	Rockdale Mechanical Repairs	Car repairs	Adjacent to West Botany Street works
Rockdale	Waterforms International Pty Ltd	Construction company	Adjacent to West Botany Street works and C2
Rockdale	Ralph's Smash repairs	Car repairs	Adjacent to West Botany Street works and C2
Rockdale	Bunnings Warehouse	Home improvement store	Around 70 metres from West Botany Street works
Rockdale	Mansour Paving - Civil Contractors	General contractor	
Rockdale	Fitness First	Gym	Adjacent to West Botany Street works
Rockdale	Repco	Automotive store	Adjacent to West Botany Street works
Rockdale	BBC Tile Centre	Tile store	Adjacent to West Botany Street works
Rockdale	Plus Fitness	Gym	Adjacent to West Botany Street works

Location	Business Name	Business Type	Proximity
Rockdale	EWS Electrical Wholesale services (L&H)	Electrical store	Adjacent to West Botany Street works
Rockdale	Opposite Lock	Four-wheel drive equipment seller	Adjacent to West Botany Street works
Rockdale	InFloorings	Flooring store	Adjacent to West Botany Street works
Rockdale	NRMA Motorserve	Car service	Adjacent to West Botany Street works
Rockdale	Patra Group Pty Ltd	Commercial refrigerator supplier	Adjacent to West Botany Street works
Rockdale	CBD Couriers by demand	Courier service	Adjacent to West Botany Street works
Rockdale	Kirby Industrial Centre	Multiple	Adjacent to West Botany Street works
Rockdale	Zions Safety	Office supply store	Adjacent to West Botany Street works
Rockdale	Pet-O	Pet store	Adjacent to West Botany Street works
Rockdale	Car detailing	Car detailing service	Adjacent to West Botany Street works
Kogarah	Tyrepower	Tyre shop	Within MOC boundary at West Botany Street
Kogarah	Bubblegum clothing outlet	Clothing outlet	Within MOC boundary at West Botany Street
Rockdale	Glass Direct Australa	Glass and mirror shop	Within MOC boundary at West Botany Street
Rockdale	P & C Joinery commercial fitout	Furniture store	Within MOC boundary at West Botany Street
Rockdale	Heritage Building Centre	Building materials supplier	Adjacent to C2
Rockdale	Capral Aluminium Limited	Aluminium warehouse	Adjacent to C2
Rockdale	Salvos Store	Home goods store	Adjacent to C2
Rockdale	Salvation Army Sports Centre	Sports complex	Adjacent to West Botany Street works and C2
Rockdale	Motorcycle Service and Repair Centre	Motorcycle repair shop	Adjacent to C3
Rockdale	St George Metal recovery	Scrap metal dealer	Within 20 metres of C3
Rockdale	IS Motor Racing	Auto Repairs	Adjacent to C3
Rockdale	Revolute Movement Academy	Health club	Within 50 metres of C3 and 70 metres of C2
Rockdale	Husky Tape Converting	Packaging company	Within 50 metres of C3 and 70 metres of C2
Rockdale	CT Automotive	Mechanic	Within 50 metres of West Botany Street works, 80 metres from C3
Rockdale	Uber Onboarding Centre	Uber operations	Within 50 metres of West Botany Street works, 80 metres from C3

The presence of construction vehicles on the road network, installation of construction hoardings, construction equipment, construction activities and acoustic sheds would affect the visual amenity of the environment surrounding the businesses, which would impact businesses sensitive to this, such as food and beverage businesses.

The magnitude of construction activity on amenity for business is considered to be moderate. The sensitivity of affected businesses is considered to be moderate, given some businesses rely on a certain level of amenity to provide a particular customer experience. As a result, the socio-economic significance of construction activity on the amenity for businesses is considered to be moderate.

15.3.7 Economic impacts

Expenditure and employment

Construction activity can benefit the economy by injecting economic stimulus benefits into the local, regional and state economies. The economic benefits of construction include:

- Increased expenditure at local and regional businesses through purchases by construction workers
- Direct employment through on-site construction activities
- Direct expenditure associated with on-site construction activities
- Indirect employment and expenditure through the provision of goods and services required for construction.

The number of direct and indirect jobs generated as a result of the proposed four-year construction period has been estimated based on the following assumptions:

- A base year of 2021 for the start of construction
- A four-year construction period (from 2021 to 2024)
- The project opening to traffic in 2025.

Direct jobs are defined as those relating to the project's development throughout construction, commissioning, operation and management of the facility and would include on-site labour, supervision, professional services and project managers. Indirect jobs are defined as jobs that support the project through the provision of goods and services such as off-site manufacturing and equipment hire (within Australia).

Based on a four-year construction period, direct (on site) 3,250 job years[20] would be created from 2021 to 2024, which is equivalent to 812 full time equivalent jobs. Furthermore, around 2,050 indirect (off-site) full time equivalent jobs would be generated in a typical construction year.

Construction of the project would significantly increase the employment opportunities across the study area, and is considered to have a significant positive benefit for the local economy. As a result, the magnitude of impact on expenditure and employment is considered to be moderate. The sensitivity of affected stakeholders is considered to be low. As such, the overall socio-economic significance on expenditure and employment is considered to be moderate (positive).

Value add

The construction industry contributes around 7.7 per cent of total gross domestic product (GDP) to the Australian economy. In calculating the flow-on economic benefits of a project, it is common to employ economic multipliers. Multipliers refer to the level of additional economic activity generated by a source industry. There are two types of multipliers:

- Production induced, comprising:
  - First round effects (all outputs and employment required to produce the inputs for construction)
  - Industrial support effect (induced extra output and employment from all industries to support the production of the first round effect)
- Consumption induced, which relates to the demand for additional goods and services due to increased spending of wages and/or salaries across all industries.

[20] One job for one year is one 'job year'

Consumption induced effects comprise the increase in output required to satisfy the additional demand generated by the increased wages and salaries resulting from all increased output (i.e. direct and indirect employment).

The estimated construction costs of the project (F6 Extension Stage 1) and ABS multipliers have been analysed to determine that construction of the project would generate a further $775 million of activity in production induced effects per year of construction and nearly $300 million in consumption induced effects per year. Total economic activity generated by the full construction of the project would be around $4.3 billion.

Overall, construction of the project (F6 Extension Stage 1) would produce a long-term economic benefit for the region. The magnitude of this effect is considered to be moderate and the sensitivity of affected stakeholders is considered to be low. As such, the socio-economic significance of these benefits would be moderate-low (positive).

Property values

Property values are driven by a range of factors. Business property values are generally driven by factors such as access to or proximity to markets and products, customer access, and visibility, whereas residential property values are more heavily influenced by liveability factors such as local amenity and accessibility to employment, transport and social infrastructure.

The project has the potential to affect business property values through changes to factors such as passing trade and access for deliveries.

Impact on property values during construction would be of a temporary nature and would affect both residential and commercial property owners. Impacts are likely to arise from uncertainty about acquisition and the magnitude of potential amenity, accessibility and construction traffic effects leading to potential impacts to the perceived value of properties during the construction period. These impacts are likely to be highly specific to individual businesses according to their type.

The long term impact of the project on property values would be influenced by the long term benefits of the project as perceived in the land and property markets, arising from general overall improvements in amenity and improved road safety, as traffic movements in the area change. New project elements such as the shared cycle and pedestrian pathways would provide improved connectivity, bringing a positive influence on the property values of surrounding communities. These pathways would be further enhanced through the reinstatement of Rockdale Bicentennial Park.

Generally future movements in the value of a property are difficult to forecast as they are subject to many variables, including specific attributes of the property, capital investments, demand and supply factors and other changes in the wider property market.

15.3.8 Impacts to community identity, values and aspirations

Potential impacts on community identity, values and aspirations are assessed in **Table 15-14**, with reference to further assessment in the following sections.

Table 15-14 Assessment of impacts to community identity, values and aspirations

Community identity, values and aspirations	Assessment of potential impacts
Community identity and wellbeing	As outlined in section 15.2.5 it is apparent that local communities within the study area value their local area as a safe and welcoming place. This value is likely to be influenced in part by the visual aesthetics of the area, as a place that people enjoy visiting and living in, as well as their goal to be inclusive and embrace cultural diversity. The presence of construction activities and an influx of newcomers to the area as part of the construction workforce may affect local amenity and the community's perception of safety. As discussed in section 15.3.2, it is unlikely that there would be substantial changes to the local demographic profile due to construction of the project. Construction hoarding would be installed to limit visual impacts of construction of the project. The construction contractor would prepare and implement a construction strategy, including a code of conduct for the construction workforce to promote and encourage respect for local residents and businesses, and maintain the community perception of a safe and welcoming community. Impacts to amenity and community wellbeing are assessed in section 15.3.3. Section 15.2.5 identifies the local community as an active and healthy place, with a number of concerns raised around the project's potential impacts on areas of public open space and recreation. Concerns were raised with regard to specific sporting fields and clubs, including access to, amenity and enjoyment of these areas by a range of stakeholders (e.g. sporting clubs, school groups, dog walkers, cyclists and the general public for exercise and recreation). Access to areas of public open space and recreation provides the opportunity for numerous community-scale health benefits including improved overall cardiovascular health, reduced stress and improved mental health[21]. Maintaining the accessibility and amenity of public open space and recreation also increases opportunities for social interaction and provides areas of respite to relax, play, exercise and socialise. This contributes to the overall wellbeing of local communities and the community identity as an active and healthy place. An increase in construction activity in or around public open space and recreational areas has the potential to reduce the amenity and accessibility of these areas, as discussed in section 15.2.5. These impacts may affect the enjoyment or use of these areas for sporting and recreational uses and may deter people from using these areas for respite and relaxation. However, recreational facilities affected by construction of the project would be temporarily relocated to a nearby area, allowing the community to continue to benefit from use of these facilities during the construction period.
Cultural diversity	The study area is culturally diverse and embraces this diversity as a part of the local community identity. As discussed in section 15.3.2, it is unlikely that there would be substantial changes to the local demographic profile due to construction of the project. While project construction may affect the accessibility or amenity value of some places of worship within the study area, and the religious and cultural background that these facilities support, impacts on the cultural diversity of the study area are not anticipated to be significant. Potential impacts to social infrastructure during construction, including places of worship, are assessed in section 15.2.2.

[21] Healthy Spaces and Places (a collaboration between the Australian Local Government Association, National Heart Foundation of Australia and Planning Institute of Australia) (2009) Design Principles: Parks and Open Space https://www.healthyplaces.org.au/site/parks_and_open_space_full_text.php

Community identity, values and aspirations	Assessment of potential impacts
Governance and engagement	Local communities within the study area are informed and value opportunities for engagement on key issues. Consultation with the community and other stakeholders has been and would continue to be undertaken throughout the design development and construction stages of the project. Local councils, residents and businesses would also have the opportunity to respond to this EIS during the submissions process, as discussed in Chapter 2 (Assessment process).
Economy and employment	The project would provide economic benefits through infrastructure investment and direct expenditure associated with on-site construction activities within the study area. However, potential impacts to local businesses as a result of changes in traffic, access, parking and amenity may affect business revenue. Potential impacts on the local and regional economy during construction are assessed in section 15.3.7. Local communities within the study area value access to employment and training. While construction of the project is likely to require employment of a skilled workforce, the project would aim to maximise equitable training and employment opportunities.
Liveability and environment	The study area is valued for its liveable neighbourhoods, the visual appeal of streetscapes, and aspires to be a clean, green and sustainable community, maintaining and enhancing the quality of its natural and built environments. The liveability of local area is likely to be influenced by its amenity, ease of access and connectivity, and the availability of and access to areas of employment, social infrastructure and local business. The construction strategy to be prepared for the project would seek to reduce the overall duration of construction and to minimise impacts on nearby communities, including impacts to amenity and access and connectivity. Impacts to amenity and community wellbeing are assessed in section 15.3.3. Potential impacts on access and connectivity during construction are assessed in section 15.2.4. The Rockdale Wetlands and Recreation Corridor is highly valued by the local community for its ecological, recreational, heritage and amenity value. Excavation and temporary diversion of the Rockdale Wetlands at Rockdale Bicentennial Park is likely to create community concern for the health and welfare of the wetlands and the flora and fauna that they support, as well as the recreational, heritage and amenity value that this area provides. Potential impacts to these wetlands are likely to affect a number of stakeholders including local community groups that support the wetlands, bird watchers (including community bird watching groups), local councils and local residents who benefit from the aesthetic value that the wetlands provide. Assessment of construction of the project on ecological and local heritage values is provided in Chapter 12 (Biodiversity) and Chapter 19 (Non Aboriginal heritage), respectively. Social and economic impacts on social infrastructure, including recreational areas, are assessed in section 15.2.2.
Connectivity	Local communities within the study area value accessible and efficient transport, including safe and convenient pedestrian and cyclist connections. The selection of construction ancillary facilities and planning of project construction activities has been undertaken to minimise potential impacts to access and connectivity, including access to residences, social infrastructure and local businesses, where possible. Temporary pedestrian and cyclist diversions would be established to maintain active transport networks, where required. Potential impacts on access and connectivity during construction are assessed in section 15.2.4.

Overall, changes to community values as a result of construction of the project would be medium term and reflect a moderate change to the existing environment, particularly through amenity impacts, and changes to access and connectivity. The sensitivity of the local community is considered to be moderate given that these issues reflect local community identity, sense of place and core values and aspirations for their community. The socio-economic significance of potential impacts on community identity, values and aspirations is therefore considered to be moderate.

15.3.9 Cumulative impacts

Cumulative impacts from the construction of the project are discussed in **Chapter 8** (Traffic and transport), **Chapter 9** (Air quality), **Chapter 11** (Noise and vibration), and **Chapter 13** (Landscape and visual). The impacts from the construction of the project would follow on from the construction impacts of the New M5 Motorway / WestConnex project. This would effectively extend the duration of impacts for a period of four years for some receptors in these areas (such as around Arncliffe). The range and intensity of impacts would continue to vary during these periods as construction progresses, with the majority of impacts occurring or expected to occur as a result of certain construction activities (such as from tunnelling) and during certain times of the day (such as outside standard daytime construction hours).

Key impacts resulting from longer duration construction in these areas may include noise and vibration, including ground-borne noise from tunnelling, construction traffic (including spoil haulage), dust, visual impacts and impacts on parking around construction sites. The construction activities that are most likely to extend outside of normal construction hours include utility works, and tunnelling and tunnelling support (such as spoil handing and transport).

15.3.10 Construction fatigue

Construction fatigue relates to receptors that experience ongoing construction impacts from a variety of projects or multiple construction effects of a single project over an extended period of time with few or no breaks between construction periods. Construction fatigue typically relates to the cumulative effects of traffic and access disruptions, noise and vibration, air quality and visual amenity impacts, and the social and economic effects of these impacts, from projects that have concurrent or subsequent construction phases.

For this project, consideration of construction fatigue is most relevant to receptors surrounding the Arncliffe construction ancillary facility (C1), proposed to be undertaken at Kogarah Golf Course which is currently being used for construction of the New M5 Motorway. Construction fatigue may also be experienced by receptors where the complexity of the project requires extended construction timeframes or coordination with other works, such as utility relocations or reconfigurations.

The study area is also subject to ongoing urban development, with LGAs in the study area projected to have significant population growth over the next 20 years (refer **section 15.2.1**). Such growth is anticipated to be accommodated through increased development density in the Arncliffe, Banksia, Rockdale and Kogarah areas, as well as the proposed Cooks Cove development.

As described in **Chapter 3** (Consultation), during construction of the project, the community relations team would build a working relationship with the teams for other major projects to identify sensitive receptors who may be susceptible to construction fatigue, consultation fatigue and complaint fatigue and develop coordinated responses, where needed. Mitigation measures to address impacts of the project that may be experienced over longer durations are provided in the respective technical assessment chapters, including **Chapter 8** (Traffic and transport), **Chapter 9** (Air quality), **Chapter 10** (Noise and vibration) and **Chapter 13** (Landscape and visual).Potentially impacted receptors and a summary of the mitigations proposed to address these issues is provided in **Table 15-15**.

The construction of the permanent power supply route would largely take place in areas separated from other main construction activities associated with the project. These works would also be temporary and progressive throughout the alignment. On this basis the potential for construction fatigue from this element is considered to be low.

Table 15-15 Identification of potential construction fatigue risks areas

Project site and activities	Potentially impacted receptors	Mitigation summary
Arncliffe construction ancillary facility (C1)		
Concurrent or subsequent construction activities for the project and the New M5 Motorway project, including: • Spoil haulage. A respite period of around 12 months is anticipated between projects • Movement of trucks into and out of C1 • Presence of construction workforce (including potential on-street parking impacts).	Adjacent residents and businesses along Marsh Street and the adjoining streets. Sporting and recreational facilities including Kogarah Golf Course and St George Rowing Club. Social infrastructure, including: • Ira's Day Care	Coordination between the project and the New M5 Motorway project would consider any potential overlap between the respective construction programs and allow for maximum respite time between intensive construction activities, where possible. Construction program coordination and potential construction fatigue implications would be identified early and mitigation developed, where necessary. Ongoing community consultation would occur throughout the construction period, with consultation and complaints management coordinated with the New M5 Motorway project team, where possible to reduce the potential for consultation fatigue and complaints fatigue. A car parking strategy would be developed as part of the Construction Traffic and Access Management Plan (CTAMP) to manage potential parking impacts. A construction strategy would be prepared and implemented, including consideration of noise attenuation and periods of respite for affected receptors, a code of conduct for construction personnel to be mindful of their behaviour while working in and travelling to/from local communities and site inductions for the construction workforce prior to the commencement of work, including briefings on the potential impacts and the management measures proposed to minimise impacts.
Rockdale construction ancillary facility (C2)		
Extended duration of project construction activities, including: • Spoil haulage • Tunnel construction (noise) • Movement of trucks into and out of C2 • Changes to access and connectivity on West Botany Street.	Residents and businesses along West Botany Street, Bay Street, England Street and Kurnell Street. Social infrastructure, including: • Places of worship, including Jesus is Lord Church Rockdale and Salvation Army Rockdale Community Church • Child care centres including The Berry Patch Preschool and Brighton-le-Sands Kindergarten • Brighton-Le-Sands Scout Hall, Kurnell Street.	A Business Management Plan would be prepared and implemented which would include measures to maintain appropriate access for customers and the visibility of businesses. Preparation and implementation of a construction strategy (as described above). Ongoing consultation with the community, including affected residents and businesses, would occur throughout the construction period.

Project site and activities	Potentially impacted receptors	Mitigation summary
President Avenue construction ancillary facility (C3)		
Extended duration of project construction activities, including: • Diaphragm wall construction (noise and visual impacts) • Stockpiling of acid sulphate soils (odour impacts) • Movement of trucks into and out of C3 • Changes to access and connectivity on West Botany Street.	Residents and businesses along West Botany Street, O'Neill Street and President Avenue. Sporting and recreation facilities including Rockdale Bicentennial Park, Skate Park and disability playground, Ilinden Sports Centre and Memorial Playing Fields.	Preparation and implementation of a Business Management Plan (as described above). Preparation and implementation of a construction strategy (as described above). Provision of temporary alternative sporting and recreational facilities in nearby locations, including a skate park, children's disability playground and sporting fields, would be investigated during detailed design to account for the temporary loss of these facilities during construction of the project. Ongoing consultation with the community, including affected residents and businesses, would occur throughout the construction period.
Pedestrian and cyclist path east (C4) and west (C5)		
Construction activities for the shared pedestrian and cyclist pathways would be minor in duration and scale. Construction fatigue is not anticipated.	Residents between West Botany Street, Bruce Street, Francis Street and Bestic Street. Sporting and recreational facilities including CA Redmond Field, Rockdale Women's Sports Field, St George District Netball Association, White Oak Reserve and playground, and Sheralee Tourist Caravan Park. Social infrastructure, including: • Cairnsfoot Special Education School • Brighton-Le-Sands Scout Hall, Kurnell Street.	Although no major construction is planned, and therefore construction fatigue is not anticipated, the following mitigation measures would be implemented to reduce potential social and economic impacts: • Preparation and implementation of a construction strategy (as described above) • Ongoing community consultation would occur throughout the construction period.

Project site and activities	Potentially impacted receptors	Mitigation summary
Princes Highway / President Avenue intersection upgrade		
Coordination of the project with other works, including utility relocations or reconfigurations. Extended duration of project construction activities, including: • Night works for upgrade of the Princes Highway / President Avenue intersection (noise) • Changes to access and connectivity on Princes Highway and President Avenue • Presence of construction workforce (including potential on-street parking impacts).	Residents and businesses along President Avenue and Princes Highway. Social infrastructure, including: • TAFE St George College Campus and TAFE St George College Hogben Street Campus • Child care centres including Little Dragons Academy and St Paul's Children Centre • Places of worship including Grace Chinese Christian Church and Saint Paul's Anglican Church • Schools including James Cook Boys Technology High School, Moorefield Girls High School, • Health and medical facilities including St George Private Hospital and Montgomery General Practice.	Preparation and implementation of a Business Management Plan (as described above). Preparation and implementation of a construction strategy (as described above). A car parking strategy would be developed as part of the Construction Traffic and Access Management Plan (CTAMP) to manage potential parking impacts. Ongoing consultation with the community, including affected residents and businesses, would occur throughout the construction period.

15.4 Potential impacts – operation

This section outlines potential social and economic impacts, identified in the context of the social baseline discussed in **section 15.2**, as a result of the project's operation.

15.4.1 Acquisition of property and changes to land use

The project has been designed and developed to minimise the need for surface property acquisition. Where property acquisition could not be avoided, impacts have been balanced by maximising opportunities for the beneficial re-use of land that is required for construction of the project but not operation.

