15. NON-ABORIGINAL HERITAGE

This chapter provides a summary of the non-Aboriginal heritage impact assessment undertaken by Artefact Heritage. A copy of the full assessment report is provided as *Technical Report 9 – Statement of Heritage Impact*.

15.1 Assessment approach

A summary of the approach to the assessment is provided in this section, including the legislation, guidelines and policies driving the approach and the methodology used to undertake the assessment. A more detailed description of the approach and methodology is provided in *Technical Report 9 – Statement of Heritage Impact.*

15.1.1 Legislative and policy context to the assessment

National and commonwealth legislation

Airports Act 1996 and associated regulations

The Airports Act (and associated regulations) provides statutory controls for ongoing regulation of development activities on Commonwealth-owned land leased from the Australian Government for the operation of Sydney Airport.

As the project would require temporary use of Commonwealth owned land during the construction phase, an assessment of the consistency of the project with the Airports Act, associated Sydney Airport Master Plan 2039 and Sydney Airport Environment Strategy 2019-2093 is required.

Sydney Airport Master Plan 2039

As part of the planning framework established by the Airports Act, airport operators are required to prepare a master plan for the coordinated development of their airport.

The *Sydney Airport Master Plan 2039* (SACL 2019a) includes the following relevant heritage initiatives:

- conserve the significant places of the airport, in line with the Heritage Management Plan
- actively conserve heritage elements listed as Environmentally Significant under the Airports Act
- deliver and continually build upon the online experience centre, to tell the history of the airport site, detail its significance and its aviation history
- integrate heritage interpretation devices into new and existing Sydney Airport facilities through delivery of an interpretation strategy
- ensure that heritage items of recognised significance are recorded to an appropriate archival standard
- establish an archive of historical records of the history of Sydney Airport and the site
- implement the management plan for the fig trees and the Sydney Airport Wetlands, located in the South East Sector.

This assessment was completed in accordance with the objectives outlined in section 2.3 of the Sydney Airport Master Plan 2039, to ensure heritage items are appropriately considered and managed.

Sydney Airport Environmental Strategy 2019–2039

The Airports Act requires that airport operators provide an assessment of the environmental issues associated with implementing the airport master plan and the plan for dealing with those issues. This is documented in an environment strategy that forms part of the airport's master plan. The Sydney Airport Environment Strategy (SACL 2019b) stipulates that heritage must be appropriately considered and managed.

Technical Report 9 – Statement of Heritage Impact has been prepared in accordance with this requirement.

Airports (Environmental Protection) Regulations 1997

The objective of *the Airports (Environmental Protection) Regulations 1997* (the regulations) is to establish a system of regulation for activities at airports that generate or have potential to generate pollution or excessive noise. The regulations impose a general duty to prevent or minimise environmental pollution and have as one of their objects the promotion of improved environmental management practices at Commonwealth-leased airports.

Under Part 4 of the regulation, the operator of an undertaking must ensure that there are no adverse consequences for existing aesthetic, cultural, historical, social and scientific (including archaeological and anthropological) values of the local area.

The project would require the temporary use of Commonwealth owned land during the construction phase, therefore the provisions of the regulation apply to the project.

Environmental Protection and Biodiversity Conservation Act 1999

The (EPBC Act provides a legislative framework for the protection and management of matters of national environmental significance, including flora, fauna, ecological communities and heritage places of national and international importance. Heritage items are protected through their inscription on the World Heritage List, CHL or the NHL.

Under Part 9 of the EPBC Act, approval under the EPBC Act is required for any action occurring within, or outside, a Heritage place that has, will have, or is likely to have a 'significant impact' on the heritage values of a World, National or Commonwealth heritage listed property (referred to as a 'controlled action' under the Act). A summary of heritage listings within the study area is included in section 15.2.2 and briefly summarised below:

- *World Heritage Listing* – There are no heritage items listed on the World Heritage List within or in a 100 metre buffer zone of the project site.
- *Commonwealth Heritage List* – The curtilage of one item listed as an indicative place on the CHL (Sydney (Kingsford Smith) Airport Group) is located within the project site. Indicative places have not been formally nominated for the CHL, rather their date has been provided to, or obtained by the Heritage branch and entered into the Australian Heritage Database.
- *National Heritage List* – There are no heritage items listed on the NHL located within the study area or the 100-metre buffer zone of the project site.
- *National Trust of Australian (NSW*) – There are no heritage items listed on the NHL located within the study area or the 100 metre buffer zone.

As the project would not have a significant impact any heritage items include in the above listings, EPBC approval is not required.

State and local legislation

Environmental Planning and Assessment Act 1979

The EP&A Act establishes a framework for cultural heritage values to be formally assessed in the land use planning and development consent process. The EP&A Act requires that all environmental impacts are considered prior to land development, including impacts on cultural heritage items and places as well as archaeological sites and deposits. The EP&A Act also requires that Local Governments prepare planning instruments (such as LEPs and policies such as Development Control Plans) in accordance with the EP&A Act to provide guidance on the level of environmental assessment required.

The project is being assessed as an SSI development (SSI 18_9714) under Part 5, Section 5.2 of the EP&A Act.

Heritage Act 1977

The Heritage Act is the primary piece of State legislation affording protection to heritage items (natural and cultural) in New South Wales. Under the Heritage Act, ‘items of environmental heritage’ include places, buildings, works, relics, moveable objects and precincts identified as significant based on historical, scientific, cultural, social, archaeological, architectural, natural or aesthetic values. State significant items can be listed on the NSW State Heritage Register (SHR) and are given automatic protection under the Heritage Act against any activities that may damage an item or affect its heritage significance. The Heritage Act also protects 'relics', which can include archaeological material, features and deposits.

The project is being assessed as SSI under Division 5.2 of the EP&A Act. Under section 5.23 of the EP&A Act, an approval under Part 4 of the Heritage Act 1977 is not required.

State Heritage Register

The SHR was established under Section 22 of the Heritage Act and is a list of places and objects of particular importance to the people of NSW, including archaeological sites. The SHR is administered by the NSW Department of Premier and Cabinet (formerly NSW Heritage Division of the OEH) and includes a diverse range of over 1,500 items, in both private and public ownership. To be listed, an item must be deemed to be of heritage significance for the whole of NSW.

No heritage items listed in the SHR are located within the project site, however one item is listed within a 100-metre buffer of the project site (see section 15.2.2).

Section 170 Registers

The Heritage Act requires all government agencies to identify and manage heritage assets in their ownership and control. Under Section 170 of the Heritage Act, government instrumentalities must establish and keep a register which includes all items of environmental heritage listed on the SHR, an environmental planning instrument or which may be subject to an interim heritage order that are owned, occupied or managed by that government body.

Section 170 registered heritage items are located within the project site (see section 15.2.2).

Botany Bay LEP 2013

The Botany Bay LEP 2013 (City of Botany Bay, 2013a) applies to all land within the Botany Bay LGA, excluding some industrial zoned areas such as those covered by the State Environmental Planning Policy (Three Ports) 2013 and individual addresses in Mascot and one in Botany.

Heritage items listed under Schedule 5 of the Botany Bay LEP are located within, partially within or within 100 metres of the project site (see section 15.2.2).

Other relevant guidelines

The assessment of potential heritage impacts was also undertaken with reference to the following guidelines:

- *Statements of Heritage Impact 2002, NSW Heritage Manual 2002* (NSW Heritage Office)
- A*ssessing Significance for Historical Archaeological Sites and Relics 2009* (Heritage Branch, Dept. of Planning)
- *Burra Charter* 2013 (Australia ICOMOS)
- *Criteria for the assessment of excavation directors* (NSW Heritage Council, 2011).

A detailed description of the legislative and policy context for the assessment is provided in Chapter 2 of *Technical Report 9 – Statement of Heritage Impact.*

15.1.2 Methodology

Key tasks

The assessment of potential non-Aboriginal heritage impacts involved:

- reviewing the following heritage databases to identify whether any listed heritage items are located in the vicinity of the project site:
  - NSW State Heritage Register
  - Botany Bay Local Environmental Plan 2013
  - Heritage Conservation Development Control Plan No.37
  - Roads and Maritime s170 Register
  - Sydney Water s170 Register
  - RailCorp s170 Register
  - ARTC s170 Register
  - NSW Fire Brigade s170 Register
  - Ausgrid170 Register
  - National Heritage List
  - Commonwealth Heritage List
  - Register of the National Estate
  - National Trust Register (NSW)
  - Australian Heritage Database
  - NSW State Heritage Inventory (SHI)
  - State Heritage Register (SHR)
  - Sydney Airport Heritage Management Plan, 2009
- a review of historical research including available literature
- a review of the project description and plans
- a field survey and photographic inventory completed on 18 July 2018
- completion of a significance assessment to determine the heritage significance of items, landscapes or archaeological remains
- assessment of the potential impacts of the project, and preparation of a historical heritage impact statement, in accordance with the guidelines listed above.

A detailed description of the assessment methodology is provided in Chapter 2 of *Technical Report 9 – Statement of Heritage Impact*.

Study area

For the purpose of the non-Aboriginal heritage assessment, the study area was defined as a 100-metre buffer around the project site. The area within the project site has been divided into three sections (western, central and eastern extents) (see Figure 15.3). This chapter differentiates between the project site and the 100-metre buffer (study area) throughout.

15.1.3 Risks identified

The preliminary environmental risk assessment undertaken for the project (provided in Appendix B) included potential non-Aboriginal heritage risks. Potential risks were considered according to the impacts that may be generated by the construction or operation of the project. The likelihood, consequence and overall risk level of each potential risk were assessed, with avoidance and management measures defined for each potential risk. Further information on the risk assessment, including the approach, methodology and the full results, is provided in Appendix B.

The assessed risk prior to mitigation associated with potential non-Aboriginal heritage impacts (with a rating of medium or above) were:

- High risk:
    - impacts on listed heritage items or items with heritage values due to demolition, altered historical arrangements and access, visual amenity, landscape and vistas and curtilage.
- Medium risk:
    - damage to heritage items from vibration during construction or operation
    - disturbance of unknown or unidentified items or places of non-Aboriginal heritage significance.