Residential properties

Any private property acquisitions would largely be for permanent infrastructure. There would be very little reusable land to support residential development at the completion of construction. There is a pocket of residential land adjacent to O'Neil Street that would be residual following completion of the President Avenue and the President Avenue construction ancillary facility (C3) construction works (**Figure 14-13** of **Chapter 14** (Property and land use)). The land within this area would be rehabilitated and made ready for a future land use.

As a result, the magnitude of residual residential land is considered to be low given the low number of affected landowners. The sensitivity of affected residential landowners is considered to be moderate, given that landowners would need to relocate and re-establish themselves. As a result, the socio-economic significance of residual residential land is considered to be moderate-low.

Businesses

Any private property acquisitions would largely be for permanent infrastructure. There would be very little reusable land to support commercial development at the completion of construction. Following completion of the Princes Highway / President Avenue intersection upgrade, part of the 7-eleven petrol station site would be residual land (**Figure 14-13** of **Chapter 14** (Property and land use)). This land would be rehabilitated and made ready for a future land use.

As a result, the magnitude of residual business land is considered to be low given the low number of affected landowners. The sensitivity of affected businesses is considered to be moderate, given that landowners would need to relocate and re-establish themselves. As a result, the socio-economic significance of residual business land is considered to be moderate-low.

Social infrastructure

At the completion of project construction, any land not comprising part of the permanent operation elements of the project would be rehabilitated with the intention that it be returned to its original or possibly reconfigured (within the construction footprint) use.

Land required temporarily by way of a construction lease (e.g. for construction within Rockdale Bicentennial Park) would be returned to its former use as public space. Consequently, there would be no residual land in these circumstances.

Residual land within the Arncliffe construction ancillary facility (C1) is shown in **Figure 14-13** of **Chapter 14** (Property and land use). Land permanently occupied at this site would house the Arncliffe Motorway Operations Complex. The land on either side of this facility would be stabilised following the completion of activities and returned to the landowner (Kogarah Golf Course) in accordance with the lease agreement. Future land use and development of this land would be subject to separate approval process.

Within the President Avenue construction ancillary facility (C3), the majority of residual project land falls within Rockdale Bicentennial Park. The land within this area would be reinstated as parkland and would include landscaping works. A concept design for urban design and landscaping works at Bicentennial Park has been prepared and is included in **Appendix C of Chapter 14** (Property and land use). The concept design would be refined during the development of an Urban Design and Landscape Plan which would be prepared in consultation with relevant councils and stakeholders.

Following completion of the shared cycle and pedestrian pathways there would be some residual land, including within the shared cycle and pedestrian pathways construction ancillary facilities (C4 and C5) and White Oak Reserve (**Figure 14-13** of **Chapter 14** (Property and land use)).

As a result, the magnitude of residual social infrastructure is considered to be moderate. The sensitivity of affected social infrastructure is considered to be moderate, given the physical changes to the park land. As a result, the socio-economic significance of residual social infrastructure is considered to be moderate.

Future land use

Land required for the construction of the project that is not required for permanent operational infrastructure, and that would not be subject to the Urban Design and Landscape Plan has been termed remaining project land. This land would consist of:

- Land that would be retained by Roads and Maritime for future (separate) road infrastructure projects
- Land that would be considered for separate future development (residual land).

The potential future use of this land would be identified in the Residual Land Management Plan (RLMP) that would be prepared for the project. A summary of the potential future uses of land required for construction and not required for permanent operational infrastructure is included in **Chapter 14** (Property and land use). These areas would be confirmed following detailed design. A description of how remaining project land would be managed following the project is provided in **Table 14-8.**

In considering the potential future use of remaining project land, regard would be given to identifying opportunities to deliver outcomes that support and connect existing neighbourhoods, complement and stimulate local economies, and provide opportunities for growth across existing and future local industries. The project would not rezone or consolidate remaining project land and therefore there would be no changes to land use zoning for future development.

15.4.2 Changes to the demographic profile

Operation of the project is not anticipated to affect the demographic profile of the study area, as much of the project's operational infrastructure would be unmanned or would require only a small operational workforce. However, for as stated in strategic planning documents, urban development and renewal is anticipated to occur within the vicinity of the project (refer to **Chapter 14** (Property and land use)). This urban development is proposed to contribute to accommodating the significant population growth projected for the area, and Greater Sydney, over the next 20 years.

15.4.3 Amenity and community wellbeing impacts

The project would improve general amenity within the study area by reducing the volume of traffic on surface roads, which would be displaced into the mainline tunnels. This would subsequently reduce current levels of noise and vibration, air pollution from vehicle emissions, traffic movements and congestion.

Adverse amenity impacts during the operation of the project could arise from changes to visual amenity due to the presence of new infrastructure, increased noise levels which could impact the ambience of a business or changes in the distribution of air quality impacts. The majority of these impacts would be localised around the President Avenue intersection, the Arncliffe ventilation facility and the Rockdale ventilation facility.

Emissions associated with the operation of the tunnel relate to the discharge of air from within the tunnel to atmosphere via ventilation outlets. The utilisation of ventilation outlets change the distribution and equity of air quality impacts of vehicles utilising the tunnels compared to air quality impacts from utilisation from surface roads. As assessed in **Chapter 9** (Air quality) and as shown on the dispersion contour plots the predicted outlet concentrations remained well below the relevant air quality criteria.

As discussed in **Chapter 10** (Health safety and hazards) and summarised **Chapter 14** (Property and land use), ground settlement as a result of construction of the project mainline tunnels and President Avenue ramp tunnels may occur under the palaeochannel, and may affect the Muddy Creek concrete-lined channel. The range of impacts may include: concrete cracking, opening of expansion joints, pooling water, and misalignment of slabs. However, any settlement would occur slowly and is not anticipated to pose a significant risk to public safety.

Arncliffe Motorway Operations Complex

The Arncliffe Motorway Operations Complex would comprise operational facilities constructed both within and adjacent to the New M5 Motorway operational infrastructure. The tunnel ventilation infrastructure for the project would be co-located within the same building as the New M5 Motorway infrastructure adjacent to Marsh Street in Arncliffe. The project's water treatment plant and electrical substation would be located in a separate building adjacent to the above co-located facility.

It should be noted that the operation of the New M5 Motorway operational facilities was approved to include the operation of the co-located F6 Extension Stage 1 facilities. The impact upon nearby sensitive receptors relating to noise and air quality impacts of the relocated F6 Extension Stage 1 operational facilities would not present any increase in the magnitude of impact. With regard to noise, impacts are likely to be reduced through the increased separation of the F6 Extension Stage 1 water treatment facility and substation from sensitive receptors compared to their previous co-location with the New M5 Motorway infrastructure.

The change to the operational layout would have no impact upon traffic generation of the facility compared to that approved as part of the New M5 Motorway.

The separated F6 Extension Stage 1 operational facilities would increase the visual impact of the operational infrastructure in this location. The Landscape and Visual impact assessment (**Chapter 13**) assessed three viewpoints around this operational facility, all of which were deemed to be of a negligible visual impact during both day and night time.

The above changes to amenity would be permanent and highly localised. The severity of impacts would be minimal. As such the overall magnitude of amenity impact within the local area (in addition to that previously assessed as part of the New M5 Motorway) is considered to be negligible. The sensitivity of receptors within this area is considered to be low based upon the existing amenity impacts of Marsh Street and nearby Sydney Airport. As such the socio-economic significance of changes to operational amenity associated with the project in this location would be negligible.

Social infrastructure and community facilities

The operational project would have a permanent impact upon the amenity of Kogarah Golf Course and adjacent pedestrian and cycle path through the occupation of additional land to that was originally planned to be returned to the club upon completion of construction of the New M5 Motorway. This additional footprint required by the project would be used to accommodate the project's water treatment plant and electrical substation. This facility would not alter local amenity for the golf course or pedestrian and cycle path in terms of air quality or traffic compared to the approved New M5 Motorway facility. The F6 Extension Stage 1 infrastructure would increase the extent of noise impacts to users of the golf course and pedestrian and cycle path, though these are expected to be minimal on the basis that the noise at the nearest affected residential receptor would not exceed operational criteria.

The additional operational footprint of this facility would initially result in a low visual impact to users of the golf course and pedestrian and cycle path. Over time screening vegetation around the facility would mature, obscuring most views to the single-storey building and as a result the overall operational visual impact is expected to be negligible.

There would be no impact upon any other community facilities within this location. Given the above identified amenity change the overall magnitude of impact would be negligible. The sensitivity of golf course patrons and pedestrian and cycle path users would be expected to be moderate, resulting in a negligible overall socio-economic significance.

Rockdale Motorway Operations Complex (north)

The project would be controlled and managed from the operational motorway control centre located within the Rockdale Motorway Operations Complex (north) on West Botany Street, as described in **Chapter 6** (Project description). This facility would largely operate in line with the current use of the site and would not include any ventilation facility for the project.

Visual impact

Chapter 13 (Landscape and Visual Impact Assessment) assesses the operational impact to views from public land to the west of the Rockdale Motorway Operations Complex (north). The location of this facility within a light industrial area means that there would be a low visual impact for views from West Botany Street and adjacent areas due to the compatibility of this structure with the surrounding area.

Noise and vibration

As discussed in **Chapter 11** (Noise and Vibration), noise emissions during operation of this control centre during normal traffic conditions, low speed traffic conditions and emergency operating conditions would not exceed the operational noise criteria during the day time or night time (including in adverse weather conditions).

Traffic and access

While the motorway control centre would operate 24 hours a day, seven days a week, this would largely be via a computerised operations management and control system.

Air quality

This facility would not include any ventilation facility. Air emissions are expected to be limited to project vehicles accessing the site on a daily basis. As outlined above, the likely number of vehicles using this site would be low and as such air quality impacts to amenity would be negligible.

Overall amenity

The above changes to amenity would be permanent and highly localised. The severity of impacts would be minimal. As such the overall magnitude of amenity impact within the local area is considered to be negligible. The sensitivity of receptors within this area is considered to be low based upon the amenity impacts of West Botany Street and surrounding industrial development. As such the socio-economic impact of changes to operational amenity associated with the project in this location would be negligible.

Social infrastructure and community facilities

There are a large number of community facilities located within 400 metres of the Rockdale Motorway Operations Complex (north). These include five child care centres, two schools, four churches, a gym and several areas of public open space. As outlined above the individual local amenity impacts of the Rockdale Motorway Operations Complex (north) are expected to be negligible to low.

Operational noise impacts upon community facilities arising from this facility be limited, with only one community facility in this area being deemed eligible for additional noise mitigation (Brighton-Le-Sands Public School). This is however due to traffic noise, not impact from the Rockdale Motorway Operations Complex (north).

The operation of the Rockdale Motorway Operations Complexes (north) would have a negligible traffic impact as discussed above. The facility would initially result in a low visual impact to users of community facilities in the area, however is not inconsistent with other development in the area. On this basis the overall operational visual impact is expected to be negligible.

The spatial extent of the above impacts is local, with the duration permanent. Whilst severity varies for each factor overall this is limited. On this basis the overall magnitude of amenity impacts upon social infrastructure is deemed to be low. Taken as a whole, the sensitivity of the nearby social infrastructure and community facilities would be moderate. As such the overall socio-economic impact upon these facilities would be moderate-low.

Rockdale Motorway Operations Complex (south)

The Rockdale Motorway Operations Complex (south), also located on West Botany Street, would comprise the Rockdale ventilation facility and other operational infrastructure as described in **Chapter 6** (Project description). The Rockdale Motorway Operations Complex (south) would be located on the west side of West Botany Street, opposite Rockdale Bicentennial Park.

Visual impact

Chapter 13 (Landscape and Visual Impact Assessment) assesses the operational impact to views along West Botany Street and within Ilinden Sports Centre that would be affected by the Rockdale Motorway Operations Complex (south). The establishment of this facility represents a permanent change, although the facility itself would not be dissimilar to the existing character of the western side of West Botany Street.

Noise and vibration

As discussed in **Chapter 11** (Noise and Vibration), noise emissions during operation of this control centre during normal traffic conditions, low speed traffic conditions and emergency operating conditions would not exceed the operational noise criteria during the day time or night time (including in adverse weather conditions).

Traffic and access

While the motorway control centre would operate 24 hours a day, seven days a week, this would largely be via a computerised operations management and control system.

Air quality

This facility would include a ventilation facility. The effect of this on air quality is assessed in **Chapter 9** (Air quality). It concludes that emissions from the project ventilation outlets, even in the regulatory worst case scenarios, would be unlikely to result in adverse impacts on local air quality. Roads and Maritime would conduct ambient air quality monitoring of emissions from the ventilation outlets to enable continual assessment of any impact on local air quality.

Overall amenity

The above changes to amenity would be permanent and highly localised. The severity of impacts resulting from the operation of the Rockdale Motorway Operations Complex (south) would be minimal. As such the overall magnitude of amenity impact within the local area is considered to be negligible. The sensitivity of receptors within this area is considered to be low based upon the amenity impacts of West Botany Street and surrounding industrial development. As such the socio-economic impact of changes to operational amenity associated with the project in this location would be negligible.

Social infrastructure and community facilities

There are a large number of community facilities located within 400 metres of the Rockdale Motorway Operations Complex (south). These include seven recreation and sporting facilities, the Sunnyhaven Disability Service, and a church.

As outlined above the individual local amenity impacts of the Rockdale Motorway Operations Complex (south) are expected to be negligible.

Operational noise impacts upon community facilities arising from this facility would comply with the applicable criteria at the most affected residential receptors, with appropriate noise controls in place. Therefore the facility would have negligible impact on surrounding social infrastructure and community facilities.

The operation of the Rockdale Motorway Operations Complex (north) would have a negligible traffic impact upon community facilities as the facility would generate a limited volume of traffic.

The Rockdale MOC would be largely concealed from public view behind residential and industrial properties. The MOC would be largely consistent with existing industrial development in the area and as such is expected to result in a negligible operational impact upon local amenity.

The spatial extent of the above impacts is local, with the duration permanent. Whilst severity varies for each factor overall this is limited. On this basis the overall magnitude of amenity impacts upon social infrastructure is deemed to be low. Taken as a whole, the sensitivity of the nearby social infrastructure and community facilities would be moderate. As such the overall socio-economic impact upon these facilities would be moderate-low.

President Avenue intersection

The President Avenue intersection would consist of a new intersection in a location that was previously open space and roadway. As discussed in **Chapter 6** (Project description) the intersection would connect the entry and exit ramps with the existing surface road network. All traffic would enter and exit the tunnels at the President Avenue intersection (as shown in **Figure 6-10**). Nearby residents would likely be more susceptible to impacts associated with increased noise, such as general annoyance and interference with household activities such as eating outdoors. Some residents may experience stress and anxiety and sleep disturbance. This is considered to have a moderate negative impact on the social and economic environment for residents who are currently shielded from traffic noise.

Open space areas are also particularly sensitive to changes in noise levels. Increased noise levels in proximity to Rockdale Bicentennial Park and Scarborough Park North may affect a person's desire to use the parks (including the reinstated Rockdale Bicentennial Park) in the future given elevated noise levels in the surrounding area.

At locations where residual impacts remain after all feasible and reasonable approaches have been exhausted, noise mitigation in the form of acoustic treatment of existing individual dwellings would be considered (refer to **Chapter 11** (Noise and vibration)).

Visual impact

Chapter 13 (Landscape and Visual Impact Assessment) assesses the operational impact to views from public and private land in the vicinity of the President Avenue intersection. The establishment of this intersection represents a permanent change, although the reinstatement works (as shown in **Figure 6-12** of **Chapter 6** (Property and land use)) would, over time, go some way to mitigating the visual impact. In particular, the establishment of vegetation along the road corridor would minimise the impact of views from the recreation and sporting facilities nearby. At night the new President Avenue intersection, entry and exit ramps and tunnel portal would be brightly lit, representing a change from the surrounding dark setting of the park.

Noise

Noise sensitive receptors include residents and users of social infrastructure in the area. As a result of this new intersection there would be an increase in noise within the surrounding area. As discussed in **Chapter 11** (Noise and vibration) both the daytime and night-time noise criterions would be exceeded at a number of receptors. Some of these receptors would be eligible for the consideration of feasible and reasonable noise mitigation measures, such as architectural treatment (to be confirmed in the detailed design phase) (refer to **Appendix G** Noise and vibration technical report).

Traffic and access

As discussed in **Chapter 8** (Traffic and transport), with the operation of the President Avenue intersection there would be increased travel times and reduced average speeds along Princes Highway and West Botany Street (in both the AM and PM peaks) with smaller increases in travel time along The Grand Parade.

Air quality

As discussed in **Chapter 9** (Air quality) and as detailed on the contour plans, there would be a decrease in local air quality within proximity to the President Avenue intersection as a result of increased traffic. This has the potential to affect local amenity particularly for receptors, participating in activities within the surrounding recreation and sporting facilities.

Overall amenity

The above changes to amenity would be permanent and highly localised. The severity of impacts would be moderate. As such the overall magnitude of amenity impact within the local area is considered to be moderate. The sensitivity of receptors within this area is considered to be high based on the number and proximity of recreational and residential receptors. As such the socio-economic impact of changes to operational amenity associated with the project in this location would be high.

Social infrastructure and community facilities

There are a large number of community facilities located within 400 metres of the President Avenue intersection. These include seven recreation and sporting facilities, the Sunnyhaven Disability Service, and a church. As outlined above the individual local amenity impacts of the President Avenue intersection are expected to be high. As a result of the operation of this new intersection there would be an increase in noise experienced by users of the adjacent social infrastructure. As discussed in **Chapter 11** (Noise and vibration) both the daytime and night-time noise criterions would be exceeded.

With the reinstatement works, the President Avenue intersection would result in a moderate visual impact to users of social infrastructure and community facilities in the area. On this basis the overall operational visual impact is expected to be moderate. The spatial extent of the above impacts is local, with the duration permanent. On this basis the overall magnitude of amenity impacts upon social infrastructure and community facilities is deemed to be moderate. Taken as a whole, the sensitivity of the nearby social infrastructure and community facilities would be moderate. As such the overall socio-economic impact upon these facilities would be moderate.

Princes Highway/President Avenue intersection

As discussed in **Chapter 6** (Project description) the project would include the widening of President Avenue and Princes Highway at their intersection to provide additional turning lanes and to increase the intersection's capacity and performance.

Visual impact

Chapter 13 (Landscape and visual) assesses the operational impact of views to the President Avenue/Princes Highway intersection. The widening of this intersection represents a permanent change, although the intersection would not represent a substantial departure from the existing character of this area.

Noise and vibration

Noise sensitive receptors include residents and users of social infrastructure in the area. As a result of this new intersection there would be an increase in operational noise within the surrounding area. As discussed in **Chapter 11** (Noise and vibration) both the daytime and night-time noise criteria would be exceeded at a number of receptors. Some of these receptors would be eligible for the consideration of feasible and reasonable noise mitigation measures, such as architectural treatment (to be confirmed in the detailed design phase) (refer to **Appendix G** Noise and vibration technical report).

Traffic and access

As discussed in **Chapter 8** (Traffic and transport), during operation of the project traffic is expected to shift to utilising the tunnels which would reduce (compared to the 'do minimum') the traffic volumes on both President Avenue and Princes Highway,

Air quality

As discussed in **Chapter 9** (Air quality) and as detailed on the contour plans there would be an increase in concentration of some air emissions along President Avenue to the west of the new intersection. This has the potential to affect local amenity particularly for sensitive receptors, including the amenity and enjoyment of activities within the surrounding recreation and sporting facilities.

Overall amenity

The above changes to amenity would be permanent and highly localised. The severity of impacts from the operation of the President Avenue/Princes Highway intersection would be minimal. As such the overall magnitude of amenity impact within the local area is considered to be low. The sensitivity of receptors within this area is considered to be low based upon the existing impacts to amenity. As such the socio-economic impact of changes to operational amenity associated with the project in this location would be low.

Social infrastructure and community facilities

There are a large number of community facilities located within 400 metres of the President Avenue/Princes Highway intersection. These include three child care centres, two primary schools, six high schools, one special school, four places of worship, five hospitals/medical facilities, a public pool, playground and reserve, and a police station.

As outlined above the individual local amenity impacts of the President Avenue/Princes Highway intersection) are expected to be low.

As a result of the operation of this widened intersection there would be an increase in noise experienced by users of nearby social infrastructure. As discussed in Chapter 11 (Noise and vibration) both the daytime and night-time noise criterions would be exceeded.

The widened intersection would result in a moderate visual impact to users of social infrastructure and community facilities in the area, given the relative change to the existing intersection.

The spatial extent of the above impacts is local, with the duration permanent. On this basis the overall magnitude of amenity impacts upon social infrastructure and community facilities is deemed to be moderate. Taken as a whole, the sensitivity of the nearby social infrastructure and community facilities would be moderate. As such the overall socio-economic impact upon these facilities would be moderate.

Shared cycle and pedestrian pathways

The project would deliver new shared cycle and pedestrian pathways as shown in **Figure 6-14** in **Chapter 6** (Project description). These would be developed from Bestic Street, Brighton-le-Sands south to Civic Avenue, Kogarah through the reinstated Rockdale Bicentennial Park, including some parts as an on-road cycleway. As part of the project, a dedicated shared cycle and pedestrian bridge would be built over President Avenue. The shared cycle and pedestrian pathways would provide connections with several existing and proposed routes.

Visual impact

Chapter 13 (Landscape and visual) assesses the operational impact to views from public land to the west of the shared cycle and pedestrian pathways. The operation of the new shared cycle and pedestrian pathways represents a permanent change, although the reinstatement works (as shown in **Figure 6-12** of **Chapter 6** (Project description)) would, over time, go some way to mitigating the visual impact of the pathways. In particular, the establishment of vegetation along the pathways would eventually screen of views from the recreation and sporting facilities nearby. The cycle and pedestrian footpath bridge over President Avenue would have a low impact on view 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.

Noise

While there are noise sensitive receptors (including residents and users of social infrastructure) in the area, the operation of the shared cycle and pedestrian pathways would not exceed either the daytime or night-time noise criterions.