These potential risks and impacts were considered as part of the assessment. The assessment also considered matters identified by the SEARs and stakeholders (as described in Chapters 3 and 4).

15.1.4 How potential impacts have been avoided or minimised

As described in Chapters 6 and 7, design development and construction planning for the project has included a focus on avoiding or minimising the potential for environmental impacts during all key phases of the process. Direct impacts on known non-Aboriginal heritage impacts have been avoided or minimised where possible by providing the second track within the existing rail corridor (where possible) in order to minimise potential impacts on known heritage items adjacent to the rail corridor.

15.2 Existing environment

15.2.1 Historical context

European occupation of the project area can be broken into five phases of European occupation.

Phase 1 – Early occupation and industry (circa 1809–1862)

During the early years of settlement, land within the study area consisted of marshy swamp land and sand banks dissected by streams and creeks associated with the Botany Wetlands and Sheas Creek. The earliest land grants ranging in size from 53 to 600 acres were given from 1810, including ex-convict Simeon Lord’s 600 acre allotment.

Botany's natural environment and the area's distance from the city attracted water reliant industries such as fishing, wool washing, and grain and wool mills, which were established from the early 1800s onwards. These were often built close to the water's edge, providing hydraulic power to power the mills and large bodies of water for washing and processing wool.

The earliest flour and wool mills in the area were established by Simeon Lord in 1815, in the southern portion of the study area. The mills ran until 1855, when land was resumed by the Government for the Botany Water Pumping Station which was established in 1858. Several buildings associated with the mills were situated along Mill Stream to the northeast and southwest of the study area.

In the 1830s the first market gardens were established around Botany and Mascot, with Botany becoming known as Sydney's 'backyard vegetable garden'. The majority of gardens were established between the Alexandra Canal and O'Riordan Street.

The sandy characteristics of the areas soil meant that 'night soils' collected from cesspits and earth closets across Sydney were often used as fertiliser. These cesspits were often used to discard general household waste, meaning early market gardens were likely to include deposits of 19th century household rubbish. It is not known if any Chinese or European market gardens were located within the study area during this occupation phase.

The implementation of the *Noxious Industries Act 1848* pushed many of Sydney's industries out of the city limits and into Botany, Alexandria and Waterloo. The act resulted in significant land use changes in and around the study area, which was soon being heavily utilised for wool washing, meat works, candle works, leather tanning, paper making, soap making and boiling down works.

Phase 2 – Residential development, Botany Water Pumping Station and Botany Goods Line development (1858–1925)

Botany Water Pumping Station

In 1852, the Botany Wetlands were chosen as Sydney's third fresh water source. The scheme involved damming the wetlands and directing water downstream to a large pond and pumping station near the current Sydney Airport. A total of six dams were created, all of which remain within the landscape today and are shown in Figure 15.1. Although some modifications to the wetlands were required for the dams, Mill and Engine Ponds and have retained their original form. They therefore represent intact evidence of Lord's early industrial activities in the area.

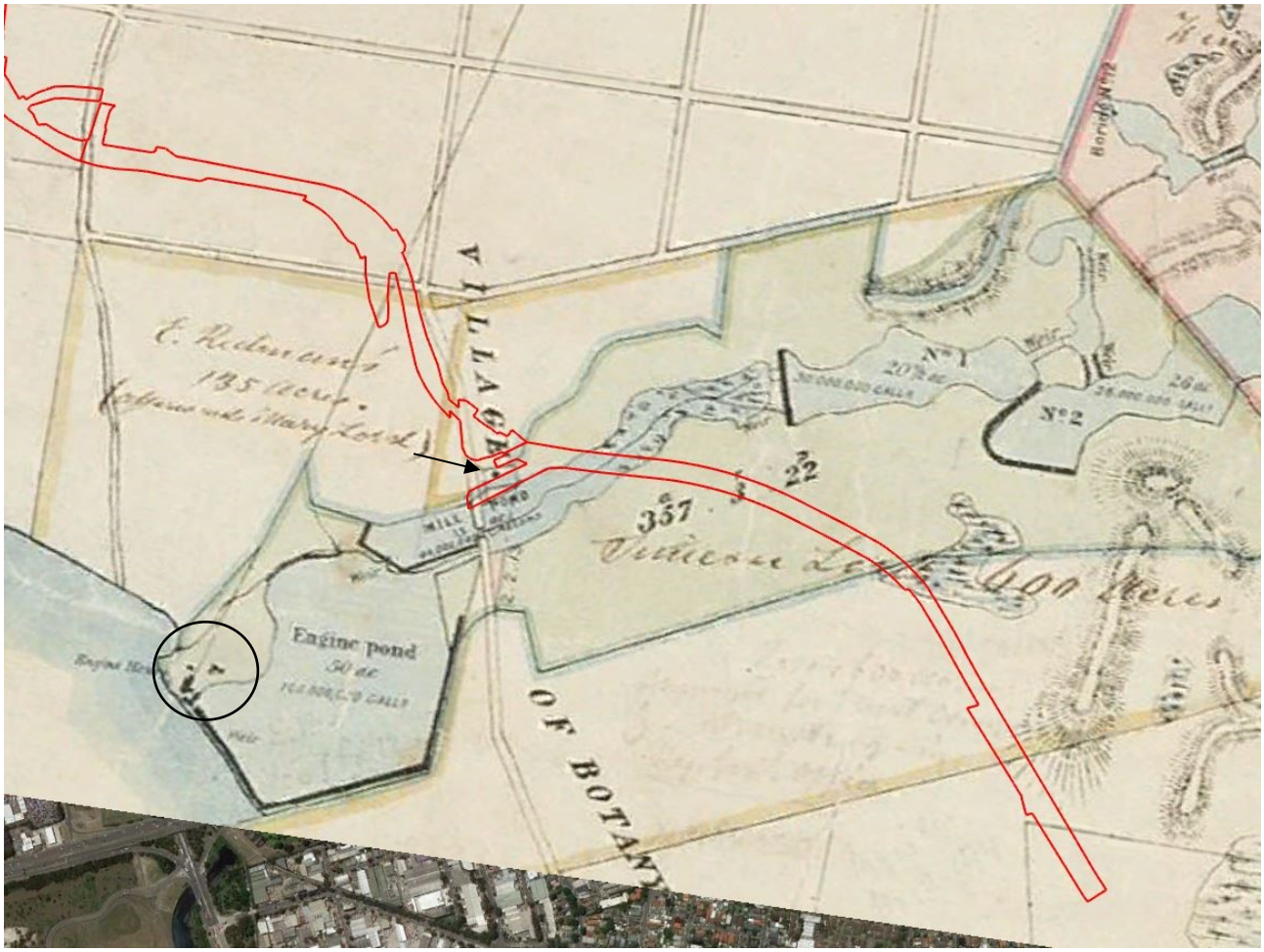
The scheme was successful for over a decade. However, by 1869 water within the wetland had become polluted and unreliable. The development of the Upper Nepean Scheme led to the decommissioning of the Botany Pumping Station in 1886. The end of the Botany Scheme was followed by a short industrial renaissance, with factories and wool washing establishments taking over land and waterways once again.

Market Gardens

The presence of early (Phase 1) market gardens in the study area cannot be confirmed. However evidence suggests the central portion of the study area between Botany Road and Robey Street was partially occupied by two market gardens.

Establishment of Municipalities

The implementation of the *Municipalities Act of 1867*, resulted in the formation of Botany, North Botany and West Botany municipalities. Later becoming the suburbs of Mascot (formerly North Botany), Rockdale (West Botany) and Botany. During this period, Botany Council invested themselves in beautifying and formalising the area through residential subdivisions, parks, sports fields and community buildings.



Source: State Library of NSW

Figure 15.1 1875 plan of the Botany and Lachlan Watersheds showing indicative location of dams in Simeon Lord's 600 acre allotment and the Engine House, just west of Engine Pond. There is one structure (indicated) reordered on the plan, north of Mill stream close to the study area

Botany Goods Line construction

The Botany Goods line, which is encompassed by the majority of the study area, was completed in 1925. The line followed Botany Road and was designed to carry goods from Sydney's western industrial sites to Port Botany.

Although partially constructed by 1915, it wasn't until an additional line linking Marrickville to Botany was completed in 1925 that the route was finally opened. The construction of all bridges, including the single line steel girder bridge over Botany Road, a reinforced concrete bridge over O'Riordan Street and a single wooden trestle bridge over mill pond, were completed by 1924. The O'Riordan Street Underbridge was the first reinforced concrete underbridge constructed in NSW.

The construction of the goods line also required the establishing of a railway embankment to the north of Mill Pond, in a water body referred to in the Botany Wetlands CMP as 'New Pond'. New Pond comprises two ponds formed by the construction of a weir along their southern extent and the c.1925 construction of the embankment for the goods line.

Phase 3 – Botany Goods Line, Sydney Airport and residential development (1925-1960)

Sydney Airport (Kingsford Smith Airport)

Sydney Airport was originally located immediately west of the study area with a small 400-acre cow paddock used as an aerodrome and leased to returned WWI service airmen Nigel Love, Harry Broadsmith and Jack Warneford by the Kensington Race Club in 1920. In 1921, an additional 161 acres was purchased by the Australian government for the construction of a formalised airport. The airport began serving regular flights in 1924 and contained three landing strips by 1938.

The advent of WWII required the airport to expand to nine times its original size. Following the war, it was once again enlarged, this time requiring the resumption of residential subdivisions, farmland, the Sydney sewage farm and two golf courses.

Botany Goods Line

Once the Botany Goods Line was complete, various private and government owned sidings were incorporated into the line to serve them. Those relevant to the study area included the Bayley and Sons siding, the Commonwealth and Hardies sidings and steel distributers, Stewart and Lloyds sidings.