Traffic and access

The operation of the new shared cycle and pedestrian pathways would increase the availability of alternative transport methods in the area and thus have a positive impact on the operation of the transport network.

Air quality

The operation of the new shared cycle and pedestrian pathways would increase the availability of alternative transport methods in the area and thus potentially reduce the need for motorised transport, resulting in a positive impact upon local air quality.

Overall amenity

The above changes to amenity would be permanent and localised. The severity of impacts would be minimal. As such the overall magnitude of amenity impact within the local area is considered to be negligible. The sensitivity of receptors within this area is considered to be high based upon the number and type of users of Rockdale Women's Sports Field, CA Redmond Field, Greg Arkins Mini Field, Rockdale Bicentennial Park, Scarborough Park North and surrounding residential development. As such the socio-economic impact of changes to operational amenity associated with the project in this location would be negligible.

Social infrastructure and community facilities

There is a large number of community facilities located within 400 metres of the new shared cycle and pedestrian pathways. These include the 14 recreation and sporting facilities (including Rockdale Women's Sports Field, CA Redmond Field, Greg Arkins Mini Field, Rockdale Bicentennial Park, and Scarborough Park North), five child care centres, three primary schools, one special school, one aged care, five places of worship, two hospital and medical facilities, and two community services.

The operation of new shared cycle and pedestrian pathways would have a moderate visual impact to users of social infrastructure and community facilities in the area, given the relative change to the existing park infrastructure. On this basis the overall operational visual impact is expected to be moderate. The spatial extent of the above impacts is local, with the duration permanent. As such the overall magnitude of amenity impacts upon social infrastructure and community facilities is deemed to be moderate. Taken as a whole, the sensitivity of the nearby social infrastructure and community facilities would be moderate. The overall socio-economic impact upon these facilities would be moderate.

15.4.4 Access and connectivity impacts

Permanent changes to the existing road, public transport and active transport networks could potentially affect access and connectivity for residents, business owners and visitors. This section assesses the potential access and connectivity impacts during operation of the project.

Road network

Once operational the project is forecast to reduce travel times between southern Sydney and the CBD, as well as facilitating faster journeys elsewhere through the broader Sydney motorway network. The project would also reduce traffic on sections of major arterial roads including Princes Highway, West Botany Street and General Holmes Drive

Reduced heavy vehicle volumes on non-motorway links is also forecast, as heavy vehicles shift onto the F6 Extension Stage 1. Daily heavy vehicle volumes are expected to fall by approximately 50 per cent on sections of Princes Highway and West Botany Street, and by more than 20 per cent on General Holmes Drive.

These benefits, with improved access and connectivity to the Sydney CBD, align with community values and aspirations for the former Rockdale City and Kogarah City LGAs and are likely to be perceived positively by the local community.

As part of detailed design and construction of the project the proponent and construction contractor would investigate prioritising the construction of the shared cycle and pedestrian pathways between Bestic Street and Bay Street. Should this be feasible, it would provide the local community with the benefit of a permanent improvement to pedestrian and cycle access early in the construction program.

The operation of the project may lead to isolated areas of increased community severance. Community severance relates to physical or psychological barriers between communities that discourage movement or interaction. The operation of the project has the potential to create or exacerbate this effect around areas of surface infrastructure such as widened roads, new intersections or in areas of increased traffic. In particular changes to the road layout on and around President Avenue, including the closure of some local roads, may affect community severance. In this case though, the potential for impacts is considered to be low based upon the existing busy nature of President Avenue and the existing access restrictions to some side roads. Reduction in the ability for vehicles to access side roads would however improve pedestrian connectivity, reducing the need to cross intersections to move east and west along President Avenue.

The project would also provide additional connectivity improvements for pedestrians and cyclists through the shared cycle and pedestrian pathways. This would north-south connectivity along the majority of the project, as well as providing east-west connections to relevant social infrastructure such as schools and sporting fields. Importantly, the President Avenue bridge would dramatically improve pedestrian cyclist connectivity across President Avenue – a major local and regional road corridor that would see an increase in traffic during operation.

Overall, the project is forecast to improve travel times, reduce congestion, reduce travel costs and reduce traffic-related mental and physical health impacts for both motorists and residents living near major arterial surface roads in the area. Changes to local roads are unlikely to affect the broader road network. However, these changes would directly affect accessibility for local residents, businesses and visitors. Generally, improvements to the overall road network and the mental and physical wellbeing of local residents on certain major roads are considered a high positive benefit to the social and economic environment.

As a result, the magnitude of operational impact is considered to be moderate positive. The sensitivity of affected stakeholders is considered to be moderate based upon their existing degree of access and severance. As such, the overall significance to the road network resulting from the operation of the project on the socio-economic environment is considered to be moderate positive.

Public transport

The reduction in traffic forecast on key roads with the project is expected to improve bus speed and reliability and access to public transport (i.e. train stations). This would contribute to a number of direct and indirect social and health benefits such as reduced stress and accessibility. As people often choose to shop, visit and spend their time at the most convenient and accessible locations, changes to public transport travel times may benefit businesses and social infrastructure within the study area.

Increases in traffic on the Princes Highway (south of President Avenue) and along President Avenue would be expected to increase travel times for road users. This may contribute to increased stress and accessibility for the community.

Adverse impacts on the road network arising from delays due to the project are considered low and are unlikely to deter a person from using public transport Details of changes to public transport as a result of the project are outlined in **Chapter 8** (Traffic and transport).

As a result, the magnitude of operational impact on public transport is considered to be low. The sensitivity of affected stakeholders is considered to be moderate. The overall significance to public transport resulting from the operation of the project on the socio-economic environment is considered to be moderate-low.

Active transport

Social and economic benefits from active transport networks include enhanced connectivity, increased opportunities for social interaction and community cohesion, improved access to job opportunities, reduced car dependency, reduced cost of travel and the promotion of more active lifestyles, resulting in community health benefits.

As outlined above, the shared cycle and pedestrian pathways (including the President Avenue bridge) to be delivered as part of the project would substantially improve the connectivity of the active transport network in the study area. This path would be separated from traffic and would therefore also improve the safety of the network.

During consultation, the community expressed their aspiration (and provided suggestions) for upgraded and new active transport links. These have been accommodated as far as feasible and as such the provision of the shared cycle and pedestrian pathways are considered a high positive impact, as it would result in a noticeable, long-term change to the social and economic environment, benefiting a large number of people.

On this basis the magnitude of operational impact on active transport networks is considered to be moderate positive. The sensitivity of affected stakeholders is considered to be moderate. The overall significance to the active transport networks resulting from the operation of the project on the socio-economic environment is considered to be moderate positive.

Parking

The project would implement peak period clearways in both directions along President Avenue, which would reduce the number of parking opportunities in this area throughout the week day. It should be noted that this road has existing clearways eastbound in the AM peak and westbound in the PM peak, and as such the change from the existing scenario would not be substantial. Furthermore, parking availability in adjacent side streets would remain unchanged.

The section of the Princes Highway (southbound) near the intersection with President Avenue is currently designated as no parking, and would remain so once the project is operational.

During operation of the project, there would be no changes to local roads and parking around Arncliffe, the Rockdale Motorway Operations Centre (north) or the Rockdale Motorway Operations Centre (south).

On this basis the magnitude of operational impacts on parking is considered to be negligible. The sensitivity of affected stakeholders is considered to be moderate. As such, the overall significance to parking resulting from the operation of the project on the socio-economic environment is considered to be negligible.

15.4.5 Social infrastructure impacts

Elements of the operational project have the potential to affect users of social infrastructure in the nearby area. These impacts are outlined and assessed with reference to the specific type of social infrastructure below.

Educational facilities

There are a large number of education facilities within 400 metres of the project, including five primary schools, six high schools, and two special schools,

Chapter 9 (Air quality) indicates that predicted changes in concentrations of air pollutants would be driven by changes in the traffic volumes on the modelled surface road network, not by the tunnel ventilation outlets. While these outlets would contribute some increase in local air pollutants such as particulate matter, these would not exceed relevant criteria for any location. Under all modelling scenarios air quality at all facilities would not be significantly affected such that the presence of the operational project would cause exceedances of criteria limits. In these cases high existing background levels would continue to dominate the air quality environment, with one measure (annual mean $PM_{2.5}$ concentration) already exceeding criterion limits for all facilities. This includes Brighton-Le-Sands Public School, where there would be a slight fall in 24-hour $PM_{2.5}$ concentration under all scenarios.

Air quality around Kogarah TAFE, James Cook Boys Technology High School, Moorefield Girls High School, St Patrick's Catholic Primary School and St George School would be affected by changes to surface road traffic along Princes Highway and President Avenue. In each of these cases air quality changes associated with the project would not cause any of these facilities to exceed criterion levels (noting that annual mean $PM_{2.5}$ concentrations already exceed criterion limits for these facilities).

On this basis the overall changes to local air quality for local education facilities is deemed to be negligible.

During operation the project would contribute to noise exceedances at Kogarah TAFE, James Cook Boys Technology High School (both exceeds cumulative noise limit) and Brighton-Le-Sands Public School (exceeds the road noise policy limits and increases by more than 2.0 dB(A) due to the project). Affected buildings within each of these facilities would be eligible for consideration of at-property architectural treatment, should noise impacts not be able to managed as part of the detailed design.

As discussed in **Chapter 11** (Noise and vibration) noise mitigation (such as architectural treatment) has been recommended to minimise impacts on the impacted educational facilities from the noise impacts associated with the operation of the project. Operational traffic noise would be monitored at sensitive receptors between six months and one year after opening.

The new shared cycle and pedestrian pathways would provide an improved active transport link in close proximity to many educational facilities. As previously discussed, this corridor would be separated from motorised traffic and would therefore also improve the safety of the network, particularly for vulnerable transport users (such as children). The changes to the public transport network are considered to have an overall negligible impact to users of educational facilitates.

Landscape and visual impacts of the project on educational facilities would be negligible given their proximity to the project areas. Brighton Le-Sands Public School would be the closest to the operational elements of the project. This school would view elements of the project from a distance, with views largely screened by existing parkland vegetation.

Care, health, medical, and emergency services facilities

There are a large number of care, health, medical, and emergency services facilities within 400 metres of the project. These include nine child care centres, one aged care facility, two emergency services, and eight hospital and medical facilities.

Chapter 9 (Air quality) indicates that predicted changes in concentrations of air pollutants would be driven by changes in the traffic volumes on the modelled surface road network, not by the tunnel ventilation outlets. While these outlets would contribute some increase in local air pollutants such as particulate matter, these would not exceed relevant criteria for any location.

Under all modelling scenarios air quality at all facilities would not be significantly affected such that the presence of the operational project would cause exceedances of criteria limits. In these cases high existing background levels would continue to dominate the air quality environment, with one measure (annual mean $PM_{2.5}$ concentration) already exceeding criterion limits for all facilities. It is further noted that four childcare centres already exceed 24-hour $PM_{2.5}$ concentration limits as part of the baseline assessment.

On this basis the overall changes to local air quality for these facilities is deemed to be negligible.

No care, health, medical, and emergency services facilities were identified in **Chapter 11** (Noise and vibration) as being adversely affected by the operation of the project.

The new shared cycle and pedestrian pathways would provide an improved active transport link in close proximity to many of these facilities. As previously discussed, this corridor would be separated from traffic and would therefore also improve the safety of the network, particularly for vulnerable

transport users (such as children and the elderly). The changes to the public transport network are considered to have an overall negligible impact to users of care, health, medical, and emergency services facilities. As discussed in **Chapter 8** (Traffic and transport) overall, the project is forecast to improve travel times, reduce congestion, reduce travel costs, thereby not adversely affecting on the ability to provide a timely emergency service response.

Many of these facilities are located within close proximity to the widened Princes Highway/President Avenue intersection, around the Rockdale Motorway Operations Centre (north) and the new shared cycle and pedestrian pathways. As discussed in **Chapter 13** (Landscape and visual) there would be a loss of vegetation and open spaces within the Rockdale Bicentennial and Scarborough Parks, although these impacts would be minimised through the eventual reinstatement works.

Places of worship

There are ten places of worship within 400 metres of the project.

Chapter 9 (Air quality) indicates that predicted changes in concentrations of air pollutants would be driven by changes in the traffic volumes on the modelled surface road network, not by the tunnel ventilation outlets. While these outlets would contribute some increase in local air pollutants such as particulate matter, these would not exceed relevant criteria for any location.

Under all modelling scenarios air quality at all facilities would not be significantly affected such that the presence of the operational project would cause exceedances of criteria limits. In these cases high existing background levels would continue to dominate the air quality environment, with one measure (annual mean $PM_{2.5}$ concentration) already exceeding criterion limits for all facilities.

On this basis the overall changes to local air quality for these facilities is deemed to be negligible.

No places of worship were identified in **Chapter 11** (Noise and vibration) as being adversely affected by the operation of the project.

The new shared cycle and pedestrian pathways would provide an improved active transport link in close proximity to many of these facilities. As previously discussed, this corridor would be separated from traffic and would therefore also improve the safety of the network, particularly for vulnerable transport users (such as children and the elderly). As discussed in **Chapter 8** (Traffic and transport) the changes to the road and public transport networks are considered to have an overall negligible impact on the ability of users to access places of worship.

Many of the places of worship are located within close proximity to the widened Princes Highway/President Avenue intersection, around the Rockdale Motorway Operations Centre (north) and the new shared cycle and pedestrian pathways. As discussed in **Chapter 13** (Landscape and visual) there would be a loss of vegetation and open spaces within the Rockdale Bicentennial and Scarborough Parks, although these impacts would be minimised through the eventual reinstatement works.

Community service facilities

There are two community services facilities within 400 metres of the project. These are the Bay Community Garden and Brighton Le Sands Scout Hall.

Chapter 9 (Air quality) indicates that predicted changes in concentrations of air pollutants would be driven by changes in the traffic volumes on the modelled surface road network, not by the tunnel ventilation outlets. While these outlets would contribute some increase in local air pollutants such as particulate matter, these would not exceed relevant criteria for any location.

Under all modelling scenarios air quality at all facilities would not be significantly affected such that the presence of the operational project would cause exceedances of criteria limits. In these cases high existing background levels would continue to dominate the air quality environment, with one measure (annual mean $PM_{2.5}$ concentration) already exceeding criterion limits for all facilities.

These facilities were not identified in **Chapter 11** (Noise and vibration) as being adversely affected by the operation of the project.

The new shared cycle and pedestrian pathways would provide an improved active transport link in close proximity to these two community services facilities. As previously discussed, this corridor would be separated from traffic and would therefore also improve the safety of the network, particularly for vulnerable transport users (such as children). As discussed in **Chapter 8** (Traffic and transport) the

changes to the road and public transport networks are considered to have an overall negligible impact on the ability of users to access community services facilities.

Given the distance of the Community Garden from the works, any visual impacts from users of this facility would be negligible. The Brighton Le Sands Scout Hall would be is close proximity to the new shared cycle and pedestrian pathways. As discussed in **Chapter 13** (Landscape and visual) there would be a loss of vegetation and open space within the Rockdale Bicentennial Park, although this impact would be minimised through the eventual reinstatement works.

The magnitude of the operational impact on the community services facilities discussed in the above sections (educational, care, health, medical, emergency services, places of worship and community services) is considered to be negligible. The sensitivity of affected stakeholders is considered to be high. The overall significance to social infrastructure resulting from the operation of the project on the socio-economic environment is considered to be negligible.

Sporting and recreational facilities

There are 28 sport and recreational facilities within 400 metres of the project. These include parks and reserves, playing fields, playgrounds, netball courts, a bowling club, a skate park, a caravan park, and a boating and fishing association.

Chapter 9 (Air quality) indicates that predicted changes in concentrations of air pollutants would be driven by changes in the traffic volumes on the modelled surface road network, not by the tunnel ventilation outlets. While these outlets would contribute some increase in local air pollutants such as particulate matter, these increases would not exceed relevant criteria for any location.

Parts of Rockdale Bicentennial Park, Memorial Fields and Scarborough Park North would be affected by very minor increases in emissions associated with the tunnel entry/exit ramps and additional traffic on President Avenue. These increases would also be highly localised around the road alignments, with the air quality of the main playing fields of Ilinden Sports Centre and Memorial Fields remaining unaffected.

It should be noted that all most areas within the vicinity of the project are already subject to existing background levels of air pollutants which would continue to dominate the air quality environment. The existing annual mean concentration of $PM_{2.5}$ already exceeds criterion limits across the region.

On the basis of the above the magnitude of the project's impact upon the air quality of sporting and recreation facilities is expected to be very low.

As discussed in **Chapter 8** (Noise and vibration) a noise barrier has would be considered on the east side of the entry/exit ramps at the new intersection of President Avenue. This would assist in mitigating noise impacts on the users of Rockdale Bicentennial Park and Memorial Fields.

The new shared cycle and pedestrian pathways would provide an improved active transport link in close proximity to many of the sporting and recreational facilities. This would provide a clear benefit in terms of improving access to these facilities. As discussed in **Chapter 8** (Traffic and transport) the changes to the road and public transport networks are considered to have an overall negligible impact upon the ability of users to access sporting and recreational facilities.

Many of these facilities are located within close proximity to the new President Avenue intersection, around the Rockdale Motorway Operations Centre (south) and the new shared cycle and pedestrian pathways. As discussed in **Chapter 13** (Landscape and visual) there would be a loss of vegetation and open spaces within the Rockdale Bicentennial and Scarborough Parks, although these impacts would be minimised through the eventual reinstatement works.

As a result, the magnitude of operational impact on sporting and recreational facilities is considered to be moderate. The sensitivity of affected stakeholders is considered to be moderate. The overall significance to sporting and recreational facilities resulting from the operation of the project on the socio-economic environment is considered to be moderate.

15.4.6 Business and industry impacts

Elements of the operational project have the potential to affect businesses in the nearby area. These impacts are outlined and assessed with reference to specific types of businesses below.

Deliveries, access and parking

Businesses rely on deliveries and dispatch of goods to support the sale of products and/or services, as well as relying on services from other businesses such as refuse collection. These activities may sometimes be required multiple times per day.

Permanent changes to the existing road network have the potential to both positively and adversely affect servicing, delivery and dispatch opportunities for businesses in the vicinity of the project. This may occur through street closures, alterations to on-street parking locations or restrictions, or changes to intersections such as turn restrictions. In certain cases this can result in increased costs for businesses through extensions of delivery routes, additional driver wages or through the need to find alternative parking or delivery arrangements.

Overall, it is expected that the local road, active transport and public transport network would improve as a result of the operation of the project. Increased accessibility and connectivity has the potential to reduce delivery times, increase delivery reliability and reduce transport costs for businesses. Access for customers travelling to business premises in the area would also be improved as a result of better links to other regions within Sydney and beyond.

A general reduction in traffic is expected along the Grand Parade and Princes Highway, which would potentially benefit businesses in these locations through generally improved amenity and improved delivery and dispatch efficiency.

At Arncliffe there would be no surface changes to local roads or parking such that customer or worker access or servicing or deliveries to any existing businesses would be affected. Similarly, there would be no permanent changes to local roads and parking around the Rockdale Motorway Operations Centre (north) that are likely to affect customer or worker access or servicing or deliveries to businesses on West Botany Street.

There would be no operational changes to surface roads around the Rockdale Motorway Operations Centre (south) that would potentially affect customer or worker access or servicing or deliveries to businesses in this area.

Businesses along President Avenue to the west of the West Botany Street intersection all have some form of business access independent of on-street parking provisions on President Avenue. As such there would be no impact servicing or deliveries for these businesses. The project would implement peak period clearways in both directions along President Avenue, which may reduce the number of parking opportunities for customers of these businesses. It should be noted that this road has existing clearways eastbound in the AM peak and westbound in the PM peak, and as such the change from the existing scenario would not be substantial. Furthermore, parking availability in adjacent side streets would remain unchanged.

Operational changes at the intersection of Princes Highway and President Avenue would not be expected to alter the ability of businesses in this area to receive services or deliveries. This section of the Princes Highway is currently designated as no parking, and would remain so once the project is operational.

The project would potentially broaden the customer and services catchment for businesses in the Rockdale area thorough the direct motorway connection to the wider Sydney region and beyond. Access to supply chains would be enhanced and an increase in efficiency of shipping goods would be expected.

As a result of these changes, the magnitude of impact on deliveries, access, and parking for businesses is considered to be low. The sensitivity of affected stakeholders is considered to be moderate. The overall significance to deliveries, access, and parking resulting from the operation of the project on the socio-economic environment is considered to be moderate-low.

Passing trade

Passing trade refers to customers who choose to visit a business because they see it when walking or driving past, or as a matter of convenience when en route to another destination, rather than an intentional trip with that business as the desired destination.

Upon opening of the project, traffic volumes along Marsh Street at Arncliffe are expected to slightly increase. Whilst this has the potential to result in a low positive impact upon passing trade it is noted that the only businesses directly visible to Marsh Street are the Kogarah Golf Course, Mercure Hotel and Vink Printing Group, none of which are likely to be dependent upon passing trade. Further to this, the project would not substantially alter the visibility of these businesses other than through the presence of the operational motorway operations complex. This would screen a part of the view of the golf course adjacent to the existing M5 East Motorway.

Passing trade for businesses around the around the Rockdale Motorway Operations Centre (north) are unlikely to be affected by the presence of the operational project based on the relative low impacts of the project in this area. West Botany Street would not be affected directly though there would be a slight decrease in expected traffic which may reduce the potential for passing trade. Some businesses along this road such as clothing outlets and retail outlets may rely to some extent upon passing trade.

Traffic along President Avenue is forecast to increase with the project. This would result in increased passing trade for businesses on this road. This includes several businesses that are likely to rely to some degree on passing trade, such as convenience stores, cafes, a petrol station and a fruit shop. For these businesses the operation of the project would be a low positive.

Following construction a general reduction in traffic is expected along the Grand Parade and Princes Highway, which may lead to further activation of these commercial areas by facilitating greater levels of foot traffic. This however may also reduce passing trade through the diversion of traffic onto the parallel underground route.

As a result of the above, the magnitude of operational impact on passing trade is considered to be low. The sensitivity of affected stakeholders is considered to be moderate. The overall significance to passing trade resulting from the operation of the project on the socio-economic environment is considered to be moderate-low.

Amenity

Many businesses such as accommodation providers, restaurants, cafes, and health and beauty businesses rely to an extent upon high levels of local amenity. This includes aspects such as low traffic, low background noise and the presence of positive visual environments including street vegetation and green spaces. The construction of the project has the potential to disrupt amenity values for certain areas, particularly where the operational project results in increases in traffic or noise, or reduces the visual amenity of a location.

The severity of impact on amenity on individual businesses would vary depending on the nature of their business and the proximity to project-induced changes. Businesses that rely on a high level of amenity would be particularly affected.

At Arncliffe, impacts to local amenity are expected to be very low and would be limited to slight increases in traffic volumes. Given the nature of the businesses and the existing high noise and traffic environment in this location these changes would result in a negligible overall impact.

Along West Botany Street, the project would result in a minor decrease in traffic levels (and associated traffic noise). The project would also involve an increase in street trees around the Rockdale ventilation facility. This would lead to a slight overall improvement in local amenity.

Amenity along President Avenue is likely to slightly decrease as a result of the project. This would occur due to increases in traffic volumes (and associated noise) as well as removal of street trees to facilitate widening. Street vegetation would be reinstated though this would take some time to reach maturity.

Operational parts of the project at the Princes Highway and President Avenue intersection would be expected to result in a minor decrease in amenity value through the removal of street vegetation and increases in traffic.

This loss in amenity along both President Avenue and Princes Highway is somewhat mitigated by the existing busy and highly developed nature of these locations.

As a result of these changes, the overall magnitude of operational impact on amenity for businesses is considered to be negligible. The sensitivity of affected stakeholders is considered to be moderate. As such, the overall significance to amenity resulting from the operation of the project on the socio-economic environment is considered to be negligible.

Parking

The project would implement peak period clearways in both directions along President Avenue, which would reduce the number of parking opportunities for customers of businesses located in this area throughout the week days. The removal of parking may also affect nearby deliveries to businesses and/or services and parking convenience for workers and customers. Reduced parking can force customers to seek alternative businesses or services in a more accessible location.

As mentioned, President Avenue has some existing clearways, and as such the change from the existing scenario would not be substantial. Furthermore, parking availability in adjacent side streets would remain unchanged.

The section of the Princes Highway (southbound) near the intersection with President Avenue is currently designated as no parking, and would remain so once the project is operational.

During operation of the project, there would be no changes to local roads and parking around the Arncliffe construction ancillary facility (C1), the Rockdale Motorway Operations Centre (north) (MOC2) or the Rockdale Motorway Operations Centre (south) (MOC3).

On this basis the magnitude of operational impacts on parking is considered to be negligible. The sensitivity of affected stakeholders is considered to be moderate. The overall significance to parking resulting from the operation of the project on the socio-economic environment is considered to be negligible.

15.4.7 Economic impacts

Expenditure and employment

Operational expenditure is estimated to contribute a total of $46 million in output and $21 million in value added per year of operation of the project. In addition to those directly employed by the project, operational expenditures would generate around 120 full time equivalent positions off-site.

Freight and efficiency costs

The freight industry is an important part of the NSW economy as an enabler of economic activity, contributing an estimated $66 billion[22] to NSW State Gross Product (GSP) in 2011. One objective of the project, in alignment with strategic planning at a national and state level, is to encourage heavy and commercial vehicle movements into the tunnel, increasing efficiencies and reducing freight costs through increased travel speeds and reliability and reduced travel distances.

Commercial vehicle movements are generally oriented around the major commercial/industrial centres of Port Botany and Sydney Airport. As stated in **Chapter 8** (Traffic and transport), analysis determined that the project would result in substantial potential benefits for freight and commercial vehicle movements. Improvements in the efficiency and reliability of these transport networks would likely result in increased productivity, reduced costs and broader economic benefits for these workforces.

Employment connectivity

Over 25 per cent of all Sydney jobs are located in the Global Economic Corridor, which extends from Norwest Business Park in the north through to the Sydney CBD and on to Port Botany and Sydney Airport in the south[23]. Western Sydney is expected to deliver strong job growth over the next 20 years, however employment in the eastern part of Sydney, namely Sydney CBD, would also continue to grow. This means that people from south of Sydney would continue to travel north for employment opportunities. The project would improve existing transport connections to the Global Economic Corridor and the eastern part of Sydney, as well as facilitating growth in suburban areas to the south. Furthermore, access to Sydney Airport from the south would be greatly improved as part of the project.

[22] Transport for NSW (2017) Freight https://www.transport.nsw.gov.au/industry/freight
[23] NSW Government (2014) A Plan for Growing Sydney

For commuters, the project would lead to a more reliable road network, reducing commuting time and lowering vehicle operating costs. The project would facilitate improved commuting from points south of Sydney, helping to unlock a catchment of employment resources in the Illawarra region, where there is better access to affordable housing. This improved connection and commuter access has potential to relieve pressure on Sydney's constrained development and growth.

Road tolling

Travel through the F6 Extension Stage 1 tunnel would incur a toll. A tolling system results in direct impacts to the management of congestion, which affects economic productivity, as well as social elements such as stress, time spent waiting in traffic, travel behaviour, financial cost and environmental amenity. It should be noted that motorists travelling through the F6 Extension Stage 1 tunnel would be subject to a $1.77 toll in each direction. The northern end of the tunnel would however connect directly to the New M5 Motorway, which is part of WestConnex. This would mean that all motorists using the F6 Extension Stage 1 would also be subject to the WestConnex flagfall and minimum distance charge, resulting in a minimum toll of $4.56 (one-way) for all motorists using the F6 Extension Stage 1.

The use of a toll road may increase the cost of living for individuals and can exacerbate social inequality. Generally, higher income earners are more capable of absorbing the cost of tolls than lower income households. Comparatively, low income households are more likely to travel longer distances to avoid tolls[24]. Analysis of ABS 2016 Census data on taxable personal incomes does not suggest that the study area contains a high concentration of people with low incomes. However a proportion of the population within the study area, and areas south of the study area that have low incomes, may not be able to afford to benefit from the increased efficiency and travel times that the project could offer.

An impact of implementing a tolled road is the potential for increased congestion on surrounding roads as a consequence of motorists changing travel patterns to avoid incurring the new toll. Once the project is operational, it is expected that there would be a period during which drivers would trial both existing toll-free routes and the new, tolled motorway, before deciding on a regular route. Congestion in peak periods on the existing, toll-free surface roads may provide an incentive to use the new, tolled road. This would result in improvements to the existing conditions of alternative routes within the study area, resulting in a moderate positive impact on the social and economic environment.

15.4.8 Cumulative impacts

Road tolling

Toll pricing for the F6 Extension Stage 1 tunnel has been developed on a distance basis in accordance with other NSW toll roads. The shortest possible trip when using the tunnel would be between the President Avenue intersection and St Peters Interchange, which would include travel via the WestConnex New M5 Motorway between Arncliffe and the St Peters Interchange. The estimated one-way cost for cars for this trip would be $4.56 including the WestConnex flag fall and distance tolls. For users that require travel to other destinations via the WestConnex network, and trips via other toll roads, additional costs would be incurred at the respective toll rates.

In recognition of the growing number of toll roads within Sydney, the NSW Government recently implemented the Toll Relief plan[25] designed to ease the financial burden on privately registered vehicle owners who regularly need to use toll roads. The Toll Relief plan provides free vehicle registration for NSW registered vehicle owners who spend on average more than $25 a week (i.e. at least $1,300 over a year) on NSW toll roads. Free registration would be available to all owners of privately registered vehicles from 1 July 2018. It is anticipated that tolls paid for use of the F6 Extension Stage 1 tunnel would be counted towards the total spend for privately registered vehicles under the Toll Relief plan. This would assist in alleviating the cumulative economic impact of tolled roads on private vehicle users.

[24] Mokonyama, M. (2012) The social impact of introducing a tolling scheme on a pre-existing urban network', Association of European Transport and Contributors

[25] NSW Government (2017) Toll Relief – free rego for drivers. https://www.nsw.gov.au/your-government/the-premier/media-releases-from-the-premier/toll-relief-free-rego-for-drivers/

Ongoing urban development

The project would be built and operated within the context of ongoing urban development within the immediate and surrounding parts of southern Sydney. In particular, urban residential development within the local area is predicted to intensify and, in certain places, expand. Areas around the project that have experienced high levels of recent historical residential growth include:

- Wolli Creek
- Kogarah
- Hurstville
- Arncliffe.

Development in these areas has typically been characterised by significant increases in the number of high and medium density development. Within the proximity of the project this is most apparent at Wolli Creek and parts of Kogarah adjacent to the Princes Highway.

In addition it is noted that the Department of Planning and Environment, with Bayside Council, has developed a Land Use and Infrastructure Strategy (LUIS) for the Bayside West Precincts[26]. These precincts include parts of the suburbs of Arncliffe, Banksia and Turrella. The strategy identifies that parts of these precincts could be subject to further development, especially for residential housing. The strategy signals intent to explore intensification of land use.

It is recognised that residential urban development in these locations is conservatively expected to continue for several years. In addition, the existing Kogarah Golf Course area is part of the above LUIS, with a view to rezoning much of the site to medium or high density residential.

With ongoing and proposed development there is the potential for increased cumulative impacts alongside those generated by the operational project. This includes a range of local amenity impacts such as traffic, air quality, noise and visual impact.

The project's impact associated with each of these factors would vary throughout the footprint. For example, impacts associated with traffic are expected to ease in certain locations such as along the Princes Highway at Arncliffe, though would increase around President Avenue. Broadly, the removal of through traffic from surface roads along the alignment is considered a notable positive impact of the project.

Operation of the project

When considered alongside other strategic transport projects in Sydney the operation of the project is expected to result in a variety of socio-economic benefits. These include:

- Improved road connectivity between all parts of Sydney, including major road connections south (M31 Motorway), west (Great Western Highway) and north (M1 Motorway), as well as Sydney Airport and Port Botany. This would support Sydney's ongoing economic growth through the efficient connection of people, goods and services, Of particular importance is the contribution of the project to the efficiencies of the freight industry
- Improved connectivity between Sydney's key employment areas within the global economic corridor and largely residential suburbs adjacent to and to the south of the project
- Reductions in local and regional levels of congestion, particularly through the diversion of heavy vehicles off the existing surface road network. This carries with it benefits to road safety and efficiency and local amenity, particularly noise, and opens up the potential for urban renewal along major road corridors in the area.

[26] NSW Department of Planning and Environment (2018) *Bayside West Precincts 2036 Plan – Arncliffe, Banksia and Cooks Cove.*

15.5 Management of impacts

Social and economic impacts associated with other key environmental issues would be managed in accordance with the recommended management and mitigation measures outlined in their respectively sections. Mitigation measures to address direct impacts on sensitive receptors and to manage community concerns with regard to key environmental issues are summarised in **Table 15-16**.

Table 15-16 Environmental management measures – social and economic

Impact	Reference	Environmental management measures	Timing
Amenity	SE1	A Site Establishment Management Plan will be prepared prior to construction and will have regard to the amenity of adjacent areas and minimising impacts to adjacent sensitive receptors, including potential noise, dust, traffic, visual, lighting and overshadowing and overlooking impacts.	Construction
Social infrastructure	SE2	Provision of temporary alternative sporting and recreational facilities in nearby locations, including a skate park, children's disability playground and sporting fields, will be investigated during detailed design to account for the temporary loss of these facilities during construction of the project at the President Avenue construction ancillary facility (C3).	Construction
Impacts to businesses	SE3	• A Business Management Plan will be prepared prior to construction to detail the process for identification and communication with businesses adversely affected by construction works.	Construction
Construction fatigue	SE4	• Prepare and implement a Construction Fatigue Protocol as part of the CNVMP to address potential construction fatigue impacts. The Protocol will include consideration of noise attenuation and periods of respite for affected stakeholders, where reasonable and feasible, and restricting out of hours work where practicable.	Construction
Community consultation	SE5	A Community Communication Strategy would be prepared prior to construction to detail the processes to facilitate communication between the project team and the community.	Construction
Social infrastructure	SE6	A Community and Social Management Plan will be prepared. The plan will detail the process for identification and implementation of measures to offset community and social impacts associated with the project. The plan is to be prepared by a suitably qualified and experienced person(s) in consultation with the community and relevant councils.	Operation

15.6 Environmental risk analysis

An environmental risk analysis was undertaken for social and economic risk and is provided in **Table 15-17**.

A level of assessment was undertaken commensurate with the potential degree of impact the project may have on that issue. This included an assessment of whether the identified impacts could be avoided or minimised (for example, through design amendments). Where impacts could not be avoided, environmental management measures have been recommended to manage impacts to acceptable levels.

The residual risk is the risk of the environmental impact after the proposed mitigation measures have been implemented. The methodology used for the environmental risk analysis is outlined in **Appendix O** (Methodologies).

Table 15-17 Environmental risk analysis – social and economic

Summary of impact	Construction/ operation	Management and mitigation reference	Likelihood	Consequence	Residual risk
Social and economic impacts of acquisition of private property	Construction	SE1, SE2	Likely	Moderate	Medium
Impacts to community identity and values	Construction	SE1, SE2, SE6	Likely	Moderate	Medium
Amenity and community wellbeing	Construction	SE1	Likely	Moderate	Medium
Impacts to social infrastructure	Construction	SE2	Likely	Minor	Low
Impacts to access and connectivity	Construction	SE6	Likely	Moderate	Medium
Impacts to businesses as a result of changes in traffic, access, parking and amenity	Construction	SE3	Likely	Minor	Low
Impacts to community identity and values	Operation	SE1, SE2, SE6	Unlikely	Minor	Low
Amenity and community wellbeing	Operation	SE1, SE6	Likely	Minor	Low
Impacts to access and connectivity	Operation	SE6	Likely	Moderate	Medium
Impacts to businesses as a result of changes in traffic, access, parking and amenity	Operation	SE3	Likely	Minor	Low

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16 Soils and contamination

This chapter assesses the potential soils and contamination impacts associated with the project. This chapter is informed by **Appendix J** (Contamination technical report), **Appendix L** (Surface water technical report) and **Appendix K** (Groundwater technical report).

Table 16-1 sets out the SEARs relevant to soils and contamination and identifies where the requirements have been addressed in this EIS.

Table 16-1 SEARs – Soils and contamination

SEARs	Where addressed in this EIS
Soils	
1. The Proponent must verify the risk of acid sulfate soils (Class 1, 2, 3 or 4 on the Acid Sulfate Soil Risk Map) within, and in the area likely to be impacted by, the project.	The potential for acid sulfate soils to occur within the study area is discussed in section 16.2.1 and section 16.3.4.
2. The Proponent must assess the impact of the project on acid sulfate soils (including impacts of acidic runoff offsite) in accordance with the current guidelines and detail the mitigation measures proposed to minimise potential impacts.	Potential impacts of acid sulfate soils are discussed in section 16.3.4. Mitigation for acid sulfate soils is described in section 16.5.
3. The Proponent must assess whether the land is likely to be contaminated and identify if remediation of the land is required, having regard to the ecological and human health risks posed by the contamination in the context of past, existing and future land uses. Where assessment and/or remediation is required, the Proponent must document how the assessment and/or remediation would be undertaken in accordance with current guidelines.	Qualitative assessment of the potential contamination risks is addressed in section 16.3 and section 16.4. Remediation for construction ancillary facilities is provided in Appendix J (Contamination technical report). Commitment to undertaking and implementing a Remediation Action Plan is provided in section 16.5. Human health risks are discussed in Appendix F (Human health technical report).
4. A baseline contamination assessment must be undertaken for filled land in the vicinity of the proposed cut and cover works near President Avenue. The Proponent must provide details of contamination characteristics and measures to manage this spoil, including spoil stockpile management, transport and disposal to avoid adverse impacts to land, water quality and sensitive receivers;	A preliminary investigation and assessment is provided in section 16.2.4 for the President Avenue construction ancillary facility (C3) and in section 16.2.6 for the tunnel alignment. Recommended management is provided in section 16.5.
5. The Proponent must assess whether salinity is likely to be an issue and if so, determine the presence, extent and severity of soil salinity within the project area.	An assessment of the potential for salinity to be present, and the associated impacts, is provided in section 16.2.1 and section 16.3.2.
6. The Proponent must assess the impacts of the project on soil salinity and how it may affect groundwater resources, hydrology and vegetation.	An assessment of potential project impacts on soil salinity, including how it may affect hydrology, is provided in section 16.3.2. The impacts of soil salinity on groundwater resources are assessed in Appendix K (Groundwater technical report). The impacts of soil salinity on vegetation are assessed in Appendix H (Biodiversity development assessment report).
7. The Proponent must assess the impacts on soil and land resources (including erosion risk or hazard). Particular attention must be given to soil erosion and sediment transport consistent with the practices and principles in the current guidelines.	Impacts on erosion and sediment are assessed in section 16.3.1 and section 16.4.1.
8. The Proponent must assess the impact of any disturbance of contaminated groundwater and the tunnels should be carefully designed so as not to exacerbate mobilisation of contaminated groundwater and/or prevent contaminated groundwater flow.	Potential impacts on groundwater are addressed in section 16.3, section 16.4 and Chapter 17 (Groundwater and geology).

SEARs	Where addressed in this EIS
Air Quality	
3. The Proponent must undertake a landfill gas assessment in the vicinity of the President Avenue interchange and provide details on proposed methods and options for managing and mitigation impacts during construction and operation	Potential impacts from landfill gas are addressed in section 16.3.3.

16.1 Assessment approach

A full discussion on the assessment methodology undertaken to identify potential soil and contamination impacts as a result of the project is provided in **Appendix J** (Contamination technical report), **Appendix L** (Surface water technical report) and **Appendix K** (Groundwater technical report).

16.1.1 Methodology

A desktop data review was undertaken and included:

- Review of soil, groundwater and gas data collected as part of the targeted geotechnical investigations within the study area, in order to characterise contamination in the study area
- Identification and assessment of risk of acid sulfate soil exposure, erosion, soil sediment mobilisation, subsidence, settlement and presence of soil salinity
- A review of relevant data and background information including, but not limited to, previous site contamination reports, historical land titles, NSW Environment Protection Authority (NSW EPA) records and Universal Business to Business Directories Pty LTD (UBD) business directories historical records to evaluate whether historical land uses were likely to have caused contamination of soil and groundwater
- Review of Environmental Risk and Planning (ERP) Reports prepared for the length of the mainline tunnel alignment by Lotsearch Pty Ltd (Lotsearch)[1]
- Obtaining and reviewing historical titles and section 149 certificates for the relevant surface works and construction ancillary facilities.

An inspection of the study area from publically accessible land was undertaken by AECOM Environmental Scientists on 11 December 2017 to ground truth information obtained during the desktop review and to inform a description of the existing environment.

A preliminary qualitative risk assessment was then undertaken to assess the potential construction and operation impacts on contamination. The preliminary qualitative risk assessment involved development of a conceptual site model (CSM) for the project to identify and present information about potential contamination sources, receptors and potential exposure pathways between the identified sources and receptors. The CSM provided the framework for identifying how potential receptors may be exposed to contamination from previous or current site sources.

The sources, pathways and receptors were identified by information obtained in the desktop review and site inspection. The qualitative risk ranking was completed by identifying and assessing the pollutant linkages in the CSM and assigning the following risk:

- Low risk: based on the available information, a complete pollutant linkage is considered to be unlikely
- Medium risk: based on the available information, a complete pollutant linkage may potentially be present, however the likelihood and consequence is considered to be medium
- High risk: based on the available information, a complete pollutant linkage is considered to be likely.

Results of the risk assessment are summarised in **section 16.2.8** and **section 16.4**.

[1] Lotsearch (2017a) Environmental Risk and Planning Report, Stage 1 F6 Extension (Section 1 to Section 5)

Adopted assessment criteria

Groundwater contamination results have been screened against the following criteria where relevant for the investigations that have informed this assessment:

- National Environment Protection Measure (NEPM) Table 1C Groundwater Investigation Levels (GILs) for marine and fresh waters and drinking water, National Environment Protection Council (NEPC, 2013 as amended)
- NEPM Table 1A (4) Groundwater Health Screening Levels (HSLs) for vapour intrusion 2 metres to < 4 metres (NEPC, 2013 as amended).

Soil contamination results have been screened against the following criteria where relevant for the investigations that have informed this assessment:

- *National Environment Protection (Assessment of Site Contamination) as amended, 2013* (NEPM, 2013):
  - Soil Health Investigation Levels (HILs): HIL D (commercial/industrial land use)
  - Health Screening Levels (HSLs): HSL D (commercial industrial, zero metres to less than one metre, sand) for non- petroleum sites
  - HSL D for direct contact and intrusive maintenance worker
  - HSL C (open space/recreational land use) for direct contact
  - Ecological Investigation Levels (EIL) EIL D (commercial/industrial land use) and EIL C (open space/recreational land use)
  - Ecological Screening Levels (ESL) ESL D (commercial/industrial land use) and ESL C (open space/recreational land use)
- *Technical Report No.10 – Health Screening Levels for Petroleum Hydrocarbons in Soil and Groundwater* (Friebel, E. and Nadebaum, P, 2011) – Soil Health Screening Levels (HSLs) Cooperative Research Centre for Contamination Assessment and Remediation of the Environment (CRC CARE)
- *Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites* (United States Environment Protection Authority, 2014)
- *Guidelines for the Assessment, Remediation and Management of Asbestos Contaminated Alignments in Western Australia* – commercial/industrial land use (Western Australian Department of Health, 2009)
- *Waste Classification Guidelines, Part 1: Classifying Waste* (NSW Environment Protection Authority, 2014).