Residential development

The development Sydney Airport and the Botany Rail Line encouraged scattered residential development around Botany and Mascot following the first and second world wars. After the 1940's large scale developments commenced, generally to the north east of the study area. Despite these changes, market gardens and associated structures continued to sit alongside medium density housing blocks.

Phase 4 – Post-War development (1960–2002)

Expansion of Sydney Airport, construction of Mill Pond Road and deviation of the Botany Goods Line (1955-1985) and Robey and O'Riordan Street Underbridge

In 1960, large scale expansions of Sydney Airport required that a portion of the goods line be deviated approximately 100 to 400 metres north of its original alignment between O'Riordan Street and the Alexandra Canal (located approximately 200 metres west of the study area) (Figure 15.2). This alignment represents the route of Botany Goods Line today. Prior to this, part of the line was located within what is now Sydney Airport land.

By 1965, Mill Pond Road had been established between Engine Pond and McBurney Avenue, where is continues to exist today (alongside Southern Cross Drive). Deviation of the line also required the construction of a new underbridge over Robey Street, which was the first welded steel railway bridge in the state. Although only one railway track was installed, an additional deck was provided in anticipation of any future duplication. The bridge and deck remain within the study area today.

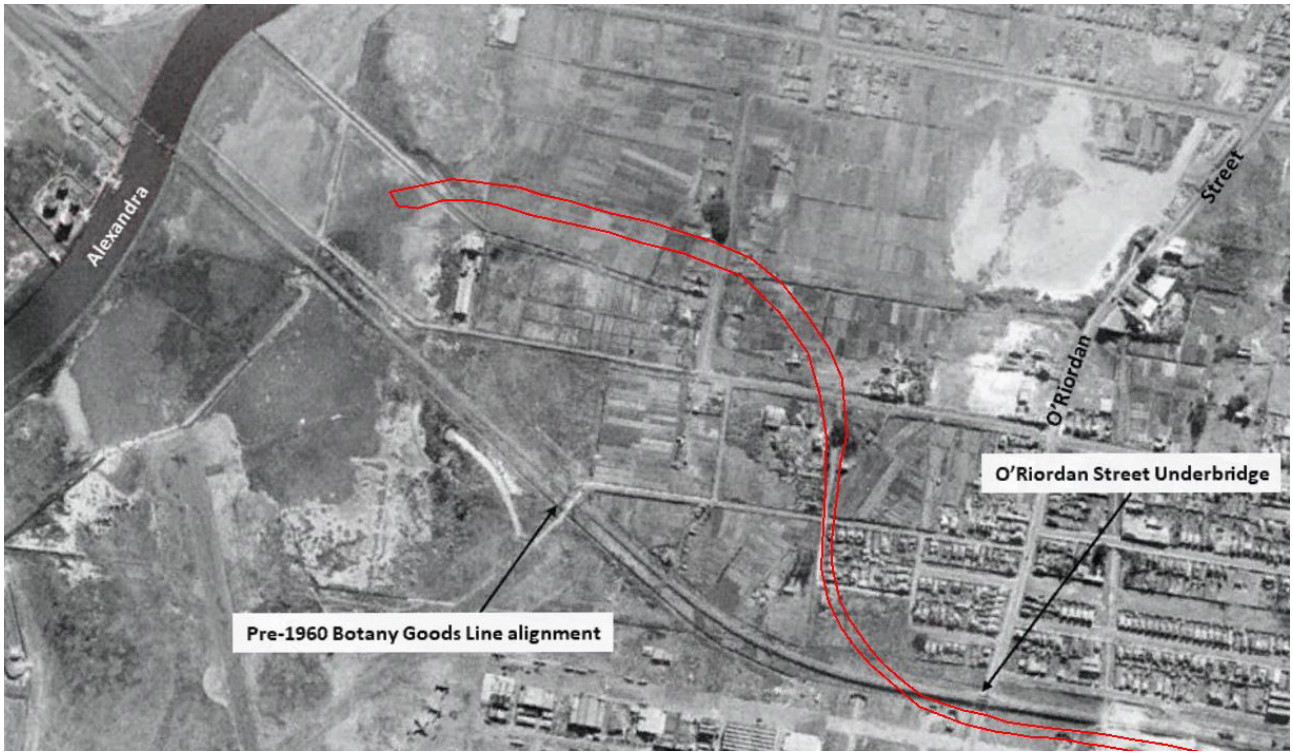


Figure 15.2 The original alignment of the Botany goods Line can be seen at the bottom of the image, prior to its deviation in 1960

Industrial sidings (1961)

In 1961 three sidings were incorporated into this new portion of the line to serve A.G. Sims Scrap Metal (which today goes by the name of Sims Metal Management), steel wholesalers J Murray Moore NSW Pty Ltd and Thomas Playfair (later known as the Australian Consolidated Glass siding). No evidence of these sidings is visible within the study area today.

Eastlake Golf Club (1960)

The Eastlake Golf Club was established to the east of the Botany Wetlands and north of the study area in 1960. Prior to this, the area comprised cleared grassy sand dunes and scattered residential development.

Southern Cross Drive and Mill Stream bridge construction (1985–1988)

Prior to 1988, road access to the city from Mascot and Botany was via Botany Road or O'Riordan Street. As the suburbs grew and airport expanded, various arterial roads were created to reduce traffic congestion and accommodate the changing shape of the area. One of these new arterial roads, Southern Cross Drive, is crossed by the study area just north of Engine and Mill Ponds. Plans for the extension of Southern Cross Drive between Wentworth Avenue to Foreshore Road began in 1984. In order to construct the road, a new concrete bridge was required for the goods line to cross Southern Cross Drive and continue onto Mascot. In order to accommodate these modifications, the c.1925 timber bridge over Mill Stream was removed and replaced with the existing concrete rail bridge.

Land now occupied by Southern Cross Drive and its associated underbridge previously comprised bare sand dunes to the west and low lying scrub to the east. The construction of Southern Cross Drive and the rail underbridge required extensive excavations and piling works to support the bridge and retaining walls on either side of the new road corridor.

Botany Operational Enhancement Project

An increase in container traffic to and from Port Botany in the 1990s and pre-Olympic Games upgrades to Sydney Airport in 1999 made it necessary to upgrade and duplicate portions of the Botany Goods Line. The majority of upgrade works took place outside of the study area, to the west.

However, re-signalling works, remote control of the line between Marrickville and Botany and duplication of the line between Botany and the Cooks River did occur. This may have resulted in some localised subsurface disturbance within the rail corridor (especially around General Holmes Drive) as well as the removal of obsolete railway infrastructure, signals and sidings. Evidence of these upgrades in the form of duplicated lines and modern concrete sleepers were identified along the western extent of the study area during the site inspection.

Phase 5 – Contemporary management and use of the Botany Goods Line (2002–present)

In July 2012, the ARTC and Transport for NSW signed an agreement transferring management and operation of Sydney's Metropolitan Freight Network (MFN) to ARTC until 2064. Under this agreement, management of the Robey Street Underbridge and O'Riordan Street Underbridge was transferred to ARTC. The railway line remains in Sydney Trains ownership.

The WestConnex and Airport East projects have been ongoing since 2015. These works were designed to ease congestions along some of Sydney's busiest roads. As part of the works, a new rail bridge (RMS ID: B11701) was constructed over Wentworth Avenue for the Airport East Works. This involved the demolition of an original underpass associated with Botany Goods Line and diversion of the existing line to the west while the bridge was under construction. Construction of the bridge required 1,000 cubic metres of concrete and included a space for future duplication of the Botany Goods Line. The bridge was completed in June 2018.

15.2.2 Heritage listed items

Heritage listed items within the study area, including their location in relation to the project site are listed in Table 15.1.

Table 15.1 Heritage listed items within the study area

LISTED ITEM	SIGNIFICANCE	REGISTER	DISTANCE FROM THE PROJECT
Mascot (O'Riordan Street) Underbridge	Local	ARTC s170 Register SHI 4801830	Within the project site
Mascot (Robey Street) Underbridge	Local	ARTC s170 Register SHI 4801848	Within the project site
Railway Bridge over Botany Road/Mascot (Botany Road) Underbridge	Local	ARTC s170 Register SHI no. 4800248 Botany Bay LEP - I153	Within the project site
Sydney (Kingsford Smith) Airport Group	State	Commonwealth Heritage List (Indicative Place) Register of the National Estate (Interim List) ID – 102669 Botany Bay LEP	The heritage curtilage for this item is partially within the project site and within the study area.
Commonwealth Water Pumping Station and Sewerage Pumping Station	State	Botany LEP– I3	The heritage curtilage for the item is partially within the project site. However, the structures themselves are located one kilometre south, west of Engine Pond and outside the study area.
Ruins of the former Botany Pumping Station	Local	Botany Bay LEP– I68	The heritage curtilage for the item is partially within the project site. However, the ruins of the pumping station are located 500 metres south and outside of the study area.
Streetscape – Verge plantings of Canary Island Date Palms (Phoenix Canariensis)	Local	Botany Bay LEP– I65	Approximately 90 metres west of the project site and within the study area.
Booralee Park	Local	Botany Bay LEP– I61	Approximately 110 metres southwest of the project site and within the study area.
Botany Water Reserves (also known as Botany Wetlands or Botany Swamps)	Local	State Heritage Register (SHR) Sydney Water s170 register Botany Bay LEP RNE – 01317, 4570025, I2 and 17854	Approximately 1–10 metres north and south of the project site and within the study area.
Beckenham Memorial Church	Local	Botany Bay LEP– I61	Approximately 40 metres east of the project site and within the study area.

Heritage listed sites within the study area are shown in Figure 15.3.