Refer to **Appendix J** (Contamination technical report) for further information.

16.1.2 Relevant legislation and policies

Soils

The impact assessment of the project on soils has been prepared in accordance with the following key relevant guidelines and policies:

- *Managing Urban Stormwater: Soils and Construction Volume 1* (Landcom 2004) and Volume 2 (NSW Department of Environment and Climate Change (DECC) 2008)
- Roads and Maritime Services Erosion and Sediment Management Procedure (Roads and Maritime 2008).

Contamination

Legislation and policies relevant to the assessment and management of contaminated land include:

- *Contaminated Land Management Act 1997* (NSW) (CLM Act)
- *Protection of the Environment Operations Act 1997* (NSW) (POEO Act)
- *Environmentally Hazardous Chemicals Act 1985* (NSW) (EHC Act)
- *State Environmental Planning Policy No. 55 – Remediation of Land (SEPP 55) Relevant guidelines*
- *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997* (NSW EPA 2015)
- *Guidelines for the NSW Site Auditor Scheme (Third Edition)* (NSW EPA 2017)
- *Managing Land Contamination, Planning Guidelines SEPP 55-Remediation of Land*, (NSW Department of Urban Affairs and Planning (DUAP) and NSW EPA 1998)
- *Guidelines for the Assessment and Management of Groundwater Contamination* (Department of Environment and Conservation (DEC) 2007)
- National Environment Protection (Assessment of Site Contamination) Measure (ASC NEPM) 2013 (National Environment Protection Council (NEPC) 1999)
- *Environmental Guidelines: Solid Waste Landfills (Second Edition)* (NSW EPA 2016)
- *Guidelines for Consultants Reporting on Contaminated Sites* (NSW Office of Environment and Heritage (OEH) 2011)
- *Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases* (NSW EPA 2012)
- *National Water Quality Management Strategy, Paper No. 4, Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Volume 1, The Guidelines* (Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) 2000)
- *Acid Sulfate Soils Assessment Guidelines*, Acid Sulfate Soils Management Advisory Committee ((ASSMAC) 1998)
- *Acid Sulfate Soils Assessment Guideline* (Department of Planning (DoP) 2008)
- *Urban and regional salinity* (DLWC, 2002)
- *Landslide risk management guidelines presented in Australian Geomechanics Society* (2007)
- *Soil and Landscape Issues in Environmental Impact Assessment* (DWLC 2002).

16.1.3 Study area

The study area for the soils and contamination assessment is the same as the project footprint, which comprises the location of all operational infrastructure and areas where construction activities would occur. Particular attention has been given to those areas where historical land use activities have impacted soil, sediment and groundwater and which would require remediation and/or management during the construction and operation of the project.

Information on the operational and construction components of the project is provided in **Chapter 6** (Project description) and **Chapter 7** (Construction) respectively.

The six construction ancillary facilities and surrounding areas assessed for contamination include the Arncliffe construction ancillary facility (C1), Rockdale construction ancillary facility (C2), President Avenue construction ancillary facility (C3), Shared cycle and pedestrian pathways construction ancillary facilities (C4 and C5) as well as the shared cycle and pedestrian pathways and the Princes Highway construction ancillary facility (C6), on the north-east corner of the President Avenue and Princes Highway intersection.

The project tunnel alignment was assessed in order to identify potential sources for groundwater contamination. The permanent power supply connection from the Ausgrid Canterbury subtransmission substation, to Rockdale Motorway Operations Complex south is included in the study area.

16.2 Existing environment

16.2.1 Soils

Topography

Lands around the tunnel alignment are relatively flat and low lying with gentle undulating hills ranging from around two metres Australian height datum (AHD) to around 16 metres AHD. The lands closest to the northern and southern end of the tunnel alignment are the lowest and flattest and the land with greatest elevation, around 36 metres AHD, is located at Arncliffe near the Princes Highway.

Soil landscapes

The Soil Landscapes of the Sydney 1:100,000 Sheet 9130[2] indicates that the study area is underlain by seven soil landscapes. These are shown in **Figure 16-1**. The soil landscapes, as well as their potential for erosion are summarised in **Table 16-2**.

Table 16-2 Soil landscape characteristics and erosion potential

Soil landscape	Erosion/mass movement potential
Tuggerah (tg1 to tg6)	Low erodibility as soils consist of highly permeable, coarse sand grains, however lack of cohesion makes these soils susceptible to concentrated flows. Low to moderate erosion hazard for non-concentrated flows. Very high to extreme erosion hazard for concentrated flows.
Warriewood (wa1 to wa6)	Low to very low erodibility. Relatively stable and consist of well drained stable coarse sands or coarse sand grains weakly held together by organic matter or iron compounds. The erosion hazard for non-concentrated flows is low. The erosion hazard for concentrated flows is moderate to high and for wind erosion is low to moderate. Ground surface within the study area is generally stabilised due to urban development.
Newport (np1 to np6)	Soils range from having low erodibility (np 4 and np 5) to being moderately erodible (np1, np2, np3 and np6). Erosion hazard for non-concentrated flows is generally high but ranges from high to extreme. Erosion hazard for concentrated flows and wind is high. Ground surface within the study area is generally stabilised due to urban development.
Lambert (la1 to la6)	Soil materials are low (la5, la6) to moderately erodible. The soil erosion hazard for non-concentrated flows is usually very high but ranges from low to extreme. The soil erosion hazard from concentrated flow is extreme.
Gymea (gy1 to gy4)	Very low (gy1 and gy2), moderately (gy3) and highly erodible (gy4) soils. Erosion hazard for non-concentrated flows is generally high to very high but can range from moderate to extreme. Soil erosion hazard for concentrated flows is high to extreme.
Disturbed Terrain (xx1 to xx4)	Erodibility and erosion hazard is variable.
Hawkesbury (ha1)	Low (ha1) to moderate (ha2, ha3) erodibility. Erosion hazard for non-concentrated flows is generally very high and ranges from moderate to extreme. The soil erosion hazard for concentrated flows is extreme.

[2] Chapman, G.A. and Murphy, C.L (1989) Soil Landscapes of the Sydney 1:100,000 sheet 9130. Soil Conservation Service of NSW, Sydney

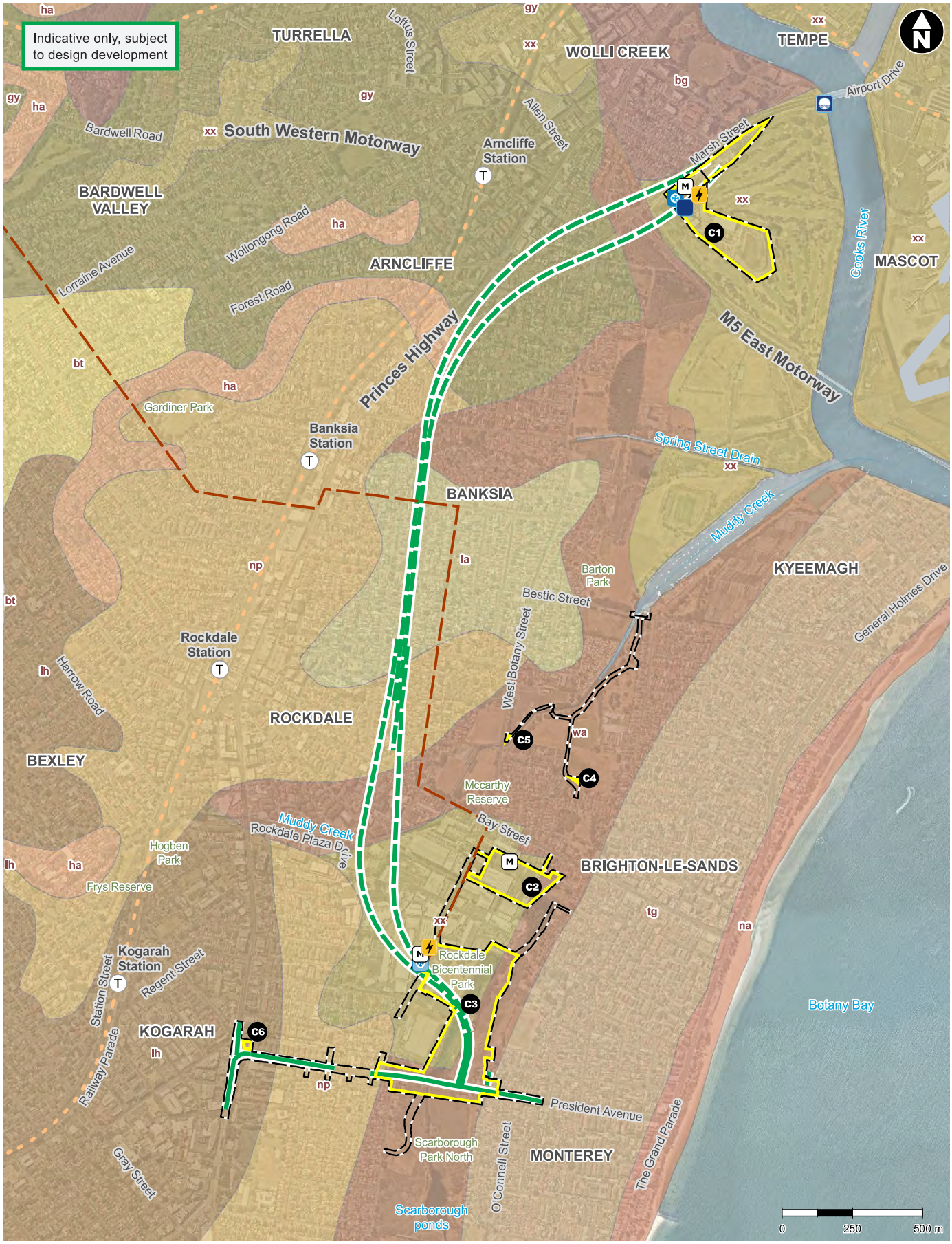


Figure 16-1 Soil landscape types along the tunnel alignment and surrounding area

Soil salinity

Salinity refers to the salt content of soil. Salinity is an important variable in landscape systems and is often a determining factor in the capacity of the landscape to absorb change. It can impact on landscapes, namely land salinisation (salts stored in the soil profile are mobilised by water movement), in-stream salt load and in-stream salt concentration[3].

Localised soil salinity is reported to occur within the Tuggerah (tg3 and tg5) and Disturbed Terrain (xx4) soil landscapes[4].

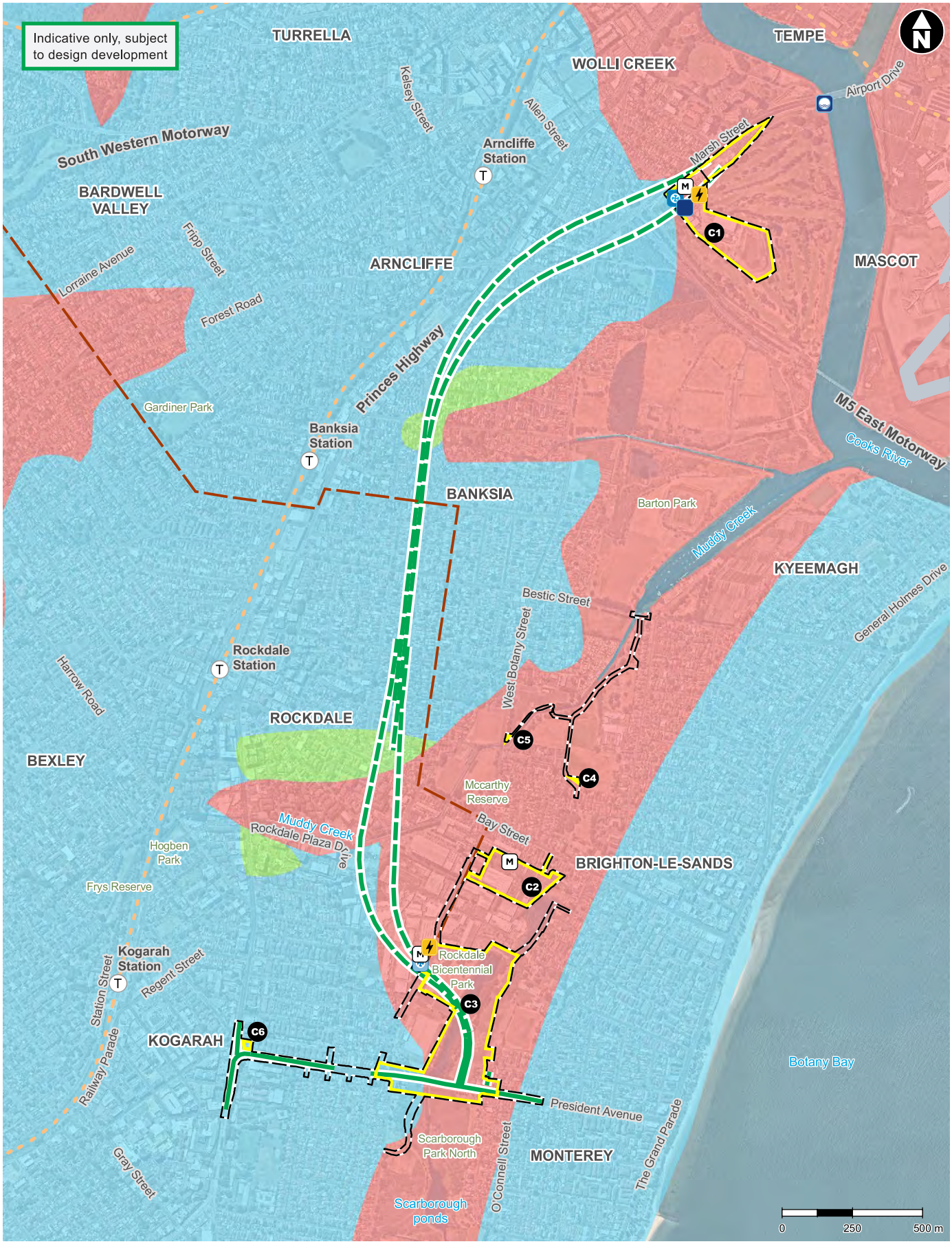
The risk of salinity impacts can be increased by clearing vegetation, irrigation or other activities that can lead to a rise in the groundwater table.

The broad salinity hazard distribution across the Sydney Metropolitan Catchment Management Authority Area (SMCMA) (now Local Land Services) has been mapped as part of the Catchment Action Plan for the SMCMA area[3]. The salinity hazard mapping in relation to the study area is shown in **Figure 16-2**.

Parts of the study area are located within areas depicted as having a very high salinity hazard based on the Sydney Hazard for Catchment Action Plan Update map[3]. The remainder of the study area is located within areas of very low salinity hazard[3].

[3] Department of Primary Industries (2013) Salinity hazard report for Catchment Action Plan upgrade - Hawkesbury-Nepean CMA

[4] Chapman, G.A. and Murphy, C.L. (1989) Soil Landscapes of the Sydney 1:100,000 sheet 9130. Soil Conservation Service of NSW, Sydney



LEGEND

- The project in tunnel
- The project on surface
- Construction boundary
- Construction ancillary facility
- Motorway operations complex
- Operational discharge location
- Substation
- Water treatment facility
- Rockdale ventilation facility
- Permanent power supply line
- Arncliffe ventilation facility*
- * Under construction as part of the New M5 Motorway project
- Very High
- Low
- Very Low
- Railway station
- Railway line

Figure 16-2 Salinity hazard

Acid sulfate soils

Acid sulfate soils are naturally occurring soils containing iron sulphides, which on exposure to air, oxidise and create sulfuric acid. Disturbance of acid sulfate soils and/or potential acid sulfate soils can result in adverse impacts on surface and groundwater quality, flora and fauna, and degradation of habitats.

In NSW, land is classified based on the likelihood of acid sulfate soils being present in particular areas and at certain depths. In accordance with the *Guidelines for the Use of Acid Sulfate Soils Risk Maps*[5], there are five classifications:

- Class 1: Acid sulfate soils are likely to be found on and below the natural ground surface. Any works would trigger the requirement for assessment and may require management
- Class 2: Acid sulfate soils are likely to be found below the natural ground surface. Any works beneath the natural ground surface, or works which are likely to lower the water table, would trigger the requirement for assessment and may require management
- Class 3: Acid sulfate soils are likely to be found more than one metre below the natural ground surface. Any works that extend beyond one metre below the natural ground surface, or works which are likely to lower water table beyond one metre below the natural ground surface, would trigger the requirement for assessment and may require management
- Class 4: Acid sulfate soils are likely to be found more than two metres below the natural ground surface. Any works that extend beyond two metres below the natural ground surface, or works which are likely to lower the water table beyond two metres below the natural ground surface, would trigger the requirement for assessment and may require management
- Class 5: Acid sulfate soils are not typically found in Class 5 areas. Areas classified as Class 5 are located within 500 metres of adjacent Class 1, 2, 3 or 4 land. Works in a Class 5 area that are likely to lower the water table below one metre AHD on adjacent Class 1, 2, 3 or 4 land would trigger the requirement for assessment and may require management.

Acid sulfate soils risk above and around the project, including the tunnel alignment, are shown in **Figure 16-3**. Areas of a high risk of acid sulfate soil occurrence are located in the following areas:

- An area surrounding the drainage line running south and perpendicular to Spring Street (Soil Class 3) into Muddy Creek (between chainage 1700 and 1900)
- The low lying areas along Muddy Creek and in the industrial area at Rockdale (Soil Class 3)
- The low lying areas surrounding Scarborough Ponds including Rockdale Bicentennial Park (Soil Class 2) and further east (Class 3 and Class 4)
- An area within and around the eastern extent of the Bardwell Valley Golf Club at Bardwell Park and
- The low lying areas within the Wolli Creek Valley at Bardwell Park.

[5] DLWC (1998) *Guidelines for the Use of Acid Sulfate Soils Risk Maps*

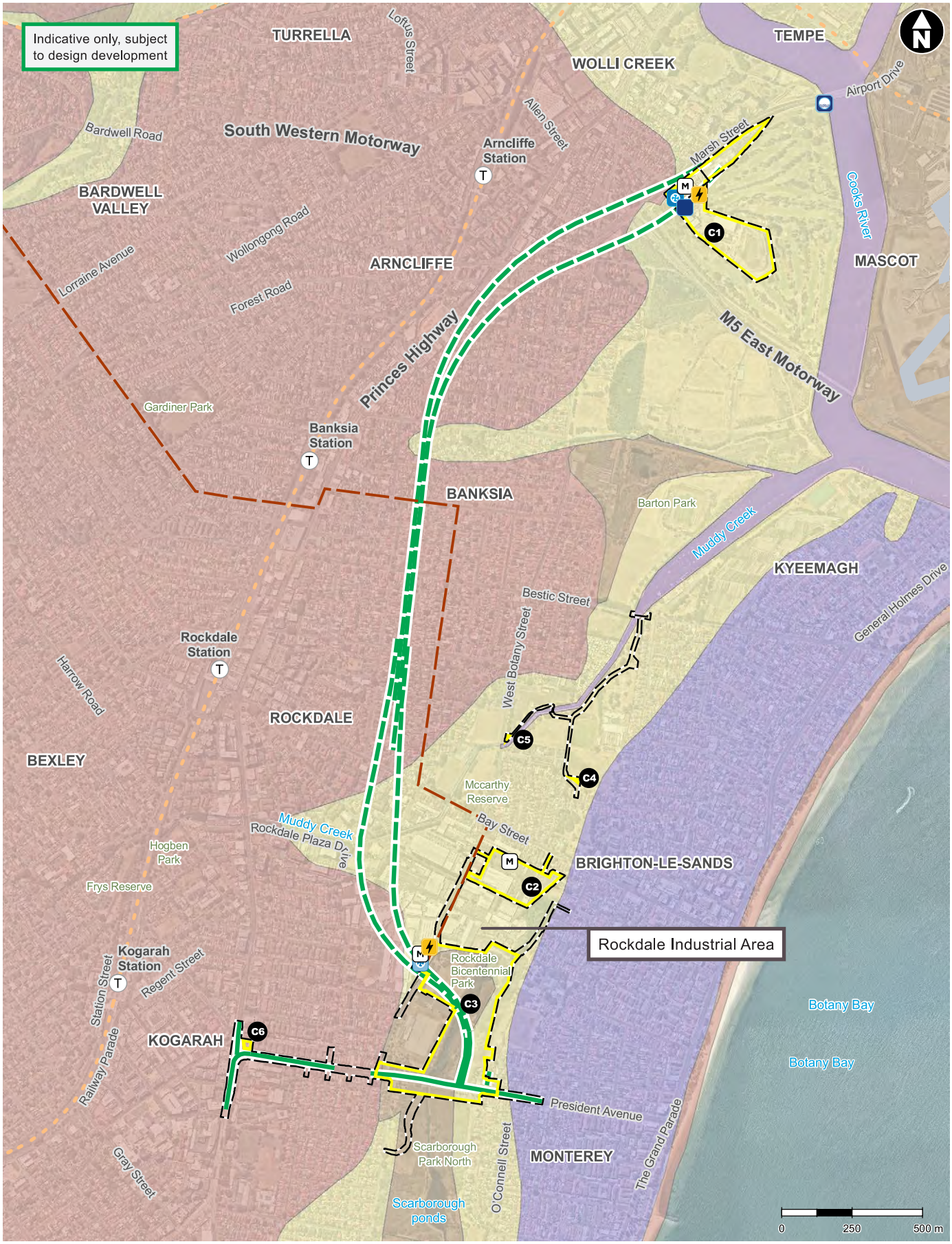


Figure 16-3 Acid sulfate soil risk

16.2.2 Arncliffe construction ancillary facility (C1)

Site description and surrounding land use

The Arncliffe construction ancillary facility (C1) would be located above and below ground at Kogarah Golf Course at Marsh Street, within land currently being used as a construction zone for the New M5 Motorway project. The site would be used to support tunnelling works during construction and then as a permanent motorway operations complex during operation. Prior to being made available for use for construction of the project, the construction site for the New M5 Motorway project would be demobilised and the area rehabilitated to a condition that is suitable for use for construction of the project.

The Arncliffe construction ancillary facility (C1) has previously been assessed by the New M5 Motorway EIS. In particular, in Volume 2F, Appendix O Technical Working Paper: Contamination New M5 Environmental Impact Statement prepared by AECOM, 18 November 2015[6] and WestConnex New M5 Phase 2 Environmental Site Assessment for Kogarah Golf Course[7]. These assessments have been used to inform the following sections.

The surrounding land use is described in **Table 16-3**.

Table 16-3 Surrounding land use – Arncliffe construction ancillary facility (C1)

Direction	Description of surrounding land use and proximity to the site
North	Marsh Street, followed by residential properties of Arncliffe and Cahill Park, followed by the Cooks River, then Tempe Recreation Reserve. Alexandra Canal enters the Cooks River at the northern extent of the site. Wolli Creek enters the Cooks River about 900 metres north of the site.
South	M5 East Motorway, followed by a driving range, lake, cycleway and a sporting field. Muddy Creek and St George Soccer Stadium were located around 400 metres south of the site.
East	The eastern extent of Kogarah Golf Course, Cooks River, followed by Kingsford Smith Sydney International Airport.
West	Eve Street Cycleway, the Southern and Western Suburbs Ocean Outfall Sewer (SWSOOS) No.1, M5 East Motorway and road reserve, Marsh Street wetlands followed by residential properties of Arncliffe.

Site history

Key findings relevant to the Arncliffe tunnel site and ventilation facility (prior to the construction of the New M5 Motorway project) include:

- Historical aerial photographs show the majority of the site being used as market gardens until between 1970 and 1981
- Filling of the land immediately to the east, south and north of the site occurred between 1955 and 1961
- Part of the site was being used as market in 1961 gardens. By 1982 the markets gardens had been replaced with the golf course
- A search of the NSW EPA records of notices and list of NSW contaminated sites identified no sites within 200 metres of the project.

Golder Associated Pty Ltd (Golder) preciously undertook a Phase 2 Environmental Site Assessment (ESA)[7] for the New M5 Motorway Arncliffe Construction Compound which includes the footprint of The Arncliffe construction ancillary facility (C1), as well as land to the north and east. The Phase 2 ESA identified the following:

- Subsurface consisted of various compositions of sand, silt and clay with minor inclusions of ceramic, wire, tile and rubber fragments. No observations of soil discolouration or chemical odour were noted

[6] AECOM (2015) Technical Working Paper: Contamination New M5 Environmental Impact Statement Volume 2F, Appendix O, 18 November 2015
[7] Golder (2016) Westconnex New M5 Phase 2 Environmental Site Assessment – Kogarah Golf Course, Marsh Street, Arncliffe, NSW

- No exceedances of the human health based assessment criteria with exception of asbestos containing material and friable asbestos identified in one soil sample at 0.5 metres depth (located in the eastern portion of the facility)
- Potential acid sulfate soils were identified to be present within footprint of the facility
- Arsenic and copper concentrations were greater than the adopted assessment criteria in four groundwater samples. As no sources were identified within the soil, it was considered that it may be indicative of background conditions
- Ammonia was detected in all groundwater wells and exceeded the adopted trigger level of 910 µg/L at five of the six locations sampled. Dissolved methane concentrations ranged between <5 µg/L and 2,700 µg/L.

The report *Design Package Report Groundwater Monitoring Progress Report (Project-wide), July 2017 M5N-GOL-TER-100-200-GT-1516-C*[8] was reviewed for data relevant to the Arncliffe construction ancillary facility. Three groundwater monitoring wells are located within the northern portion of the facility, one of which (LDS-BH-2005) was sampled for contaminants including dissolved heavy metals, total recoverable hydrocarbons (TRH), benzene, toluene, ethylbenzene, xylenes, (BTEX), Polycyclic aromatic hydrocarbons (PAHs), organochlorine pesticides (OCPs), organophosphorous pesticides (OPPs), phenols, volatile hydrocarbons, perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA), Polychlorinated Biphenyls (PCBs) and nutrients. Low concentrations of dissolved arsenic (8 µg/L, chromium (1 µg/L), copper (6 µg/L) and zinc (14 µg/L) exceeded the adopted assessment criteria.

The report stated that high concentrations of ammonia (1.2 mg/L) and dissolved methane (8.8 mg/L) were detected in another monitoring well (LDS-BH-2001) located 200 metres to the south of the Arncliffe construction ancillary facility in Eve Street.

This result was similar to those reported during a Phase 2 Environmental Site Assessment (M5N-GOL-TER-100-200-EV-1671-A) carried out in May 2016 within Kogarah Golf Course.

Further detail on the site history and previous investigations for the Arncliffe construction ancillary facility (C1) is provided in **Appendix J** (Contamination technical report).

16.2.3 Rockdale construction ancillary facility (C2)

Site description and surrounding land use

The Rockdale construction ancillary facility (C2) would be located above and below ground at Rockdale off West Botany Street within the existing Roads and Maritime maintenance depot. The site would be used to support tunnelling, including loading of spoil and spoil removal. To access the mainline tunnels for excavation, it is proposed to excavate and cut-and-cover a decline tunnel from within the site to join the mainline tunnel in the vicinity of the entry and exit ramps. After construction, part of the site would be permanently used as a motorway operations complex.

The surrounding land use of the site is described in **Table 16-4**.

Table 16-4 Surrounding land use – Rockdale construction ancillary facility (C2)

Direction	Description of surrounding land use and proximity to the site
North	Low density residential adjoining to the north, followed by Bay Street (50 metres north), and then more low density residential properties.
South	The proposed ventilation facility on West Botany Street (around 400 metres south-east) part of the President Avenue construction ancillary facility (C3), warehouses and industrial properties.
East	Infrastructure land, comprised of car parking directly adjoining to the north east, open space with vegetation north of the playing fields to the south east, and then medium density residential properties (180 metres east from the centre of the compound).
West	Industrial properties, and West Botany Street (100 metres west from the centre of the compound).

[8] Golder (2017) Design Package Report Groundwater Monitoring Progress Report (Project-wide), July 2017 M5N-GOL-TER-100-200-GT-1516-C

Site history

Key findings relevant to the Rockdale construction ancillary facility include:

- Historical aerial photographs dating back to 1943 show parts of the site were first used as market gardens and green houses
- Filling of the western portion of the site was visible in 1961 and there also appeared to be filling or earthworks in the southeast and eastern portion of the site in 1970
- Surrounding land uses comprise residential (unchanged to the present on the north and east), and agricultural land to the west and south. The development of the surrounding industrial land to the west and south began after 1951
- The site is within an area where there have been activities delicenced but still regulated by the NSW EPA. They include the Roads and Maritime maintenance depot (across the site) and Vulcan Industries (400 meters north west)
- The closest site currently licenced under the POEO act is the Rockdale Waste and Recycling Centre (Suez) which is located around 400 metres west of the site.

Three boreholes (BH208, BH217 and BH218) investigated as part of an AECOM assessment in 2015[9] are located within the Rockdale construction ancillary facility. Selected samples from the boreholes were analysed as part of the assessments for heavy metals, TRH, PAHs, OCPs, OPPs, PCBs, asbestos and acid sulfate.

No exceedances of adopted commercial/industrial land use screening criteria were reported in any of the boreholes. Exceedances of the contaminated threshold value for general solid waste were reported for concentrations of benzo(a)pyrene and lead in BH208 and BH218. Potential acid sulfate soils was confirmed in BH217 and indicated in BH218.

Another borehole (BH1313) within the southwest portion of the Rockdale construction ancillary facility was investigated as part of a SMEC assessment in 2018[10]. Selected groundwater and soil samples were analysed for heavy metals, TRH, PAHs, OCPs, OPPs, PCBs, SVOCs, VOCs, major cations and asbestos. No exceedances of adopted commercial/industrial land use screening criteria were reported in any of the boreholes. Potential acid sulfate soils were confirmed. The groundwater level at the site is expected to be shallow (less than two metres below the ground surface).

Further detail on the site history and previous investigations for the Rockdale construction ancillary facility (C2) is provided in **Appendix J** (Contamination technical report).

16.2.4 President Avenue construction ancillary facility (C3)

Site description and surrounding land use

The President Avenue construction ancillary facility (C3) would be located above ground at Rockdale Bicentennial Park and the western side of West Botany Street. The site would generally be used to support construction of the cut-and-cover structures for the President Avenue intersection. The site also includes the new ventilation facility (Rockdale ventilation facility) at West Botany Street, south of Lindsey Street and north of French Street at Rockdale.

The site includes part of a service station (7-Eleven) at 734 Princes Highway, Kogarah and a narrow strip of the western boundary of the TAFE NSW St George campus and a substation within the St George TAFE property. Construction works for the Princes highway and President Avenue intersection would include the full or partial demolition of the 7-Eleven service station (including excavation and removal of underground storage tanks (USTs)) and substation within St George TAFE.

[9] AECOM (2015) Westconnex Stage 2: M5 Factual Contamination Assessment
[10] SMEC (2018) F6 Extension Stage 1 Geotechnical Investigations

The surrounding land use of the site is described in **Table 16-5**.

Table 16-5 Surrounding land use – President Avenue construction ancillary facility (C3)

Direction	Description of surrounding land use and proximity to the site
North	Commercial/industrial properties along Bermill Street and West Botany Street, Rockdale and Rockdale construction ancillary facility (C2).
South	Parkland - Civic Avenue Wetlands and Reserve, residential land use, retail shops on President Avenue and Caltex service station at 29 President Avenue, Kogarah.
East	President Avenue, playing fields, open space, residential properties either side of President Avenue, and then The Grand Parade and Botany Bay.
West	Rockdale Industrial Area (north west), residential properties either side of President Avenue, TAFE NSW St George campus corner of Princes Highway and President Avenue and then Princes Highway and various commercial premises along the Princes Highway.

Site history

Key findings relevant to the President Avenue construction ancillary facility (C3) include:

- The 1943 historical aerial photograph shows a narrow strip of market gardens along the western side of the now Rockdale Bicentennial Park and Ilinden Sports Field along West Botany Street. The remainder of the land appears to be uncultivated
- Filling of different sections of the site began in the 1950s, up to around 2009
- Rockdale Bicentennial Park appeared to be developed into the parklands and sports field in the 1980s
- Prior to the 1980s the Rockdale Bicentennial Park appeared to be swamp
- Moorfield Racecourse was located to the south of President Avenue until after 1956 when it was redeveloped into residential housing, with the eastern section remaining part of Scarborough Park north
- Generally the surrounding land uses have comprised parkland, residential and roadway
- The industrial area of Rockdale to the north and west has been developed and consolidated since 1961
- A search of the NSW EPA records of notices and list of NSW contaminated sites identified no sites within 200 metres of the project
- The closest site currently licenced under the POEO act is the Rockdale Waste and Recycling Centre (Suez) which is located around 500 metres west of the site.

Staged combined geotechnical and contamination investigations were undertaken within the President Avenue construction ancillary facility (C3) boundary in 2016[11], 2017[12,13] and 2018[14].

The soil investigation results indicate that fill containing demolition type waste and waste typical of inert landfills (plastics, glass, metal and timber) is present below Rockdale Bicentennial Park and portions of Civic Avenue Reserve, within the President Avenue construction ancillary facility (C3).

The investigations indicate that concentrations of PAHs, TRH C10-C40, heavy metals, asbestos and acid sulfate soils are present in soil and fill materials above the assessment criteria.

[11] SMEC (2017) F6 Northern Geotechnical Investigations – Geotechnical Factual Report – Contract No. 14.2166.0517.0047, 23 February

[12] SMEC (2017) F6 Extension – EIS Section A Phase 1: Groundwater Monitoring Boreholes Geotechnical Factual Report Prepared for Roads and Maritime Services – Contract No. 14.2166.0517-0047, Reference No. 30012460-053-Rev0, 2017, 8 January

[13] SMEC (2017) F6 Northern SEA Geotechnical Investigations Final Geotechnical Factual Report Prepared for Roads and Maritime Services – Contract No. 14.2166.0517-0047, Reference No. 30012460, 13 September

[14] SMEC (2108) F6 Extension Stage 1 Geotechnical Investigations Draft Geotechnical Factual Report – Contract 17.000302526.1197, Reference No. 30012161-023-RevA-Draft GFR, 23 February

Concentrations of ground gases including methane, hydrogen sulphide, carbon dioxide and carbon monoxide were also detected within the subsurface at Rockdale Bicentennial Park. The results were interpreted as having a risk classification of characteristic gas situation (CGS) 2 (low risk) in accordance with NSW EPA (2012) guidelines. Sites classified as CGS 2 are recommended to have mitigation measures to address the risk of explosive conditions or exposure to the site. The concentrations of hydrogen sulphide also present a potential risk of nuisance odours and risk to health.

Concentrations of ammonia and nitrogen in groundwater were elevated, exceeding the assessment criteria and indicative of typical landfill leachate. Concentrations of heavy metals arsenic, lead and zinc were detected at concentrations slightly above the assessment criteria in groundwater within the fill. Concentrations of TRH, Benzene, toluene, ethylbenzene, xylenes, naphthalene (BTEXN), volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs) were detected above the limit of reporting but less than the assessment criteria.

Further detail on the site history and previous investigations for the President Avenue construction ancillary facility (C3) is provided in **Appendix J** (Contamination technical report).

16.2.5 Shared cycle and pedestrian pathways (C4 and C5)

The project would deliver new pedestrian and cyclist infrastructure, in the form of a shared cycle and pedestrian pathways. The shared cycle and pedestrian pathways would be developed from Bestic Street, Brighton-Le-Sands to Civic Avenue, Kogarah via the reinstated Rockdale Bicentennial Park and a shared cycle and pedestrian bridge over President Avenue. The alignment of the shared cycle and pedestrian pathways is shown in **Figure 6-13**. The shared cycle and pedestrian pathways has been considered in two sections which correspond to the northern and southern sections of the corridor as described below.

Shared cycle and pedestrian pathways (north)

The land uses in the northern section of the shared cycle and pedestrian pathways between Bestic Street, Brighton-Le-Sands and Bruce Street, Brighton-Le-Sands comprises of part of Bestic Street and recreational open space including Whiteoak Reserve, C A Redmond Field, Rockdale Women's Sportsfields and Greg Atkins Mini Field.

Construction ancillary facilities for the shared cycle and pedestrian pathways (north) would include:

- Shared cycle and pedestrian pathways east (C4) construction ancillary facilities
- Shared cycle and pedestrian pathways west (C5) construction ancillary facilities

The locations of the construction ancillary facilities are shown on **Figure 7-1** in **Chapter 7** (Construction).

The surrounding land use of the shared cycle and pedestrian pathways is described in **Table 16-6**.

Table 16-6 Surrounding land use – Shared cycle and pedestrian pathways

Direction	Description of surrounding land use and proximity to the site
North	Muddy Creek, Barton Park, Lance Studdert Reserve, residential land use in suburbs of Kyeemagh and Banksia. Market gardens to the north-east and 7-Eleven to the north-west on West Botany Street.
South	Residential land use in the suburb of Brighton-Le-Sands, Bay Park, Bay Street and the C2 ancillary facility.
East	Cairnsfoot Special School, residential land use in the suburb of Brighton-Le-Sands.
West	Residential land use in the suburb of Rockdale, West Botany Street, Rockdale Park, Ador Avenue Reserve and McCarthy Reserve.

Site history

Key findings relevant to the active transport network (north) include:

- The 1943 historical aerial photograph shows that the active transport network (north) and immediate surrounding land was cultivated as market gardens
- A search of the NSW EPA records of notices and list of NSW contaminated sites identified no sites within 200 metres of the project
- The closest site currently licenced under the POEO act is the Rockdale Waste and Recycling Centre (Suez) which is located around 500 metres south-west of the shared cycle and pedestrian pathway.

Further detail on the site history and previous investigations for the shared cycle and pedestrian pathways is provided in **Appendix J** (Contamination technical report).

Shared cycle and pedestrian pathways (south)

The southern portions of the shared cycle and pedestrian pathway fall within or adjacent to the Rockdale construction ancillary facility (C2) and the President Avenue construction ancillary facility (C3) and have been discussed previously in **section 16.2.3** and **section 16.2.4**, above.

16.2.6 Princes Highway construction ancillary facility (C6)

The Princes Highway construction ancillary facility (C6) would be located at Kogarah, on the north-east corner of Princes Highway and President Avenue. The land is currently occupied by 7-Eleven Kogarah.

This construction ancillary facility would be around 1,500 square metres. This site would primarily be used for the laydown and parking of construction vehicles and equipment required for the construction of the President Avenue and Princes Highway intersection upgrade. The site will also include some offices, amenities and workshops.

The 7-Eleven Service Station is currently under assessment by the NSW EPA for contamination. Petroleum soil and/or groundwater contamination is therefore known to be present at concentrations above the relevant assessment criteria. Based on the pathways for exposure to human and ecological receptors during construction, the 7-Eleven Service Station has been assessed as a high risk.

16.2.7 Tunnel alignment

Location description

The mainline tunnel alignment runs from below the Kogarah Golf Course at Arncliffe where it connects to the New M5 Motorway tunnel stubs. It then travels south, to the east of the Princes Highway beneath the suburbs of Arncliffe, Banksia and Rockdale until it emerges in the location of Rockdale Bicentennial Park at Rockdale. Tunnel stubs for the continuation for the future stages of the F6 Extension are located north of Bay Street at Rockdale. The tunnels would comprise two mainline tunnels (about three kilometres in length) in each direction and entry and exit ramp tunnels to President Avenue (about 1.5 kilometres in length). The alignment of the tunnel is shown in **Figure 6-1** and **Figure 6-2** in **Chapter 6** (Project description).

Current potentially contaminating land uses

Current commercial and industrial land uses within 250 metres of the tunnel alignment that could contain potential contaminating activities are listed in **Table 16-7**.

Table 16-7 Current potentially contaminating land uses

Land use	Activity
Numerous Petrol stations	Underground fuel storage
Numerous mechanical workshops and car dealerships with workshops	Use of oils, solvents and underground fuel storage
Arncliffe Fire Station	Fire Fighting Foam residues
23 Field Regiment Royal Australian Artillery	Potential oils, solvents and underground fuel storage
Suez Waste Transfer Stations	Waste management
Numerous manufacturing sites	Manufacturing including plastics
St George metal recovery	Storage of waste oils

Notified and regulated sites

A search of the NSW EPA records indicated that there were no sites currently regulated by NSW EPA under Section 60 of the CLM Act 1997 within 500 metres of the tunnel alignment.

Licensed sites

Current and formerly licensed and delicensed sites within 500 metres of the tunnel alignment are listed in **Table 16-8**.

Table 16-8 Tunnel alignment – currently and formerly licensed and delicensed sites within 500 metres

Property and address	Proximity to alignment	Summary
WestConnex New M5 Motorway tunnels, between Beverly Hills and St Peters, Beverly Hills	Above alignment	Currently licensed under the POEO Act 1997
Sydney Trains, Illawarra railway	124 metres north west	Currently licensed under the POEO Act 1997
Morris, McMahon & Co Pty Ltd, 34 Arncliffe Street, Arncliffe	381 metres north	Delicenced activity for Hazardous, Industrial or Group A Waste Generation or Storage
Bilfinger Berger Project Investments Pty Ltd, M5 East Between Kings Georges Rd, Beverly Hills & General Holmes Drive, Kyeemagh	Above alignment	Former license for road construction
Luhrmann Environment Management Pty Ltd, Robert Orchard and Sydney Weed and Pest Management Pty Ltd, Waterways Throughout NSW	Above alignment (including Muddy Creek and Cooks River)	Former license for Other Activities / Non Scheduled Activity - Application of Herbicides
McConnell Dowell Constructors (Aust.) Pty Ltd	365 metres south east (Cooks River)	Former license for water-based extractive activity, miscellaneous licensed discharge to waters (at any time)
SUEZ Recycling and Recovery Pty Ltd Rockdale Waste and Recycling Centre Lindsay Street Rockdale	Above alignment	Non-thermal treatment and recovery of general waste, as well as storage of all types of waste including hazardous waste (including asbestos)
Jacron Pty Ltd/Vulkan Industries 3 Garnet Street, Rockdale	25 metres east	Delicenced activity for Hazardous, Industrial or Group A Waste Generation or Storage
Roads and Traffic Authority of New South Wales, 422 West Botany Street	Above alignment	Delicenced activity for Hazardous, Industrial or Group A Waste Generation or Storage

Groundwater quality

Groundwater monitoring was undertaken within the study area by SMEC in 2016[15], 2017[16,17] and 2018[18] as part of the geotechnical and contamination investigations. Samples were collected and analysed for major cations, major anions, electrical conductivity, dissolved and total heavy metals, nutrients, total petroleum hydrocarbons, benzene, toluene, ethylbenzene, xylenes and naphthalene, organochlorine pesticides, organophosphorous pesticides, volatile organic compounds, semi volatile organic compounds, chlorinated hydrocarbons and phthalates.

There were exceedances of the criteria for heavy metals (arsenic, chromium, copper, lead and zinc), ammonia and nitrogen in groundwater from monitoring wells screened within landfill at Rockdale Bicentennial Park, at the proposed location of the cut-and-cover tunnel.

In the alluvium between Arncliffe and Rockdale industrial area, there were exceedances of zinc and ammonia, at lower concentrations than those at Rockdale Bicentennial Park. There were low concentrations of TRH and VOC compounds detected above the limit of reporting in alluvium in wells in the Rockdale industrial area and in Banksia.