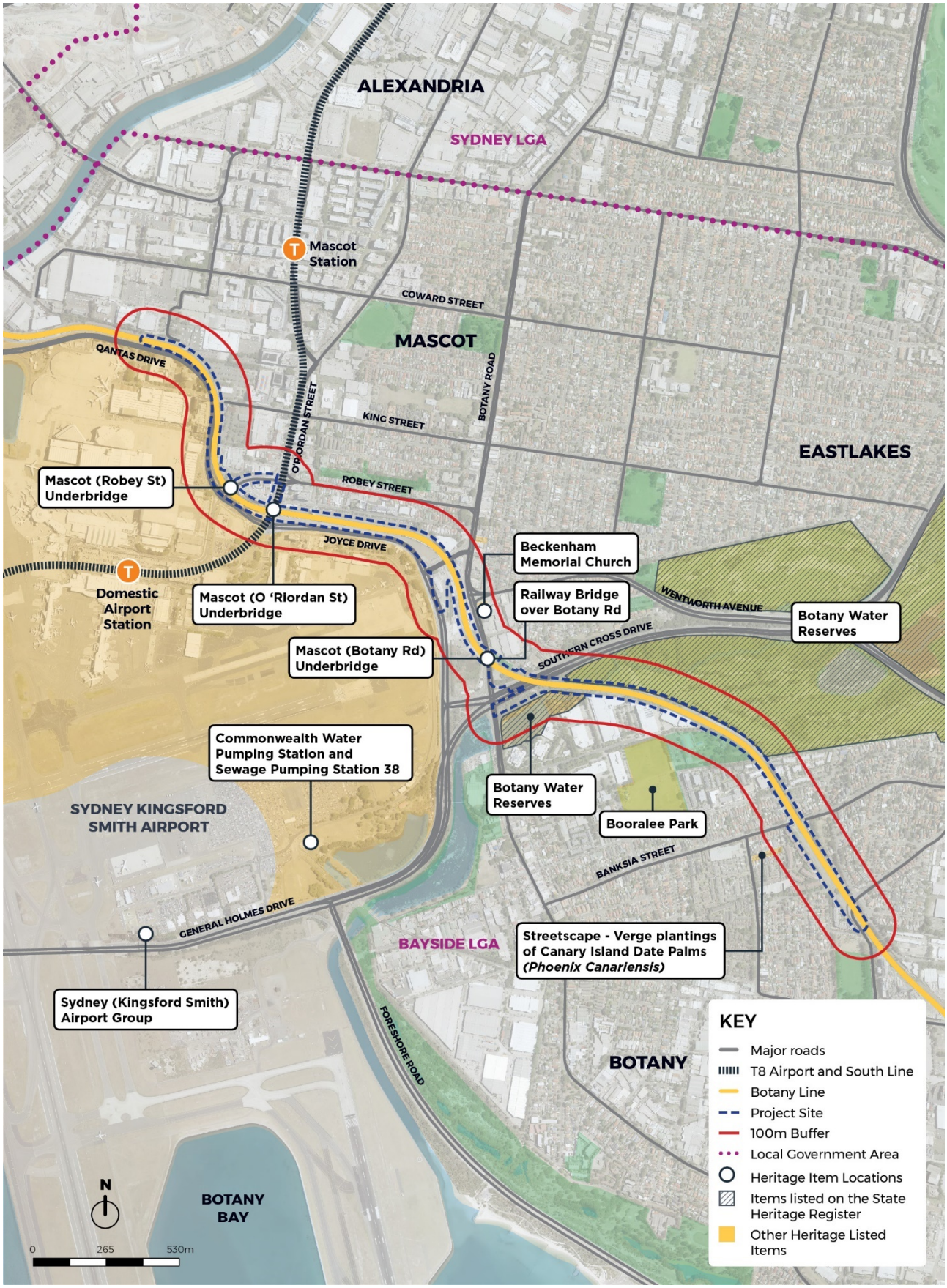


Figure 15.3 Heritage listed items within the study area

Assessment of significance

Assessment of potential impacts on non-Aboriginal heritage items first requires an understanding of the significance of each heritage item. Assessments of significance provide an understanding of why a heritage item is significant and help appropriately delineate the heritage curtilage. Many of the heritage items within the vicinity of the project already have statements of heritage significance prepared by public authorities, however based on research undertaken as part of the project, statements would be updated if required.

Summaries of the significance of individual non-Aboriginal heritage items within the study area are provided in Table 15.2. Detailed statements of significance are included in Chapter 6 of *Technical Report 9 – Statement of Heritage Impact*.

Table 15.2 Heritage listed items wholly or partially within the project site

ITEM	SUMMARY OF STATEMENT OF SIGNIFICANCE (OEH SHI, 2018c)
Mascot (O'Riordan Street) Underbridge	The original 1925 O'Riordan St Underbridge is considered significant as part of the original infrastructure of the Botany Line. Due to the high self-weight to load capacity ratio of conventionally reinforced concrete bridges their use was abandoned within the NSW rail network after few attempts. The underbridge is as a rare example of a reinforced concrete girder railway bridge construction within the NSW rail network. The 1982 additional span does not contribute to the underbridge's significance.
Mascot (Robey Street) Underbridge	The Robey Street Underbridge is of local significance as the first welded steel railway bridge on the NSW rail network. The success of the fabrication and service of the Robey Street Underbridge initiated the change over from riveted to welded steel construction, and bolts displaced rivets wherever non-welded joints were required. The bridge is a landmark structure over Robey Street; however, the significant fabric has been covered by signage, reducing its aesthetic quality.
Railway Bridge over Botany Road	The Mascot (Botany Road) Underbridge is historically significant as an integral component of the separate Botany Goods Line (1909–1925). The Goods Line is significant as part of the major Sydney goods railway expansion constructed in the early 20th Century to allow industry and shipping at Botany to be connected into the main network. The underbridge has aesthetic significance as a landmark structure over Botany Road with the brick arched piers and wing walls demonstrating fine workmanship. The bridge is unusual in its construction method, employing reinforced slabs and steel girders to accommodate the skew in the span across Botany Road.
Sydney (Kingsford Smith) Airport Group	The Kingsford Smith Airport Group is a complex cultural landscape that demonstrates strong historical, historic association, social, aesthetic and technological significance. It includes values associated with a contemporary airport as well as heritage values associated previous use of the area. The airport is also historically significant for its association with pioneers of the professional aviation industry. The airport landscape dominates the local area, and the airport is significant as the catalyst for, and provides evidence of, the significant changes it has brought to the wider Mascot and Botany areas since 1920. The Airport also demonstrates significant local heritage values that relate more directly to its influence on the course of Botany's physical, economic and social development, most notably as the catalyst for the transformation of the area from a cultural landscape dominated by noxious industries to acting as the hub for Sydney's transportation industry. Secondary businesses associated with the airport now dominate the industrial and commercial landscape of the area.

ITEM	SUMMARY OF STATEMENT OF SIGNIFICANCE (OEH SHI, 2018c)
Commonwealth Water Pumping Station and Sewerage Pumping Station No. 38	This pumping station was the first of an original group of low level Sewage Pumping Stations constructed to serve the SWOOS No.1 in 1916. It is a representative example of a simple, robust and well-proportioned Federation Free Style industrial building, the architectural expressions of which can be found in the structural detailing of the facade, superb brickwork, and roof forms. In addition, the mechanical components housed within the building have potential industrial archaeological value. Its architectural detailing makes a strong contribution to the visual catchment of the airport precinct and Botany area.
Ruins of the former Botany Pumping Station	The ruins of the Botany Pumping Station are part of a highly significant cultural landscape that remains clearly legible in its historic context despite its ruinous state and the development of the airport to the north over part of its original setting. The Pumping Station formed the centrepiece of the Botany Waterworks, and its operation facilitated the rapid expansion of Sydney's inner suburbs in the second half of the 19th century. The Waterworks is historically significant for its association with early local government authorities in NSW and its historical associated with early Colonial merchant and industrialist Simeon Lord and his attempt to secure exclusive water supply in perpetuity. The original buildings of the Waterworks are now in ruin, but the surviving footings and other fabric and the aesthetic qualities of its setting provide important and interpretable evidence. Its significance is enhanced by the survival of the series of dams and ponds that contained and supplied the water to the pumping system and which continue to provide evidence of the bountiful supply afforded by the underlying aquifer. The waterworks has had a significant impact on the course and pattern of the growth and development of the former Botany Bay area. The surviving fabric of the Waterworks (including the footings and evidence of earlier structures piled or buried in the vicinity) represents a significant archaeological deposit that has the potential to be of considerable research value for the evidence that it may provide of mid-19th century industrial structures or of the later use as a woolscour.
Botany Water Reserves	Botany Water Reserve holds considerable value for Sydney and NSW because it contains the only remaining major components of the unique water supply system that supported the expansion of the Sydney metropolis for most of the latter half of the 19th century, representing Sydney's third main water supply system since colonisation; and on account of the surviving remnants of the early 19th century industries associated with the prominent emancipist merchant Simeon Lord. Part of the original 1850s sand-cast iron water supply pipe remains within the site representing a remnant of the State's oldest main. The item is of regional environmental importance as a major recharge source for the Sydney basin aquifer. It likely holds special interest as a landmark cultural and recreational landscape for the regional community. It also has regional importance on account of the substantial infrastructure it contains of the 1910s Southern and Western Suburbs Ocean Outfall Sewer System (SWSOOS No 1) – since augmented during 1936-1941 by SWSOOS No 2 – representing one of the first major separate sewers in Sydney as well as incorporating new ventilation technologies. This infrastructure includes use of the former Engine House chimney as a sewer vent, the viaduct to carry the vent pipe, Sewage Pumping Station No 38 of 1916 near the Engine House ruins and part of the SWSOOS Nos 1 and 2 mains.

ITEM	SUMMARY OF STATEMENT OF SIGNIFICANCE (OEH SHI, 2018c)
Beckenham Memorial Church	The (former) Beckenham Uniting Church built in 1933 is of local heritage significance to the Bayside area as a fine example of a substantial Interwar church designed by significant ecclesiastical architect Arthur Layton-Clark with an unusual and distinctive radial floor plan. It has been a prominent element of the streetscape of Botany Road, and contributes significantly to the ecclesiastical precinct between Mascot and Botany. The Church is also likely to be of social heritage significance to its past and present congregations, the latter relocating to their sister church in King Street, Mascot as a result of the church's closure in 2015 following acquisition by the NSW State Government as part of the WestConnex road project.

15.2.3 Unlisted items of heritage significance

The Botany Rail Line comprises an approximately 9.2 kilometre long, single line freight corridor running from Marrickville Junction through to the wharves at Botany. The line has been upgraded and deviated over time and contains various sidings for surrounding industries. Some of these sidings have been removed to reflect changes in the occupancy and transport methods.

The Botany Rail Line has historic, associative, social, aesthetic, technical and representative significance at a local level due to its relationship with surrounding industrial development (past and present), the Metropolitan Goods Line network and the use of freight transport in NSW. The line is considered to contain research significance due to its ability to yield information regarding economic, industrial and residential growth and recession over time. In addition, the use of freight transport within areas of Sydney occupied by both residential, industrial, natural and aeronautical landscapes is becoming rare, thanks to the ongoing use of motor transport since the 1950s. A full assessment of the Botany Rail Line, and associated elements is included in section 6.3 of the *Technical Report 9 – Statement of Heritage Impact*.

15.2.4 Archaeological sites and potential

Based on the site inspection and an understanding of the historical and contemporary land use, predictions about the archaeological potential of the project site can be made. The assessment examines historical land use phases, as identified in section 15.2.1. The significance of any potential archaeological remains would inform recommendations for archaeological management throughout the project.

Table 15.3 Summary of potential archaeological remains

OCCUPATIONAL PHASE	ARCHAEOLOGICAL REMAINS	ASSESSED POTENTIAL
1 C1989–1858	**Eastern Extent** Evidence of landscape modifications and unrecorded structures associated with flour mill establishment in areas surrounding Mill Pond and south of Southern Cross Drive.	Low
	Central Extent Evidence of landscape modification, unrecorded structures and noxious industrial activities within small land grants given from 1809 onwards	Nil to low
	Western Extent Evidence of landscape modification, unrecorded structures and market gardens within small land grants given from 1809	Nil to low

OCCUPATIONAL PHASE	ARCHAEOLOGICAL REMAINS	ASSESSED POTENTIAL
2 1858–1925	**Eastern Extent** Evidence of landscape modification and unrecorded structures associated with the Botany Pumping Station in areas surrounding Mill Pond and south of Southern Cross Drive.	Nil to low
	Central Extent Evidence of landscape modification, market gardens and three structures north and south of General Holmes Drive	Market gardens and three structures to the north of General Holmes Drive – Low and moderate Remainder of central Extent – Nil to low
	Western Extent Evidence of market gardens and scattered residential development	Nil to low
3 1925–1960	**Eastern Extent** Evidence of landscape modification for the Botany Rail Line and former sidings	Moderate to High
	Central Extent Evidence of Phase 2 structures located to the north of Mill Pond and evidence of Botany Rail Line and associated sidings	Land within Southern Cross Drive – Nil Land outside Southern Cross Drive corridor – moderate to high
	Western Extent Evidence of market gardens, scattered residential development and industry along the Botany Rail Line and Robey Street	Moderate
4 1960–2002	**Eastern Extent** Evidence of former sidings	High
	Central Extent Evidence of Botany Rail Line and associated sidings	High
	Western Extent Evidence of market gardens, residential development and industry along the Botany Rail Line and Robey Street	Moderate to high
5 2002–Present	**Eastern Extent** Evidence of former sidings along the study area	High
	Central Extent Evidence of Botany Rail Line and associated sidings along the study area	High
	Western Extent Evidence of Botany Rail Line and associated sidings along the study area	High

If intact and recognisable, remains associated with Simeon Lord's industrial activities (Phase 1) such as landscape modifications and unrecorded structures were to survive in the study area, they would have historical, associative and social significance at a State level. They would also contain research potential for their ability to yield information regarding unrecorded landscape modification methods, the pre-European environment and extent of Lord's mill establishment. However the likelihood of such remains surviving in the study area is low.

The potential archaeological resource associated with **Phase 2** occupation would be associated with landscape modifications for the Botany Water Pumping Station, Chinese market gardens, early residential development and construction of the Botany Rail Line. If intact and recognisable remains were uncovered they would have historical, associative and social significance at a local level. They would also contain research potential for their ability to yield information regarding rare and early residential and agricultural activities in the Botany and Mascot area.

The potential archaeological resource associated with **Phase 3** occupation is associated with ongoing use of the Botany Line, evidence of residential occupation and the continued use of Mascot for market gardening. These remains would have historical and social significance at a local level. However, they would represent common forms of infrastructure and land use during this period and are unlikely to contain research potential. Therefore, they would not reach the threshold for local or State significance under the NSW Heritage Criteria.

Potential archaeological remains associated with **Phases 4** and **5** would not meet the threshold for local or State significance. This is primarily due to their common presence and lack of archaeological research potential (see section 7.1.2 in *Technical Report 9 – Statement of Heritage Impact*).

The locations of archaeological potential and significance within the study area are shown on Figure 15.4.

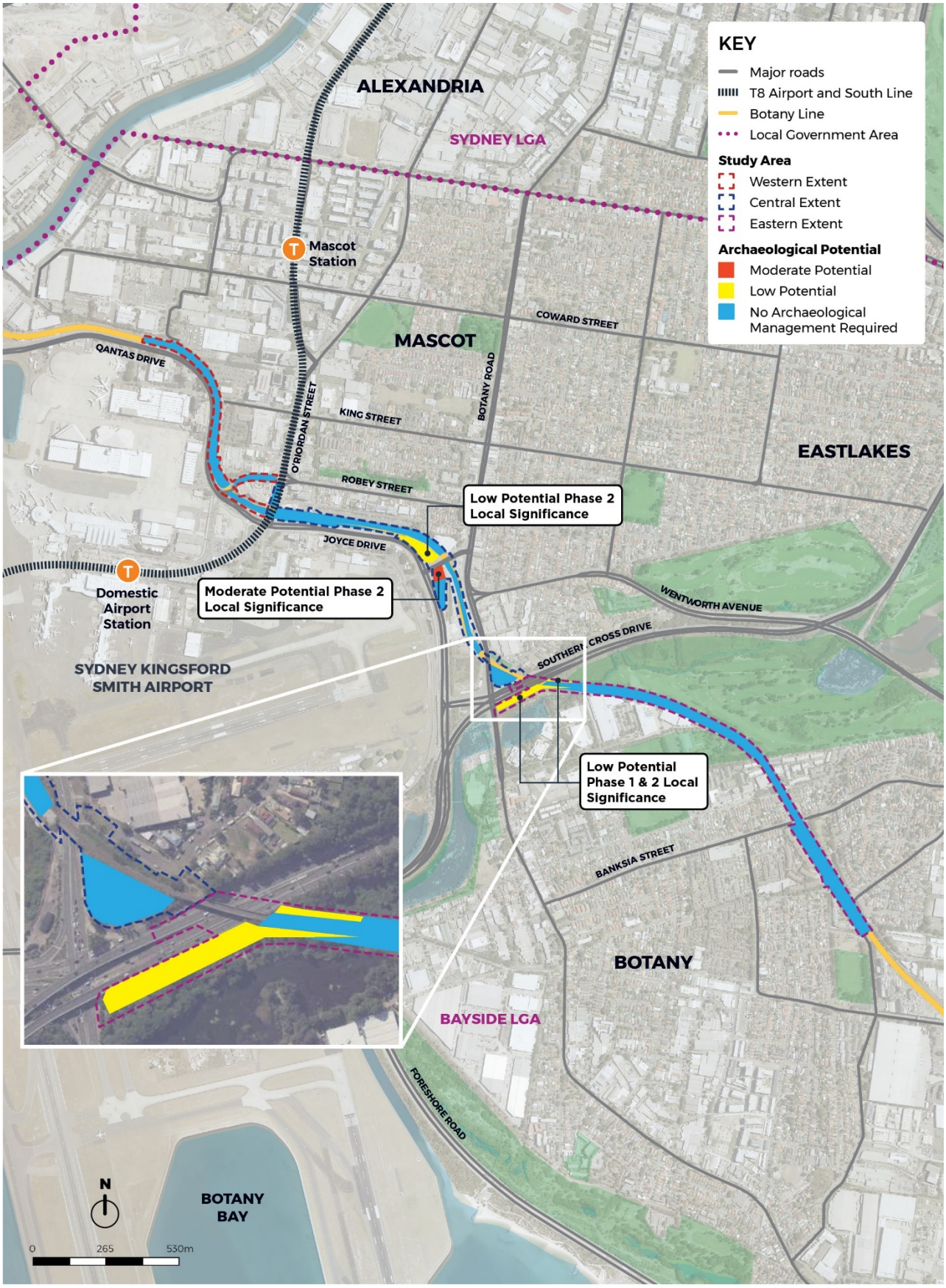


Figure 15.4 Non-Aboriginal Archaeological potential and significance with the project site

15.3 Assessment of construction impacts

15.3.1 Impacts on heritage items

The project would directly and indirectly impact a number of heritage items in the project site, as identified below in Table 15.4. The location of these items is shown in Figure 15.3.