In two deep monitoring wells screened in sandstone, there was one exceedance of the groundwater investigation level for fresh and marine water for nickel at Arncliffe. Low concentrations of TRH, VOCs and phenols were detected in the northern most groundwater well in Kyle Street, Arncliffe.

Further detail on the groundwater monitoring results is provided in **Appendix J** (Contamination technical report) and **Appendix K** (Groundwater technical report).

16.2.8 Permanent power supply

Location Description

The permanent power supply route is located between the Ausgrid Canterbury subtransmission substation, and the Rockdale Motorway Operations Complex south.

The power supply would be located underground from the Ausgrid Canterbury subtransmission at Westfield Street, along Mooney Avenue, through local roads until Harthill-Law Avenue in the suburb of Earlwood. It would pass through the local roads of Bardwell Park including part of Bardwell Valley Golf Club and along the edge of Silver Jubilee Park. It would continue along Wolli Creek Road, Kimpton Street through the T4 Eastern Suburbs and Illawarra Line, the Princes Highway and Tarbrett Street in the suburb of Banksia and along Farr Street and Bay Street before connecting to the Rockdale Motorway Operations Complex south at West Botany Street in Rockdale. The surrounding land use along the power supply route is low to medium residential housing.

The power supply would be installed underground, within the existing road reserve with the exception of:

- Ausgrid Canterbury sub-transmission substation, 16A Hansen Avenue, Earlwood
- Across Bardwell Valley Golf Club
- Along the edge of Silver Jubilee Park
- Under the T4 Eastern Suburbs and Illawarra Line.

The existing environment and areas and contaminants of concern for the section of the power supply route between Rockdale Motorway Operations Complex (south) (MOC3) and Princes Highway has been assessed in **section 16.2.4** and **section 16.2.7** respectively.

[15] SMEC (2017)F6 Northern Geotechnical Investigations – Geotechnical Factual Report – Contract No. 14.2166.0517.0047, 23 February

[16] SMEC (2017) F6 Extension – EIS Section A Phase 1: Groundwater Monitoring Boreholes Geotechnical Factual Report Prepared for Roads and Maritime Services – Contract No. 14.2166.0517-0047, Reference No. 30012460-053-Rev0, 2017, 8 January

[17] SMEC (2017) F6 Northern SEA Geotechnical Investigations Final Geotechnical Factual Report Prepared for Roads and Maritime Services – Contract No. 14.2166.0517-0047, Reference No. 30012460, 13 September

[18] SMEC (2108) F6 Extension Stage 1 Geotechnical Investigations Draft Geotechnical Factual Report – Contract 17.000302526.1197, Reference No. 30012161-023-RevA-Draft GFR, 23 February

Table 16-9 Current surrounding commercial and industrial uses

Property identification	Proximity to power supply route	Activity
Earlwood Dry Cleaners & Commercial Laundry 334 Homer Street, Earlwood	130 metres north east and topographically up-gradient	Dry cleaning
Bardwell Park Dry Cleaners 8 Hartill-Law Avenue, Bardwell Park	<3 metres west and topographically up-gradient	Dry cleaning
262 Wollongong Road, Arncliffe	<3 metres east and topographically up-gradient	Former dry cleaning premises
T&G Auto Repairs 270 Wollongong Road, Arncliffe	45 metres west and topographically up-gradient	Mechanical workshop
Nissan Rockdale 371 Princes Highway, Rockdale	<3 metres north and topographically up-gradient	Mechanical workshop
Storage King 373 Princes Highway, Rockdale	<3 metres south and topographically up-gradient	Former Ricketts & Thorp Pty Ltd furniture manufacturers factory

Site history

Key findings relevant to the permanent power supply route include:

- The 1943 aerial photograph showed the same general land uses as the 1916 aerial with the exception of the following:
  - Bardwell Valley Golf course was mostly undeveloped, consisting of uneven terrain with gullies and tracks
  - The retail buildings along William Street, Earlwood and Hartill-Law Avenue and Slade Road, Bardwell Park were not present
  - There was a quarry between Slade Road and the railway that has since been filled and now consists of a public carpark and Slade Road Reserve.
- A search of the NSW EPA records of notices and list of NSW contaminated sites identified no sites within 200 metres of the project
- The Storage King at 373 Princes Highway, Banksia was formally Ricketts & Thorp Pty Ltd furniture manufacturing factory and consisted of workshops and timber yards from 1910s to 1970s.

Further detail on the site history and previous investigations for the permanent power supply route is provided in **Appendix J** (Contamination technical report).

16.2.9 Areas and contaminants of potential concern

The contaminants of potential concern for each area are summarised in **Table 16-10**. Further detail is provided in **Appendix J** (Contamination technical report).

Table 16-10 Contaminants of potential concern

Location	Area of concern	Contaminants of potential concern
Arncliffe construction ancillary Facility (C1)	• Historical use of the site for agricultural purposes • Current use of the site as a golf course • Areas of historical landfilling • Migration of potentially contaminated groundwater beneath the site • Acid sulfate soils • Up-gradient commercial/industrial land uses	• Pesticides • Herbicides • Nutrients (ammonia, nitrate, nitrite and phosphorus) • Methane • Heavy metals • Hydrocarbons • Organic Compounds • Asbestos • PCBs • Perfluoralkylated Substances (PFAS) • Acid sulfate soils
Rockdale construction ancillary facility (C2)	• Historical use of the site for agricultural purposes • Former, current and surrounding industrial properties (chemical manufacturing) • Soils underlying the site comprising uncontrolled fill • Acid sulfate soils	• Pesticides • Herbicides • Nutrients (ammonia, nitrate, nitrite and phosphorus) • Hydrocarbons • BTEXN • Metals • PCBs • Organic Compounds • Phenols • Asbestos • Acid sulfate soils
President Avenue construction ancillary facility (C3)	• Historical use of the site for agricultural purposes • Former, current and surrounding industrial properties (chemical manufacturing, plastics, fertilisers, pesticides/herbicides) • Uncontrolled fill within Rockdale Bicentennial Park and Civic Avenue • Acid sulfate soils • Up-gradient service stations, motor and mechanical businesses	• Pesticides • Herbicides • Nutrients (ammonia, nitrate, nitrite and phosphorus) • Hydrocarbons • BTEXN • Metals • PCBs • Organic Compounds • Asbestos • Landfill gas (methane, carbon monoxide, carbon dioxide, hydrogen sulphide) • Acid sulfate soils

Location	Area of concern	Contaminants of potential concern
Shared cycle and pedestrian pathways (C4/C5)	• Historical use of the shared cycle and pedestrian pathways for agricultural purposes • Former, current and surrounding industrial properties (chemical manufacturing, plastics, fertilisers, pesticides/herbicides) • Uncontrolled fill within Rockdale Bicentennial Park, Ilinden Sports Centre and Civic Avenue and within soils underlying the corridor • Acid sulfate soils • Up-gradient service stations, motor and mechanical businesses	• Pesticides • Herbicides • Nutrients (ammonia, nitrate, nitrite and phosphorus) • Hydrocarbons • BTEXN • Metals • PCBs • Organic Compounds • Asbestos • Landfill gas (methane, carbon monoxide, carbon dioxide, hydrogen sulphide) • Acid sulfate soils
Princes Highway construction ancillary facility (C6)	• Current use of the site as a petrol station	• The 7-Eleven Service Station is currently under assessment by the NSW EPA for contamination. Petroleum soil and/or groundwater contamination is therefore known to be present at concentrations above the relevant assessment criteria.
Along the tunnel alignment	• Commercial/industrial land uses located above and adjacent to the tunnel alignment particularly Rockdale Industrial area and former commercial/industrial land use along Princes Highway Arncliffe • Areas of historical landfilling at Rockdale Bicentennial Park and the lands east of Muddy Creek • Historical use pesticides and herbicides in market gardens, waterways in the vicinity of the tunnel alignment and use of fertilisers in market gardens	• Heavy metals • Hydrocarbons • Organic Compounds • Asbestos • PCBs • PFAS • Pesticides • Herbicides • Nutrients (ammonia, nitrate, nitrite and phosphorus)
Along the permanent power supply corridor	• Ausgrid Canterbury sub-transmission substation • Sections of the powerline adjacent and route downgradient to current and former dry cleaners (334 Homer Street, Earlwood, 8 Hartill-Law Avenue, Bardwell Park and 262 Wollongong Road, Arncliffe) • Uncontrolled filling within parts of Bardwell Valley Golf Course, a former quarry adjacent to Slade Road in Bardwell Park and West Botany Street Rockdale • Former and current commercial/industrial properties on Kimpton Street and Princes Highway, Banksia • West Botany Street – surrounding Rockdale industrial area (former, current and surrounding industrial properties including chemical manufacturing) • Areas mapped Class 3 for acid sulfate soil risk	• TRH • BTEX • PAHs • Metals • PCBs • VHCs • BTEXN • TRH • PAHs • OP/OC Pesticides • VOCs • SVOCs • Asbestos • Landfill gases • Acid sulfate soils

16.3 Potential impacts – construction

The project has the potential to generate contamination during construction and operation, including the potential to disturb existing contaminated lands at surface works locations.

16.3.1 Soil erosion

Construction of the project has the potential to result in erosion and sediment migration. Surface disturbance and vegetation removal exposes soils and may weaken surface soil structure. This could lead to erosion, sedimentation and soil slippage within and around waterways and slopes in the study area, particularly during periods of high wind or rainfall. Areas of high erosion potential are at a higher risk of being subject to erosion and sedimentation. These areas are identified in **Table 16-2**.

Uncompacted or unconsolidated materials (such as excavated and stockpiled soils) have the potential to leave construction areas during rain (through surface water runoff) causing downstream sedimentation. Sedimentation in natural waterways can result in reduced water quality as well as smothering of vegetation and clogging of the channels, impacting the natural flow paths of the waterway. Potential impacts on surface water quality resulting from soil erosion are provided in **Table 16-11**.

Table 16-11 Potential impacts on surface water quality resulting from soil erosion

Construction activity / source of pollutants	Pollutants of concern	Potential impact	Receiving waterways
Erosion and mobilisation of exposed soils from open cuts, batter slopes and stockpiles by stormwater runoff and wind leading to sedimentation in receiving waterways	Sediment, nutrients, gross pollutants	Increased turbidity, lower dissolved oxygen levels and nutrients which could lead to algal blooms and aquatic weed growth Increases in toxicant concentration Reduced visual amenity (visible gross pollutants)	Rockdale wetland Northern Scarborough Pond Cooks River Muddy Creek
Soil and bank erosion and mobilisation of sediments into receiving waterways during the direct disturbance of waterway bed and/or banks as a result of earthworks and construction of instream structures	Sediment, nutrients and heavy metals stored in bed sediments	Increased turbidity, lower dissolved oxygen levels, increased nutrients which may exacerbate aquatic weed growth and algal blooms, increased toxicant concentrations	Rockdale wetland Northern Scarborough Pond

Erosion and sediment control would be implemented on and around areas of surface disturbance (i.e. surface road works, construction ancillary facility sites and excavation and vegetation removal). Particular emphasis would be given to areas of surface disturbance near waterways, including Rockdale wetland, Northern Scarborough Pond, Cooks River, Muddy Creek and Wolli Creek.

16.3.2 Soil salinity

Salinity impacts occur when salts naturally present in soil or groundwater are mobilised and accumulate to a level that damages the natural and built environment. Salinity impacts could potentially occur during construction of the project as a result of soil disturbance during earthworks and through changes in groundwater levels during tunnelling.

Measures to manage potential soil salinity impacts are provided in **section 16.5**. With the proposed management measures in place potential impacts associated with disturbance of saline soils are considered to be negligible.

Potential salinity impacts associated with groundwater are assessed in **Appendix K** (Groundwater technical report).

Saltwater intrusion from saline tidal water would occur due to groundwater level decline associated with the tunnels for the project. During construction, the slight salinity increase anticipated for the project is unlikely to impact on the environment since the groundwater along the tidal fringe is naturally saline due to tidal mixing.

During operation, initial saline groundwater inflows would represent extremely small inflows and would slowly become a larger proportion of flow over time. Groundwater quality in the tunnel catchment zones would slowly become more saline over thousands of years. Since the operational lifetime for major infrastructure is in the order of 100 years, the slow salinity increase would have minimal impacts on the tunnels, infrastructure and the environment in the short term.

16.3.3 Landfill gases and leachate

Landfill gases and leachate have been identified to be present within Rockdale Bicentennial Park, based on the results of preliminary investigations. The landfill gases and leachate have a potential to cause nuisance odours to the surrounding area during excavation for the construction of the cut and cover tunnel and associated works. The landfill gases also have the potential to accumulate within the subsurface service trenches and pits as well as within aboveground spaces such as buildings and basins.

Further detailed investigation and assessment would be undertaken in order to develop plans for leachate and landfill gas management that may comprise:

- Leachate extraction, storage, treatment and disposal during construction
- Landfill gas drainage and ventilation
- Staging of landfill excavation and spoil management to manage odour impacts
- Landfill gas monitoring of the subsurface at the ancillary facility boundary, of the surface within the ancillary facility and of service pits and trenches within and surrounding the ancillary facility
- Ambient air quality and odour monitoring around the ancillary facility boundary, including the development of site specific action criteria
- Capping and drainage plans for areas not to be excavated within the ancillary facility
- Downstream surface water monitoring during construction (refer to **Appendix L** (Surface water technical report)).

16.3.4 Construction ancillary facilities and surface works

The assessment of contamination impacts for surface works during construction is presented in **Table 16-12**. The construction works to be undertaken at each of the construction ancillary facilities are described in **Chapter 7** (Construction).

The risk ratings presented in **Table 16-12** are prior to the implementation of the management measures identified in **section 16.5**. Following the implementation of management measures, it is anticipated that identified high or medium risk rankings for the construction ancillary facilities and shared cycle and pedestrian pathways would ultimately present a low risk.

Table 16-12 Assessment of construction impacts – ancillary facilities and surface works

Area	Potential contamination impacts associated with construction phase	Likelihood of soil or groundwater contamination to be present	Consequence	Risk[1]
Arncliffe construction ancillary facility (C1)	Previous investigations completed within the New M5 Motorway Arncliffe Construction Compound, which would be used as the Arncliffe construction ancillary facility (C1) for the project, identified asbestos in fill at one location which exceeded the adopted assessment criteria. Ammonia and methane concentrations in groundwater were identified as a potential concern during construction works, due to the potential for worker exposure to ammonia in groundwater during dewatering and excavation and the potential for methane to accumulate in subsurface structures. The works would include further excavation of the existing access shaft for the construction of the mainline tunnel; and minor excavations at the surface may occur. Temporary stockpiling would also occur. Acid sulfate soil risk is classified as Class 3 and there is a high probability of disturbed terrain. The Phase 2 ESA for the New M5 Motorway confirmed the presence of Potential Acid Sulfate Soils (PASS) within C1. Use of the site as an ancillary construction facility also has the potential for leaks and spills from plant and machinery. Potential pathways of contaminants are through: • Direct contact, ingestion and inhalation by construction workers • Off-site transport via dust, vehicle/plant movements • Surface water runoff and discharge to the receiving environment • Groundwater extraction and discharge to the receiving environment • Leaching of contaminants to groundwater from stockpiles with contaminants. Cross contamination associated with the incorrect handling or disposal of spoil/unexpected finds and/or potential leaks and spills from construction equipment and plant is a potential impact during construction, if appropriate controls and handling procedures are not implemented.	Potentially present at concentrations above the relevant assessment criteria and widespread.	Exposure pathway for human or ecological receptors likely to be present and complete either now, during or post construction (without implementation of appropriate controls).	Medium

Area	Potential contamination impacts associated with construction phase	Likelihood of soil or groundwater contamination to be present	Consequence	Risk[1]
Rockdale construction ancillary facility (C2)	The area has been used for market gardens and industrial activities and was formerly filled and therefore there is potential for soil and groundwater contamination to be present. Previous limited investigations have confirmed the presence of uncontrolled fill. Soil contamination was not detected above the assessment criteria, however additional investigations would be required to characterise the site adequately. Acid sulfate soil risk is classified as Class 3 and there is a high probability of disturbed terrain. The works would include bulk excavation for the construction of the decline (cut-and-cover) to the mainline tunnels. Potential pathways are through: • Direct contact, ingestion and inhalation by construction workers • Off-site transport via dust, vehicle/plant movements • Surface water runoff and discharge to the receiving environment • Groundwater extraction and discharge to the receiving environment • Leaching of contaminants to groundwater from stockpiles with contamination. Cross contamination associated with the incorrect handling or disposal of spoil/unexpected finds and/or potential leaks and spills from construction equipment and plant is a potential impact during construction, if appropriate controls and handling procedures are not implemented.	Potentially be present at concentrations above the relevant assessment criteria and widespread.	Exposure pathway for human or ecological receptors likely to be present and complete either now, during or post construction (without implementation of appropriate controls).	Medium

Area	Potential contamination impacts associated with construction phase	Likelihood of soil or groundwater contamination to be present	Consequence	Risk[1]
President Avenue construction ancillary facility (C3) – works within Rockdale Bicentennial Park	Rockdale Bicentennial Park is known to have been used as an uncontrolled landfill and the area is surrounded to the north east by industrial land use which has included a range of manufacturing industries, workshops and garages since the 1950s and 1960s. An investigation of the site indicated that concentrations of some contaminants exceeded accepted limits in soil and fill materials, ground gases and groundwater. These are identified in section 16.2.4. Acid sulfate soil risk is classified as Class 2 and there is a high probability of disturbed terrain. The works would include bulk surface excavation for the construction of cut-and-cover tunnels, entry and exit ramps and surface road construction. Potential pathways are through: • Direct contact, ingestion and inhalation by construction workers • Off-site transport via dust, vehicle/plant movements • Surface water runoff and discharge to the receiving environment • Groundwater extraction and discharge to the receiving environment • Landfill gas migration and exposure • Generations of odour during excavation and dispersion in wind • Leaching of contaminants to groundwater from stockpiles with contamination. Cross contamination associated with the incorrect handling or disposal of spoil/unexpected finds and/or potential leaks and spills from construction equipment and plant is a potential impact during construction, if appropriate controls and handling procedures are not implemented.	Known to be present at concentrations above the relevant assessment criteria and widespread.	Exposure pathway for human or ecological receptors likely to be present and complete either now, during or post construction (without implementation of appropriate controls).	High

Area	Potential contamination impacts associated with construction phase	Likelihood of soil or groundwater contamination to be present	Consequence	Risk[1]
C3 continued – Rockdale ventilation facility construction area (427 to 441 West Botany Street	The review of historical information indicates that properties at 427 to 441 West Botany Street, Rockdale have been used for potentially contaminating activities, are within land mapped as disturbed terrain and are mapped Class 3 for acid sulfate soil risk. The works would include bulk surface excavation for the construction of the ventilation shaft. Potential contamination pathways are through: • Direct contact, ingestion and inhalation by construction workers • Off-site transport via dust, vehicle/plant movements • Surface water runoff and discharge to the receiving environment • Groundwater extraction and discharge to the receiving environment • Generations of odour during excavation and dispersion in wind Cross contamination associated with the incorrect handling or disposal of spoil/unexpected finds is a potential impact during construction if appropriate controls and handling procedures are not implemented.	Potentially present at concentrations above the relevant assessment criteria and widespread.	Exposure pathway for human or ecological receptors likely to be present and complete during construction (without implementation of appropriate controls).	Medium
C3 continued – Installation of water pipeline	West Botany Street is surrounded by a range of potentially former potentially contaminating activities and is mapped as disturbed terrain and mapped Class 3 for acid sulfate soil risk. The works would include the installation of a temporary water pipeline from the Rockdale construction ancillary facility (C2) along West Botany Street to the Rockdale ventilation facility. The works would include excavation for the construction of a trench for the water pipeline. Potential contamination pathways are through: • Direct contact, ingestion and inhalation by construction workers • Off-site transport via dust, vehicle/plant movements • Surface water runoff and discharge to the receiving environment • Groundwater extraction and discharge to the receiving environment • Generations of odour during excavation and dispersion in wind.	Potentially present at concentrations above the relevant assessment criteria and widespread	Exposure pathway for human or ecological receptors likely to be present and complete during construction (without implementation of appropriate controls).	Medium

Area	Potential contamination impacts associated with construction phase	Likelihood of soil or groundwater contamination to be present	Consequence	Risk[1]
C3 continued – Construction of the shared cycle and pedestrian pathways, including the shared cycle and pedestrian bridge over President Avenue	The shared cycle and pedestrian pathway intersects Rockdale Bicentennial Park and disturbed terrain to the north and south. Potential contamination pathways are through: • Direct contact, ingestion and inhalation by construction workers • Off-site transport via dust, vehicle/plant movements • Surface water runoff and discharge to the receiving environment • Generations of odour during excavation and dispersion in wind.	Known to be present at concentrations above the relevant assessment criteria and widespread.	Exposure pathway for human or ecological receptors likely to be present and complete during construction (without implementation of appropriate controls).	High
C3 continued – Demolition of houses	The houses to be acquired along the northern side of President Avenue, would be demolished as part of the works. The buildings may contain hazardous building materials (asbestos and lead). Potential contamination pathways are through: • Inhalation by construction workers • Off-site transport via dust.	Hazardous building materials are potentially present.	Exposure pathway for human receptors likely to be present and complete during construction (without implementation of appropriate controls).	Medium
Demolition of the substation within St George TAFE	The use of the substation could have resulted in localised PCB and hydrocarbon contamination of underlying soils. The substation may also contain hazardous building materials (asbestos, lead and PCBs). Potential contamination pathways from demolition of the substation are through: • Direct contact, ingestion and inhalation by construction workers • Off-site transport via dust, vehicle/plant movements • Surface water runoff and discharge to the receiving environment.	Potentially present at concentrations above the relevant assessment criteria and widespread.	Exposure pathway for human or ecological receptors likely to be present and complete during construction (without implementation of appropriate controls).	Medium

Area	Potential contamination impacts associated with construction phase	Likelihood of soil or groundwater contamination to be present	Consequence	Risk[1]
Shared cycle and pedestrian pathways construction ancillary facilities (C4/C5) and shared cycle and pedestrian pathways (north)	Potential for shallow soil contamination to be present due to: • Historical use of the shared cycle and pedestrian pathway for agricultural purposes and the use of pesticides, herbicides and fertilisers • Former, current and surrounding industrial properties (chemical manufacturing, plastic, fertilisers, pesticides/herbicides) • Uncontrolled fill within Rockdale Bicentennial Park, Illinden Sports Centre and Civic Avenue and within soils underlying the corridor • Areas of high risk of Acid sulfate soils • Up-gradient service stations, motor and mechanical businesses Potential pathways are through: • Direct contact, ingestion and inhalation by construction workers • Off-site transport via dust, vehicle/plant movements • Surface water runoff and discharge to the receiving environment. Use of the site as an ancillary construction facility also has the potential for leaks and spills from plant and machinery. Cross contamination associated with the incorrect handling or disposal of spoil/unexpected finds and/or potential leaks and spills from construction equipment and plant, is a potential impact during construction, if appropriate controls and handling procedures are not implemented.	Potentially be present at concentrations above the relevant assessment criteria and widespread.	Exposure pathway for human or ecological receptors likely to be present and complete either now, during or post construction (without implementation of appropriate controls).	Medium
Princes Highway construction ancillary facility (C6)	The 7-Eleven Service Station within the C6 boundary is currently under assessment by the NSW EPA for contamination. Petroleum soil and/or groundwater contamination is therefore known to be present at concentrations above the relevant assessment criteria. The works would require the excavation of soil for the removal of the underground storage tanks (USTs). Potential contamination pathways could be through: • Direct contact, ingestion and inhalation by construction workers • Off-site transport via dust, vehicle/plant movements • Surface water runoff and discharge to receiving environment • Groundwater extraction and discharge to receiving environment • Generation of odour during excavation and dispersion in wind • Cross contamination associated with the incorrect handling or disposal of spoil/unexpected finds is a potential impact during construction if appropriate controls and handling procedures are not implemented	Known to be present at concentrations above the relevant assessment criteria.	Exposure pathway for human or ecological receptors likely to be present and complete either now, during or post construction (without implementation of appropriate controls).	High

Area	Potential contamination impacts associated with construction phase	Likelihood of soil or groundwater contamination to be present	Consequence	Risk[1]
Permanent power supply alignment	There may be areas of contaminated soils encountered along the route in areas that have been filled or contaminated from surrounding land use. The soils would be excavated and groundwater dewatering may be required where shallow groundwater is encountered in trenches or directional drilling excavations. Potential pathways could be through: • Direct contact, ingestion and inhalation by construction workers • Off-site transport via dust, vehicle/plant movements • Surface water runoff or groundwater discharge and discharge to receiving environment • Generation of odour during excavation and dispersion in wind.	Potentially present at concentrations above the relevant assessment criteria and widespread.	Exposure pathway for human or ecological receptors likely to be present and complete either now, during or post construction (without implementation of appropriate controls).	Medium

Notes:
1 In accordance with National Environment Protection Council (1999) National Environmental Protection Measure (Assessment of site Contamination) (ASC NEPM), May 2013.