Table 15.4 Heritage Listed items within the study area

ITEM NAME AND SIGNIFICANCE	LOCATION	PROPOSED IMPACTS	IMPACT		
			Impact to fabric	Visual impact	Archaeological impact
Mascot (O'Riordan Street) Underbridge Local	Within the project site	The Mascot (O'Riordan Street) Underbridge would be demolished and replaced with a dual carriageway rail underbridge	Major	N/A	N/A
Mascot (Robey Street) Underbridge Local	Within the project site	The Mascot (Robey Street) Underbridge would be demolished and replaced with a dual carriageway rail underbridge	Major	N/A	N/A
Mascot (Botany Road) Underbridge Local	Within the project site	The Mascot (Botany Road) Underbridge would undergo some minor remediation works to the abutments and headstock of the existing bridge. The existing bridge would however be retained as part of the project.	Minor	Minor	N/A
Botany Water Reserves (also known as Botany Wetlands or Botany Swamps) State	Immediately adjacent to the project site	The construction boundary for the proposed works would not extend into the curtilage of the Botany Waters Reserve. Although the proposed works would be located outside of the heritage curtilage for the item, visual impacts associated with the addition of a new rail bridge over Mill Pond, retaining walls and embankments would result in a minor visual impact to the Botany Water Reserves. Due to the location of the proposed works within the existing rail corridor between the two sections of the reserve, no alternative options were considered to be viable to minimise the potential minor visual impacts.	Nil	Minor	Nil

ITEM NAME AND SIGNIFICANCE	LOCATION	PROPOSED IMPACTS	IMPACT		
			Impact to fabric	Visual impact	Archaeological impact
		Where possible, ARTC would seek to reinstate any vegetation within the existing corridor (where space and operational requirements permit).			
Sydney (Kingsford Smith) Airport Group State	Portions of the project site are located within the curtilage for this item	The construction boundary for the proposed works would extend five to 20 metres within the heritage curtilage for the item, along its eastern boundary. Works within the curtilage may involve vegetation clearing and would include the establishment of stockpile areas and temporary crane pads.	Minor	Minor	Minor
Ruins of the former Botany Pumping Station Local	The project site is located 870 metres northeast of the item	The project would not involve direct or indirect impacts on the item.	Nil	Nil	Nil
Commonwealth Water Pumping Station and Sewerage Pumping Station No 38 Local	The project site is located 870 metres northeast of the item	The project would not involve direct or indirect impacts on the item.	Nil	Nil	Nil
Beckenham Memorial Church Local	40 metres east of the project site	The project would not involve direct impact to heritage fabric associated with the item. However, works will alter existing views towards the Botany Rail Line from the item. However, this is unlikely to impact the item's heritage significance.	Nil	Negligible	Nil
Booralee Park Local	110 metres southwest of the project site	No direct impacts on the park would occur as part of the project. Views towards the study area from the park are obstructed by trees and buildings, therefore no visual impacts are anticipated as a result of the project.	Nil	Nil	Nil

ITEM NAME AND SIGNIFICANCE	LOCATION	PROPOSED IMPACTS	IMPACT		
			Impact to fabric	Visual impact	Archaeological impact
Botany Rail Line Local	Within the project site	Impacts would involve the removal and modification of modern and historic fabric in the way of underbridges and signal hut/signal location cases associated with the Botany Rail Line. These items have been assessed as having moderate to high significance as contributing elements to the Botany Rail Line. These would be replaced with modern materials and infrastructure. The existing character of the line would also be altered due to the proposed duplication of the line. However, it should be noted that the Botany Rail Line was always intended to be a dual carriage corridor and the local significance of the item is likely to be retained.	Moderate	Moderate	Minor

15.3.2 Impacts on archaeology

The project has potential to have a moderate impact to State and locally significant archaeological remains associated with Phase 1, 2 and 3 occupation, as identified in Table 15.5.

Table 15.5 Potential impacts on archaeological remains within the project site

PHASE OF WORKS AND SIGNIFICANCE	LOCATION	PROPOSED IMPACTS	POTENTIAL ARCHAEOLOGICAL IMPACT
Phase 1 (c1809–1858) – State Potential archaeological evidence of landscape modifications and unrecorded structures associated with Simeon Lord's Mill.	Within the project site	There is low potential for remains associated within Phase 1 occupation of the study area to survive within a small portion of the study area adjacent to the Botany Wetlands. The proposed installation of drainage lines, CSR routes, compound sites, materials storage and laydown areas, bridges and retaining walls all have potential to impact Phase 1 archaeological remains near the Botany Wetlands.	Negligible to minor (depending on the location/extent of proposed works and nature of archaeological remains)

PHASE OF WORKS AND SIGNIFICANCE	LOCATION	PROPOSED IMPACTS	POTENTIAL ARCHAEOLOGICAL IMPACT
Phase 2 (1858–1925) – Local Potential archaeological remains associated with early market gardens, residential development and construction of the Botany Goods Line	Within the project site	The proposed establishment of the compound sites, and materials storage and laydown area to the north and south of General Holmes Drive have the potential to impact Phase 2 archaeological remains. However, it is unlikely that major subsurface excavations will occur within these portions of the study area. Archaeological remains would include evidence of market gardens and associated structures. These may have local significance.	Negligible to minor (depending on the location /extent of proposed works and nature of archaeological remains)
Phase 3 (1925–1960) – Not Significant Potential archaeological remains associated with 20th century residential occupation, market gardens and the Botany Goods Line.	Within the project site	The proposed installation of drainage lines, CSR routes, compound sites, bridges and retaining walls all have potential to impact Phase 3 archaeological remains, including evidence of 20th century residential development and the Botany Rail Line These remains are not considered to meet the criteria for 'relics' under the Heritage Act as they do not contain research potential and their removal would not impact the overall heritage significance of the area.	Nil
Phase 4 (1960–2002) – Not Significant Modern redevelopment associated with airport expansion and demolition of Phase 2 and 3 buildings.	Within the project site	The proposed installation of drainage lines, CSR routes, compound sites, bridges and retaining walls all have potential to impact Phase 4 archaeological remains, including evidence of 20th century residential development and the Botany Rail Line. However, these remains would represent modern development and land use and do not contain research potential. Therefore, they would not meet the criteria for 'relics' under the Heritage Act and their removal would not impact the overall heritage significance of the area.	Nil

PHASE OF WORKS AND SIGNIFICANCE	LOCATION	PROPOSED IMPACTS	POTENTIAL ARCHAEOLOGICAL IMPACT
Phase 5 (2002–present) – Not Significant Modern development and land use	Within the project site	The proposed installation of drainage lines, CSR routes, compound sites, bridges and retaining walls all have potential to impact Phase 5 remains. However, these remains would represent modern development and land use and do not contain research potential. Therefore, they would not meet the criteria for 'relics' under the Heritage Act and their removal would not impact the overall heritage significance of the area.	Nil

15.4 Assessment of operational impacts

15.4.1 Impacts on heritage items

As the project would not result in any major changes to the operation of the existing Botany Rail Line with the exception of an increase in freight train movements, the project is not expected to have any non-Aboriginal heritage impacts.

15.4.2 Impacts on archaeology

As the project would not result in any major changes to the operation of the existing Botany Rail Line with the exception of an increase in freight train movements, the project is not expected to have any impacts on non-Aboriginal archaeology.

15.5 Cumulative impacts

15.5.1 Overview

The methodology of the cumulative impact assessment and details of other projects considered are detailed in Chapter 24. A summary of the predicted cumulative impacts which relate to non-Aboriginal heritage are described below.

15.5.2 Cumulative construction impacts

The Botany Rail Duplication, Sydney Gateway Road, M4-M5 Link, New M5, WestConnex Enabling Works – Sydney Airport East and Airport North will result in the following impacts:

- direct impacts on three heritage listed underbridges
- indirect impacts on two heritage listed underbridges
- demolition of heritage listed and/or heritage significant buildings
- modifications to the Botany Rail Line which is an unlisted item assessed as having local significance
- impacts on potentially significant State or local archaeological remains.

Cumulatively these works will result in moderate and irreversible impact to significant items, view lines and potential archaeological remains within the combined project sites. The cumulative impacts of the project are considered to be moderate to minor.

A summary of non-Aboriginal heritage impacts on nearby projects is included in Table 15.6 and included in *Technical Report 9 – Statement of Heritage Impact.*

Table 15.6 Summary of non-Aboriginal heritage impacts of nearby projects

PROJECT	HERITAGE IMPACT
WestConnex Enabling works (Airport East)	Most relevant to the Botany Rail Duplication, due to its close proximity to the project site, are the WestConnex enabling works (Airport east) along Wentworth Avenue. Works have involved the demolition and partial acquisition of four items listed on the Botany Bay LEP 2013, which are located within view of the project site, removal of two unlisted heritage items and partial acquisition of land within the Botany Bay LEP, RNC and CHL listed Sydney (Kingsford Smith) Airport Group (I170). The works also included the construction of a new underpass and rail overbridge over the Botany Rail Line. These impacts have already slightly modified the landscape within and surrounding the Botany Rail Line, through the loss of heritage values associated with the item.
Sydney Gateway – road project	The Sydney Gateway road project will occur adjacent to and northwest of the project site. The most significant impact on non-Aboriginal heritage values relate to the construction of four bridges over SHR-listed Alexandra canal (considered a major impact on the heritage significance of the item). Other impacts include: • demolition of eleven existing structures, their associated landscapes and mature fig trees within the Sydney (Kingsford Smith) Airport Group's heritage curtilage • construction of three bridges and overpasses over the existing Botany Rail Line • visual impacts on the Mascot (Sheas Ck) Underbridge • potential impacts on State and locally significant archaeology.
WestConnex M4-M5	The WestConnex M4-M5 Link project is occurring approximately 2.5 kilometres north of the study area. It has resulted in the following heritage impacts relevant to the project: • removal of street trees including Moreton Bay Figs and contributory trees. Although the total number is not known, satellite imagery suggest at least forty trees were removed for the works • demolition of sixteen locally-listed or s170 listed heritage items and ten potential heritage items • demolition of contributory items within the Powell's Estate and Haberfield heritage conservation areas • impacts to archaeological relics within eleven historical archaeological management units • encroachment on existing public recreational areas/parklands, namely Sydney Park.
WestConnex New M5	WestConnex New M5 project is occurring approximately 2.5 kilometres north of the study area. It has or will result in the following heritage impacts relevant to project: • direct and indirect impacts on 57 non-Aboriginal heritage items • demolition of three heritage listed buildings • modifications to the SHR, s170, RNE and LEP listed Alexandra Canal (due to the addition of crossings over the canal), RNE listed St Peters Brickpit Geological Site, LEP listed Service Garage and LEP listed Goodsell Estate Conservation Area • partial and direct impact to eight conservation areas • construction vibration impacts on 23 heritage listed items • construction of two bridges over the Alexandra Canal • visual impacts on 21 heritage listed items.

15.5.3 Cumulative operational impacts

As the project will not result in any major changes to the operation of the existing Botany Rail Line with the exception of an increase in freight train movements, the project is not expected to have any cumulative non-Aboriginal heritage impacts.

15.6 Management of impacts

15.6.1 Approach

The new track alignment across both the Mascot (Robey Street) Underbridge and Mascot (O'Riordan Street) Underbridge requires the demolition and reconstruction of both bridges. Alternative options regarding this demolition of these underbridges have been considered.

Due to the new track alignment, headroom requirements and the significant difficulties in retaining/ strengthening the existing bridges to comply with the construction requirements, retaining the current structures is not a feasible option, and each bridge must be replaced.

To reduce the impacts of the demolition of these heritage items and other identified and unidentified heritage items, the mitigation measures outlined in section 15.6.2 would be followed.

15.6.2 List of mitigation measures

The mitigation measures that would be implemented to address potential non-Aboriginal heritage impacts during construction of the project are listed in Table 15.7. This table also outlines which mitigation measures (during the construction stage) would be implemented during the enabling works and main construction works.

Table 15.7 Mitigation measures

STAGE	ISSUE	MEASURE	ENABLING WORKS	MAIN CONSTRUCTION
Design	Avoidance of heritage impacts	Impacts to significant fabric, locally and State significant archaeological remains and landscapes (including trees, plantings and public recreation areas) within and adjacent to the project site will be avoided, where possible. Designs will also endeavour to reduce visual impacts by considering sympathetic and unobtrusive fabric, colour, form and size for new built elements. Appropriate impact avoidance measures will be considered during the detailed design phase and included in the Construction Environment Management Plan (CEMP) for the project where required.	N/A – Design phase	N/A – Design phase

STAGE	ISSUE	MEASURE	ENABLING WORKS	MAIN CONSTRUCTION
	Heritage Interpretation	A Heritage Interpretation Plan (HIP) including a heritage interpretation strategy will be prepared in accordance with the *NSW Heritage Manual, the NSW Heritage Office's Interpreting Heritage Places and Items: Guidelines* (NSW Heritage Office, 2005), and the *NSW Heritage Council's Heritage Interpretation Policy* (Heritage Council of NSW, 2005). The HIP will focus on the study areas historic development and target items considered to contain heritage significance within the project site including: • Mascot (Botany Road) Underbridge • Mascot (O'Riordan Street) Underbridge • Mascot (Robey Street) Underbridge • Botany Rail Line and its associations with the development of industry and land use in the Botany and Mascot areas. The HIP will be prepared in consultation with: • Bayside Council • NSW Heritage Council • Randwick and District Historical Society.	N/A – Design phase	N/A – Design phase
Construction	Significant items within, and outside of, the study area	For the Botany Water Reserves (also known as Botany Wetlands or Botany Swamps), the following site specific management measures will be implemented: • establishment of fenced exclusion zones around the item's SHR curtilage to prevent inadvertent impacts to the item prior to, and during construction of the project • engagement of an arborist to ensure significant plant species are not impacted during the construction phase if impacts outside of the project footprint are proposed • archaeological monitoring in areas assessed as containing low potential for Phase 1 archaeological remains where subsurface impacts are proposed. This would be carried out in accordance with recommendations set out in Section 11.5 of *Technical Report 9 – Statement of Heritage Impact.*	✓	✓
	Significant items within, and outside of, the study area	The CEMP will identify measures to specifically minimise the potential impact to the bridge during the construction phase of the project. This may include establishment of protective barriers or pads around elements of the bridge to ensure impacts to fabric are avoided.	✓	✓

STAGE	ISSUE	MEASURE	ENABLING WORKS	MAIN CONSTRUCTION
	Significant items within, and outside of, the study area	The CEMP will include measures to prevent inadvertent impacts to fabric within the curtilage of the Sydney Airport Group south of Qantas Drive. This may include establishment of an exclusion zone around the LEP curtilage for the item. The inclusion of the exclusion zone in the ECMs would be appropriate.	✓	✓
	Significant items within, and outside of, the study area	For the potential archaeological remains shown in Figure 15.4, archaeological monitoring or testing will be undertaken (where required) in accordance with recommendations set out in Section 11.5 of *Technical Report 9 – Statement of Heritage Impact*	✓	✓
	Photographic archival recording	Photographic archival recording and reporting will be carried out in accordance with the NSW Heritage Office's *How to Prepare Archival Records of Heritage Items* (1998), and *Photographic Recording of Heritage Items Using Film or Digital Capture* (NSW Heritage Office 2006) for the following items: • Mascot (Botany Road) Underbridge • Mascot (O'Riordan Street) Underbridge • Mascot (Robey Street) Underbridge • existing nature and elements of the Botany Rail Line located within the study area. The relevant record will be prepared by a suitably qualified heritage consultant using archival-quality material prior to the demolition or modification of each bridge, and main construction works to Botany Line. Additional recording may also take place during bridge removal. Records for LEP-listed items would be held by the local Council and local library. A copy of the record will be held by the owner of the asset.		✓
	S170 notification	As the items listed on the ARTC s170 register will be demolished, a s170 notification will be provided to Sydney Trains and the NSW Heritage Division prior to the demolition of: • Mascot (O'Riordan Street) Underbridge • Mascot (Robey Street) Underbridge.		✓

STAGE	ISSUE	MEASURE	ENABLING WORKS	MAIN CONSTRUCTION
	Archaeological management	The location of subsurface excavations will be designed, where possible to avoid areas containing low or moderate potential for State and locally significant Phase 1 and 2 resources. If these impacts cannot be avoided, a Historical Archaeological Assessment and Research Design (HAARD) and Excavation Methodology would be prepared once designs for the project have been finalised and the extent and depth of subsurface excavations are known. Likely recommended archaeological management includes: • East: Land surrounding Mill Pond and immediately south of Southern Cross Drive – archaeological monitoring and recording with potential salvage. • Central: Land to the north and south of General Holmes Drive, west of the Botany Rail Line – archaeological test excavations or monitoring and recording to the south and archaeological monitoring and recording to the north, both with the potential for salvage. • West: No archaeological resources considered to contain local or State significance are located in this portion of the study area – unexpected finds protocol. The HAARD will recommend appropriate archaeological management and research questions based on final detailed design. It will also include a requirement that all archaeological monitoring and test excavations be led by a suitably qualified heritage consultant who meets the NSW Heritage Council's Excavation Director criterial.	✓	✓
	Heritage induction	The project environmental induction will include making contractors aware of areas of high/moderate archaeological potential, areas containing highly significant fabric, relevant strategies to minimise potential impacts on archaeological remains and heritage fabric, information regarding the identification and management of unexpected archaeological and heritage finds and their obligations under NSW heritage legislation and the conditions of approval for the project. The induction will be provided to relevant contractors and subcontractors and its preparation overseen and approved by a suitably qualified heritage professional.	✓	✓

STAGE	ISSUE	MEASURE	ENABLING WORKS	MAIN CONSTRUCTION
	Unexpected finds	An Unexpected Finds Procedure will be established and implemented in the case of unexpected structural and archaeological finds in areas not considered to contain archaeological potential for local or state significant remains.	✓	✓
	Unexpected finds	The Heritage Council will be notified if a relic is uncovered during construction.	✓	✓
Operation	Unexpected finds	The existing ARTC Standard Environmental Management Measures (under the Environmental Management System) will be implemented to manage the potential for unexpected non-Aboriginal heritage finds.	N/A – Operation	N/A – Operation

15.6.3 Consideration of the interaction between measures

In addition to the measures for non-Aboriginal heritage described above, there are interactions between the mitigation measures for Aboriginal heritage (Chapter 16). For example, unexpected finds protocols would be implemented to minimise damage to unidentified archaeological relics of both non-Aboriginal and Aboriginal heritage within the project site. All mitigation measures for the project are consolidated in Chapter 25 to ensure consistency in implementation.

15.6.4 Managing residual impacts

A residual risk analysis was undertaken taking into account the impact assessment summarised in this chapter and implementation of the mitigation measures as recommended in 15.6.2.

Due to the demolition of two heritage items of local significance and modifications to one heritage item of local significance (see Table 15.4), the residual risk level remain remains high for impacts on non-Aboriginal heritage (see Appendix B).

All detail on mitigation measures would be transferred to ARTC's asset management system for ongoing management.

16. ABORIGINAL HERITAGE

This chapter provides a summary of the *Aboriginal Archaeological Survey Report* undertaken by Artefact Heritage. A full copy of the assessment report is provided as *Technical Report 10 – Aboriginal Archaeological Survey Report.*

16.1 Assessment approach

A summary of the approach to the assessment is provided in this section, including the legislation, guidelines and policies driving the approach, and the methodology used to undertake the assessment. A more detailed description of the approach and methodology is provided in *Technical Report 10 – Aboriginal Archaeological Survey Report.*

16.1.1 Legislative and policy context to the assessment

State legislation

Environmental Planning and Assessment Act 1979

The EP&A Act establishes the framework for cultural heritage values to be formally assessed in the land use planning, development assessment and environmental impact assessment processes. The EP&A Act consists of three main parts of direct relevance to Aboriginal cultural heritage: Part 3, which governs the preparation of planning instruments, Part 4, which relates to development assessment processes for local government (consent) authorities and Part 5, which relates to activity approvals by governing (determining) authorities.

Part 3, Division 3.4 deals with the development of LEPs. Planning decisions within LGAs are guided by LEPs. Each LGA is required to develop and maintain an LEP that includes Aboriginal and historical heritage items which are protected under the EP&A Act and the Heritage Act. The study area is located within the boundary of the Bayside LGA and is covered by the Botany Bay LEP.