16.3.5 Tunnelling

A review of potential groundwater contamination sources along the alignment identified as medium or high risk based on the presence of potential current and former contamination sources and investigation results are listed in **Table 16-13**. All other areas along the tunnel alignment are considered to be a low risk for significant sources of groundwater contamination.

During tunnel construction, groundwater would be extracted from the tunnelling process, which would require disposal. The extracted water would be either:

- Treated onsite and then discharged to the Cooks River at Arncliffe and to the stormwater system at President Avenue under an EPL or to sewer under a trade waste agreement (TWA) from Sydney Water; or
- Transported to a liquid waste facility for offsite disposal.

There is potential for shallow tunnelling (such as near cut-and-cover tunnels, portals and adits) to encounter impacted groundwater from sources such as petrol stations with dissolved and undissolved petroleum hydrocarbon plumes or other industrial sources. The highest risk location for the project, due to the geology and large area of potential contamination sources, is the Rockdale industrial area and at Rockdale Bicentennial Park.

Dewatering during construction works may cause changes in the migration of plumes of contaminated groundwater, by changing groundwater gradients and drawing the contamination towards the tunnel. This is most likely in areas where the tunnels are shallow and approaching the surface such as the adit at West Botany Street, Rockdale, at Arncliffe (currently New M5 Motorway portal) and the cut-and-cover sections at Rockdale leading towards President Avenue intersection. Dewatering and its potential impacts are discussed further in **Appendix K** (Groundwater technical report).

Potential impacts on receiving water bodies and ecological receptors through the disturbance of contaminated sediments associated with the construction of new drainage outlets and drainage infrastructure adjustments and upgrades could occur at the following locations:

- Cooks River
- Muddy Creek
- Scarborough Ponds.

Potential impacts on workers include exposure to extracted contaminated groundwater from either direct contact or inhalation of vapours or vapours encountered during tunnelling. Impacts would be managed in accordance with protocols outlined in a site specific occupational health and safety plan and safe work method statement specific to the work activity being conducted.

The Arncliffe construction ancillary facility (C1) and the Rockdale construction ancillary facility (C2) would each have a construction water treatment plant to treat construction water and groundwater inflows encountered during tunnel construction. The President Avenue construction ancillary facility (C3) would also include a construction water treatment plant to treat groundwater that is extracted from the cut-and-cover structure during the excavation of the ramps at President Avenue. Construction wastewater from the Arncliffe construction ancillary facility (C1) would discharge to the Cooks River. Where feasible and reasonable, construction wastewater from the Rockdale construction ancillary facility (C2) and President Avenue (C3) construction ancillary facilities would discharge to Muddy Creek or the Cooks River to protect the more sensitive environment of Scarborough Ponds.

Discharge criteria is presented and discussed in **Appendix L** (Surface water technical report), along with further details on construction wastewater treatment. Where feasible and reasonable, construction wastewater would be treated such that discharge concentrations would be equal to or less than the discharge criteria set for the receiving waterways. The criteria have been developed in accordance with ANZECC (2000) as well as with consideration of the relevant NSW Water Quality Objectives.

Table 16-13 Summary of key groundwater contamination sources relevant to proposed tunnelling

Tunnel section	Tunnel description	Identified potential contamination source sites/areas	Risk
New M5 Motorway tunnel to Forest Road Arncliffe to Bay Street, Rockdale	• Underground connection to New M5 Motorway stub tunnels at Arncliffe in a south-westerly direction at a depth of about 75 metres below ground level (bgl) • Installation of stabilisation and excavation support (retention systems) such as sheet pile walls, diaphragm walls (where required) • Construction of required retaining structures • Depth of mainline tunnels between C1 and C2 is about 60 to 110 metres bgl • Ventilation tunnels at a proposed depth of 60 metres bgl	Kogarah Golf Course and surrounding filled land to the south Former Tempe Bus Depot Up-gradient former and current commercial/ industrial properties (mechanics and workshops) along Princes Highway, Arncliffe	Medium Medium Medium
Bay Street Rockdale to President Avenue ancillary facility	• Excavation of the construction access decline from the C2 site to the west of West Botany Street, to the Bunnings Warehouse Car Park on West Botany Street and south-west to the northbound entry ramp, from surface to a depth of about 50 metres bgl • Installation of stabilisation and excavation support (retention systems) such as sheet pile walls, diaphragm walls (where required) • Construction of required retaining structures • Depth of tunnels between C2 and C3 is about 60 metres bgl to five metres above ground surface in the location of the north bound and south bound exit ramps • Tunnel dive and cut-and-cover structures at the President Avenue ancillary facility (C3) • The President Avenue ancillary facility, including entry and exit ramps to connect with the surface road network • Stub tunnels to connect to the future stages of the F6 Extension	Former Goodfellow Dry Cleaners Rockdale industrial area Rockdale Bicentennial Park and surrounding filled land	Medium Medium High

16.3.6 Cumulative impacts

Cumulative impacts on soils and contamination are generally related to the movement of contaminated soil and water across project boundaries. Construction of the project would occur at the same time as other significant projects underway and/or planned in the surrounding area, including:

- WestConnex program of works including the M4-M5 Link, New M5 Motorway and M4 East projects
- Sydney Gateway (project is currently in planning phase)
- Sydney Metro City and Southwest
- Bayside West Precinct
- Muddy Creek naturalisation
- Future stages of the F6 Extension.

Potential construction impacts for these projects are related primarily to the disturbance and management of existing land contamination and discharge of treated groundwater and stormwater. The EISs prepared for M4-M5 Link, New M5 Motorway, M4 East and Sydney Metro – Sydney to Bankstown all included assessment of contamination within the project footprints and provided management measures. These projects are not expected to generate significant new land contamination during construction. However, they are all likely to encounter and disturb existing contamination from past land uses that would require investigation, management and remediation.

The Bayside West Precinct is likely to be developed on a site by site basis and the requirement for contamination assessment under SEPP 55 would be determined during the development application process.

During construction there would be the requirement for remediation works which would result in the disposal of contaminated soil and/or acid sulfate soils to landfill. Further assessment of cumulative impacts associated with transport and waste are discussed in **Chapter 21** (Waste management).

Further assessment of cumulative impacts associated with contamination is in **Appendix J** (Contamination technical report).

16.4 Potential impacts – operation

16.4.1 Soil erosion

During operation of the project, there is potential for recently disturbed soils to be susceptible to erosion, particularly during initial periods of landscaping and re-establishment of vegetation. This may occur in areas where soft landscaping is proposed for the project, including adjacent to disturbed areas, along embankments and in the reinstatement of temporary ancillary facilities, including at Rockdale Bicentennial Park, where topsoil is settling and vegetation is establishing.

Soil stabilisation work may be required following construction to prevent further erosion, topsoil loss or soil migration. This work is likely to be required following severe storms. Measures to manage erosion will be included in the Operation Environment Management Plan (OEMP).

16.4.2 Permanent operational facilities

Potential contamination impacts associated with roads and permanent operational infrastructure such as motorway operations complexes and associated infrastructure (ventilation facilities, water treatment plants and substations etc.) are presented in **Table 16-14**. For the purpose of this assessment, identified operational impacts primarily relate to the potential contamination of soil, surface water and ground water arising from vehicle accidents, leaks and spills on constructed project roadways including tunnels.

The motorway operations complexes are located within the footprint of the construction ancillary facilities. The area of the construction ancillary facilities that are not anticipated to be used for motorway operations complexes would be rehabilitated at the end of construction (refer to **Chapter 14** (Property and land use).

At the completion of F6 Extension – Stage 1 construction, the landscaping (where applicable) and residual land obligations detailed in the F6 Extension – Stage 1 conditions of approval would be carried out. As such there are no anticipated operational impacts of these construction ancillary facilities during operation and these are not discussed further in this section.

Site layouts showing operational infrastructure are shown in **Chapter 6** (Project description).

Table 16-14 Assessment of operational impacts – motorway operations complexes, shared cycle and pedestrian pathways (north) and permanent power supply

Area	Operation	Potential contamination impacts associated with operation
Arncliffe Motorway Operations Complex (MOC1)	• Arncliffe ventilation facility • Water treatment plant • Substation • Fire pump room and water tanks	• Contamination impacts associated with the operation of the project include leaks and spills on constructed roadways from vehicles and vehicle accidents • Minimal soil or groundwater contamination impacts would be expected from the operation of the substation. Sources of contamination could be from small volumes of oils, fuels, solvents and other chemicals used for operation and maintenance, if not stored and handled in accordance with regulations.
Rockdale Motorway Operations Complex (north) (MOC2)	• Operational Motorway Control Centre • Car parking • Deluge tanks • Workshop and office • Bulky equipment store • Pump station and pump room • Work yard	• Contamination impacts associated with the operation of the project include leaks and spills on constructed roadways from vehicles and vehicle accidents • Sources of contamination could be from small volumes of oils, fuels, solvents and other chemicals used for operation and maintenance, if not stored and handled in accordance with regulations.
Rockdale Motorway Operations Complex (south) (MOC3) and road infrastructure	• Ventilation facility • Car parking • Two substations and power supply • Disaster recovery site • Roadway • Roads, entry and exit ramps and tunnel portals	• Contamination impacts associated with the operation of the project include leaks and spills on constructed roadways from vehicles and vehicle accidents • Minimal soil or groundwater contamination impacts would be expected from the operation of the substation and ventilation facility. Sources of contamination could be from small volumes of oils, fuels, solvents and other chemicals used for operation and maintenance, if not stored and handled in accordance with regulations.
Shared cycle and pedestrian pathways	• Footpaths • Cycleway • Shared cycle and pedestrian bridge	• No contamination impacts associated with the operation of the project.
Permanent power supply	• Power supply	• Minimal soil or groundwater contamination impacts would be expected from the operation of the substation. Sources of contamination could be from small volumes of oils, fuels, solvents and other chemicals used for operation and maintenance, if not stored and handled in accordance with regulations.

16.4.3 Tunnels

During operation, groundwater seepage, stormwater drainage at tunnel portals, tunnel wash-down water, fire suppressant deluge or fire main rupture and spillage of flammable and other hazardous materials would be captured by tunnel drainage. The captured water would be treated and discharged to the receiving water bodies. If the discharged water is not treated to the required standard, there could be adverse impacts on water quality of the receiving environments.

As described in **section 16.2.6**, groundwater quality may be impacted along parts of the tunnel alignment due to overlying contamination sources impacting groundwater. As discussed in **Appendix K** (Groundwater technical report), the mainline tunnels have been aligned to minimise intersecting highly permeable material that could result in high groundwater inflows into the tunnels. The proposed tunnel alignment avoids the underlying palaeochannels and unsuitable geology that lies to the east of the project alignment. The horizontal alignment maximises the extent of the project within competent Hawkesbury Sandstone and minimises the alignment traversing immediately beneath sensitive environmental areas, creeks and wetlands to reduce the risk of surface water leakage.

The vertical tunnel alignment dives beneath palaeochannels where possible to reduce groundwater and surface water inflows into the tunnels. Where the project intersects palaeochannels and alluvium, the tunnels would be tanked (undrained) to prevent groundwater inflow in these areas. As such, where present, contaminated groundwater would be unable to enter the tunnels at those locations due to tanked sections. In addition, the proposed depth of the tunnel alignment within the Hawkesbury Sandstone would increase the rock cover and reduce the risk of significant groundwater inflows from potential hydraulic connections with the palaeochannels and surface water systems.

Assessment on the potential impacts on surface water receiving environments and proposed treatment and management is provided in **Appendix L** (Surface water technical report) and **Chapter 18** (Surface water and flooding).

An assessment of the expected groundwater seepage rates and groundwater drawdown which may have an effect on existing or future groundwater contamination plumes is provided in **Appendix K** (Groundwater technical report). Given the tunnel depth, location of the tunnel in relation to the contaminant sources and low predicted inflow rates, the risk of intercepting contaminated groundwater within the Hawkesbury Sandstone is considered to be low. The risk of contaminated groundwater ingress from the alluvium is also considered low because the tunnel is to be tanked in the alluvium, restricting groundwater movement from the alluvium.

16.4.4 Cumulative impacts

The following projects were considered in the qualitative assessment of potential operational impacts:

- WestConnex program of works including the M4-M5 Link, New M5 Motorway and M4 East projects
- Sydney Gateway
- Sydney Metro City and Southwest
- Bayside West Precinct
- Muddy Creek naturalisation
- Future stages of the F6 Extension.

Provided the projects are completed in accordance with conditions of approval, legislation under the CLM Act and in accordance with the NSW EPA guidelines, the projects should reduce the risks of existing land contamination within the project boundaries. Land within these projects is required to be assessed on a site by site basis.

A Phase 2 ESA was completed for the New M5 Motorway Arncliffe Construction Compound[19]. Contamination impacts, arising from works undertaken as part of the New M5 Motorway project, are being managed by the implementation of mitigation measures in the Arncliffe Construction Compound Construction Area Plan to manage asbestos in fill and elevated ammonia and methane concentrations identified in groundwater. The mitigation measures being adopted for the New M5 Motorway Arncliffe Construction Compound would be assessed during detailed design to confirm applicability to the construction works.

Further assessment of cumulative impacts associated with contamination is discussed in **Appendix J** (Contamination technical report).

16.5 Management of impacts

The mitigation and management measures provided in **Table 16-15** would be implemented during construction and operation of the project to reduce or minimise the potential impacts discussed in **section 16.3** and **section 16.4**. Further details on the environmental management measures are provided in **Appendix J** (Contamination technical report) and **Appendix L** (Surface water technical report).

These measures will be included in the Construction Environmental Management Plan and Operation Environmental Management Plan for the project and refined during the course of detailed design to further minimise impacts.

Table 16-15 Environmental management measures – soils and contamination

Impact	Reference	Environmental management measures	Timing
Impacts on site workers and/or local community through disturbance and mobilisation of contaminated material	SC1	A Construction Soil and Water Management Plan (CSWMP) will be prepared for the project. The plan will detail the process and measures to manage and monitor soil and water impacts associated with the construction works, including contaminated land. The CSWMP will: • Describe measures to minimise and /or manage sediment and erosion within the project footprint, including overland flow, including requirements for Erosion and Sediment Control Plans (ESCP). • Describe stockpile management measures, including location restrictions, separation of waste types, stabilisation and sediment controls • Describe measures for managing waste, including spoil classification and handling • Describe procedures for managing unexpected contamination finds • Describe procedures for managing groundwater impacts including treatment requirements • Describe procedures for dewatering accumulated water on site and within sediment basins, including discharge criteria and sign off • Describe spill management procedures including requirements for locating and maintaining spill response materials such as spill kits • Detail surface water and groundwater monitoring requirements, including discharge criteria. Measures are to be consistent with the Blue Book (Landcom 2004) and relevant Roads and Maritime guidelines.	Prior to construction

[19] Golder (2016) Westconnex New M5 Phase 2 Environmental Site Assessment – Kogarah Golf Course, Marsh Street, Arncliffe, NSW

Impact	Reference	Environmental management measures	Timing
	SC2	A Hazardous Building Materials Management Plan will be prepared detailing measures to manage the removal of known and unexpected hazardous building materials, including asbestos within buildings and soil. The plan is to be prepared in accordance with relevant guidelines.	Construction
	SC3	Detailed site (contamination) investigations will be undertaken in accordance with the NSW EPA (1995) *Sampling Design Guidelines* within the following ancillary facilities and construction sites prior to commencement of construction at these sites: • Rockdale construction ancillary facility (C2) • President Avenue construction ancillary facility (C3), specifically Rockdale Bicentennial Park and 427 to 441 West Botany Street • Parts of the shared cycle and pedestrian pathways where earth works are required within Civic Avenue, Bicentennial Park, Rockdale Women's Sports Field, Greg Atkins Mini Field, CA Redmond Field and White Oak Reserve • Princes Highway construction ancillary facility (C6), the 7-Eleven service station at 734 Princes Highway, Kogarah • The substation within St George TAFE. Where required, based on the results of the additional investigations, a Remedial Action Plan (RAP) will be prepared prior to construction.	Prior to construction Construction
Impacts on soil and water quality through incorrect handling of contaminated material	SC4	Construction water treatment plants will be established and operated at the Arncliffe Construction Ancillary Facility (C1), Rockdale Construction Ancillary Facility (C2) and President Avenue Construction Ancillary Facility (C3) to treat water from the tunnel works. Discharge from these plants will be managed to achieve the applicable ANECC criteria. Where feasible, water from the water treatment plants will be reused for construction activities.	Construction
Acid sulfate soils	SC5	An Acid Sulfate Management Plan will be prepared detailing processes to manage actual and potential acid sulfate soils disturbed during construction.	Construction
Landfill gas and leachate	SC6	Further detailed investigation and assessment will be undertaken in Rockdale Bicentennial Park in order to develop management plans for leachate and landfill gas management. The purpose of the management plans will be to minimise nuisance odours to the surrounding area during excavation, and to prevent the accumulation of gases in buildings, basins and subsurface service trenches and pits associated with the project. The management plans may include measures such as excavation staging, leachate and gas management, and gas and odour monitoring.	Construction
Erosion and sedimentation	SC7	A soil conservation specialist will be engaged for the duration of construction to provide advice regarding erosion and sediment control.	Construction
Salinity	SC8	Prior to ground disturbance in areas of very high potential soil salinity, testing will be carried out to confirm the presence of saline soils. If saline soils are encountered, they will be managed in accordance with Site Investigations for Urban Salinity (DLWC 2002).	Construction

16.6 Environmental risk assessment

An environmental risk analysis was undertaken for soils and contamination and is provided in **Table 16-16** below.

A level of assessment was undertaken commensurate with the potential degree of impact the project may have on that issue. This included an assessment of whether the identified impacts could be avoided or minimised (for example, through design amendments). Where impacts could not be avoided, environmental management measures have been recommended to manage impacts to acceptable levels.

The residual risk is the risk of the impact after the proposed mitigation measures have been implemented. The methodology used for the environmental risk analysis is outlined in **Appendix O** (Methodologies).

Table 16-16 Environmental risk analysis – Soils and contamination

Summary of impact	Construction/ operation	Management and mitigation reference	Likelihood	Consequence	Residual Risk
Impacts on soil and water quality due to disturbance of actual or potential acid sulfate soils and/or acid drainage discharge.	Construction	SC5	Likely	Moderate	Medium
Impacts on site workers and local community through direct contact, inhalation and/or ingestion of dust from contaminated soil or hazardous building materials exposed through ground disturbance and demolition of buildings.	Construction	SC2, HS2	Unlikely	Moderate	Low
Increased contamination in areas through cross contamination associated with the incorrect handling or disposal of spoil/unexpected finds and/or potential leaks and spills from construction equipment and plant.	Construction	SC1	Unlikely	Moderate	Low

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