No Aboriginal heritage items listed on the Botany Bay LEP are located within the study area.

National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NPW Act) provides statutory protection for all Aboriginal 'objects' (consisting of any material evidence of the Aboriginal occupation of NSW) under section 90 of the NPW Act, and for 'Aboriginal Places' (areas of cultural significance to the Aboriginal community) under section 84.

The protection provided to Aboriginal objects applies irrespective of the level of their significance or issues of land tenure. However, areas are only gazetted as Aboriginal Places if the Minister for the Environment is satisfied that sufficient evidence exists to demonstrate that the location was and/or is of special significance to Aboriginal culture.

There are no gazetted Aboriginal Places in the study area. All Aboriginal objects, whether recorded or not, are protected under the NPW Act.

An Aboriginal Heritage Impact Permit (AHIP) is the statutory instrument that is issued under section 90 of the NPW Act to manage harm or potential harm to Aboriginal objects and places. Various factors are considered in the AHIP application process, such as site significance, Aboriginal consultation requirements, Ecological Sustainable Development (ESD) principles, project justification and consideration of alternatives.

The project is being assessed as SSI under Division 5.2 of the EP&A Act. Under section 5.23 of the EP&A Act, an AHIP under section 90 the NPW Act 1974 is not required.

Native Title Act 1994

The (state) *Native Title Act 1994* was introduced to work in conjunction with the Commonwealth *Native Title Act 1993*. Native Title claims, registers and Indigenous Land Use Agreements are administered under the Act.

There are no registered Native Title claims identified for the study area.

Aboriginal Land Rights Act 1983

The *Aboriginal Land Rights Act 1983* (ALR Act) established LALCs at State and Local levels. Under Division 1A section 52(4) of the ALR Act, these bodies have a statutory obligation to:

- take action to protect the culture and heritage of Aboriginal persons in the council's area, subject to any other law
- promote awareness in the community of the culture and heritage of Aboriginal persons in the council's area.

The study area is within the boundary of the La Perouse LALC.

The ALR Act also provides a statutory pathway for LALCs to make an ownership claim over Crown land. There are no Registered Aboriginal Owners pursuant to Part 9, Division 3 of the ALR Act for the study area.

Commonwealth legislation

Environmental Protection and Biodiversity Conservation Act 1999

The EPBC Act is administered by the Australian Department of the Environment and Energy (DoEE) and provides a legal framework to protect and manage nationally important flora, fauna, ecological communities and heritage places defined as 'matters of national environmental significance' (MNES).

The EPBC Act includes 'national heritage' as a MNES and protects listed places to the fullest extent under the Constitution. It also establishes the NHL and the CHL.

There are no CHL listed or NHL listed places in the study area.

Aboriginal and Torres Strait Islander Heritage Protection Act 1994

The *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* (Commonwealth), deals with Aboriginal cultural property (intangible heritage) in a wider sense. Such intangible heritage includes any places, objects and folklore that "are of particular significance to Aboriginals in accordance with Aboriginal tradition". These values are not currently protected under the NPW Act.

Where an Aboriginal individual or organisation is concerned that intangible values within the proposal are not being adequately protected, they can apply to the Minister for a declaration over a place.

No intangible places or values were identified during the heritage investigations undertaken for the study area.

Native Title Act 1993

The main purpose of the *Native Title Act 1993* (Commonwealth) is to recognise and protect native title. Native title is the rights and interests in land and waters that Aboriginal and Torres Strait Islanders have under their traditional laws and customs.

Section 24KA of the *Native Title Act 1993*, requires that native title claimants are notified of any 'future act' which may result in a change in land use for Crown lands affected by claims. 'Future act' is defined in section 233 of the Act as a proposed activity or development on land and/or waters that may affect native title, by extinguishing (removing) it or creating interests that are inconsistent with the existence or exercise of native title. If after one month (from notification) there was no response, then the proponent is deemed to have fulfilled their obligations under the Act.

There are no native title claims currently registered in the study area.

Airports Act 1996

The Airports Act and associated regulations (discussed below) provide the assessment and approval process for development on Commonwealth-owned land leased from the Australian Government for the operation of Sydney Airport.

Section 70 of the Airports Act requires that any major airport development must be consistent with the master plan approved by the Minister for Infrastructure and Transport. Part 5 of the Act also requires the development of an environmental strategy (included in the master plan), against which compliance is required by Sydney Airport and all persons carrying out activities on airport land.

The study area includes areas of Commonwealth-owned land leased by Sydney Airport Corporation Limited.

Sydney Airport Master Plan 2039

As part of the planning framework established by the Airports Act, airport operators are required to prepare a master plan for the coordinated development of their airport. The Sydney Airport Master Plan 2039 (SACL 2019a) outlines the strategic direction for Sydney Airport's operations and development over the next 20 years. It acknowledges that the continued growth of Sydney Airport is vital to achieving local, state and national employment, tourism and development objectives.

The Master Plan 2039 includes the following relevant heritage initiatives:

- conserve the significant places of the airport, in line with the Heritage Management Plan
- actively conserve heritage elements listed as Environmentally Significant under the Airports Act
- deliver and continually build upon the online experience centre, to tell the history of the airport site, detail its significance and its aviation history
- integrate heritage interpretation devices into new and existing Sydney Airport facilities, through delivery of an interpretation strategy
- ensure that heritage items of recognised significance are recorded to an appropriate archival standard
- establish an archive of historical records of the history of Sydney Airport and the site
- implement the management plan for the fig trees and the Sydney Airport Wetlands, located in the South East Sector.

This assessment was completed in accordance with the objectives outlined in section 2.3 of the Sydney Airport Master Plan 2039, to ensure heritage items are appropriately considered and managed.

Sydney Airport Environmental Strategy 2019–2039

The Airports Act requires that airport operators provide an assessment of the environmental issues associated with implementing the airport master plan and the plan for dealing with those issues. This is documented in an environment strategy that forms part of the airport's master plan. The Sydney Airport Environment Strategy 2019–2024 (the Environment Strategy) (SACL 2019b), which forms part of Master Plan 2039, provides strategic direction for the environmental performance and management of Sydney Airport for the five-year period between 2019 and 2024.

The Environment Strategy stipulates that heritage must be appropriately considered and managed. The Archaeological Survey Report completed for the project was prepared in accordance with this requirement.

Airports (Environment Protection) Regulations 1997

The objective of the Airports (Environmental Protection) Regulations 1997 (Commonwealth) (the Airports regulations) is to:

- establish a system of regulation for activities at airports that generate or have potential to generate pollution or excessive noise
- to promote improving environmental management practices for activities carried out at airport sites.

Under Part 4 of the regulation, the operator of an undertaking must ensure that there are no adverse consequences for existing aesthetic, cultural, historical, social and scientific (including archaeological and anthropological) values of the local area, and there are no adverse consequences for sites of indigenous significance on the airport site.

The study area includes areas of Commonwealth-owned land leased by Sydney Airport Corporation Limited.

16.1.2 Other relevant guidelines

To meet the SEARs SSI 18_9714, an Aboriginal Archaeological Survey Report has been completed in accordance with Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales. Other guidelines and regulations included in the project SEARs include the following statutory guidelines:

- *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH 2011)
- *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (Department of Environment Climate Change and Water [DECCW] 2010)

In accordance with the SEARs SSI 18_9714 (Key issue 5 Requirement 4), further investigation under the Guide and the Consultation Requirements is only required where impacts on Aboriginal objects or places are proposed. The *Aboriginal Archaeological Survey Report (Technical Report 10)* has determined that impacts on Aboriginal objects and places as a result of the project are unlikely. Therefore, these guidelines are not relevant to this assessment, as no Aboriginal objects or places will be impacted by the proposed works.

A detailed description of the legislative and policy context for the assessment is provided in section 2 of the *Technical Report 10 – Aboriginal Archaeological Survey Report.*

16.1.3 Methodology

Key tasks

Key tasks undertaken for this Aboriginal Heritage assessment have included:

- a review of the legislative and policy context including relevant guidelines and procedures
- a desktop review of relevant background literature, search registers including the Aboriginal Information Management systems (AHIMS), and previous archaeological investigations in the broader study area
- a review of previous archaeological surveys at the project site, including the archaeological survey undertaken by Kelleher Nightingale Consulting (KNC) on 14 and 21 September 2016
- a site inspection by Artefact Heritage on 18 July 2018 (to substantiate the findings of the KNC), and a follow up site inspection on 8 November 2018, including follow-up consultation with La Perouse LALC who were not available to attend the site visit
- consideration for the need to undertake archaeological significance assessments for identified Aboriginal sites
- the completion of an archaeological significance assessment
- review of project impacts, and relevant mitigation measures to reduce any identified potential impacts on Aboriginal cultural heritage, including PADs.

Further information on key tasks is included in the *Technical Report 10 – Aboriginal Archaeological Survey Report*.

Study area

Technical Report 10 – Aboriginal Archaeological Survey Report used a number of approaches to define the study area. These include:

- Board study area – used to define areas included in board scale database searches and previous archaeological investigations.
- Study area – used to define the boundaries of site surveys which includes the project site and land immediately adjacent.
- Project site – used to define land within project boundaries.

Archaeological Investigations were divided into three survey units, and one additional investigation area, (shown in Figure 16.1):

- Survey Unit 1 – encompassed land from Banksia Street to Southern Cross Drive, Botany. The survey unit included the Botany Line and the southern boundary of the Eastlake Golf Course.
- Survey Unit 2 – encompassed Southern Cross Drive to the Alexandra Canal. The survey unit contained a combination of land occupied by the Botany Line, adjacent urban areas, road corridors and the riparian areas adjacent to Mill Stream and Mill Pond.
- Survey Unit 3 – encompassed an area from Alexandra Canal west to the boundary of the suburbs St Peters and Tempe. The survey included the Botany Line and adjacent industrial areas, however it should be noted that this area was outside the project site.
- An additional area within the Botany rail line, south of Banksia Street, Botany.

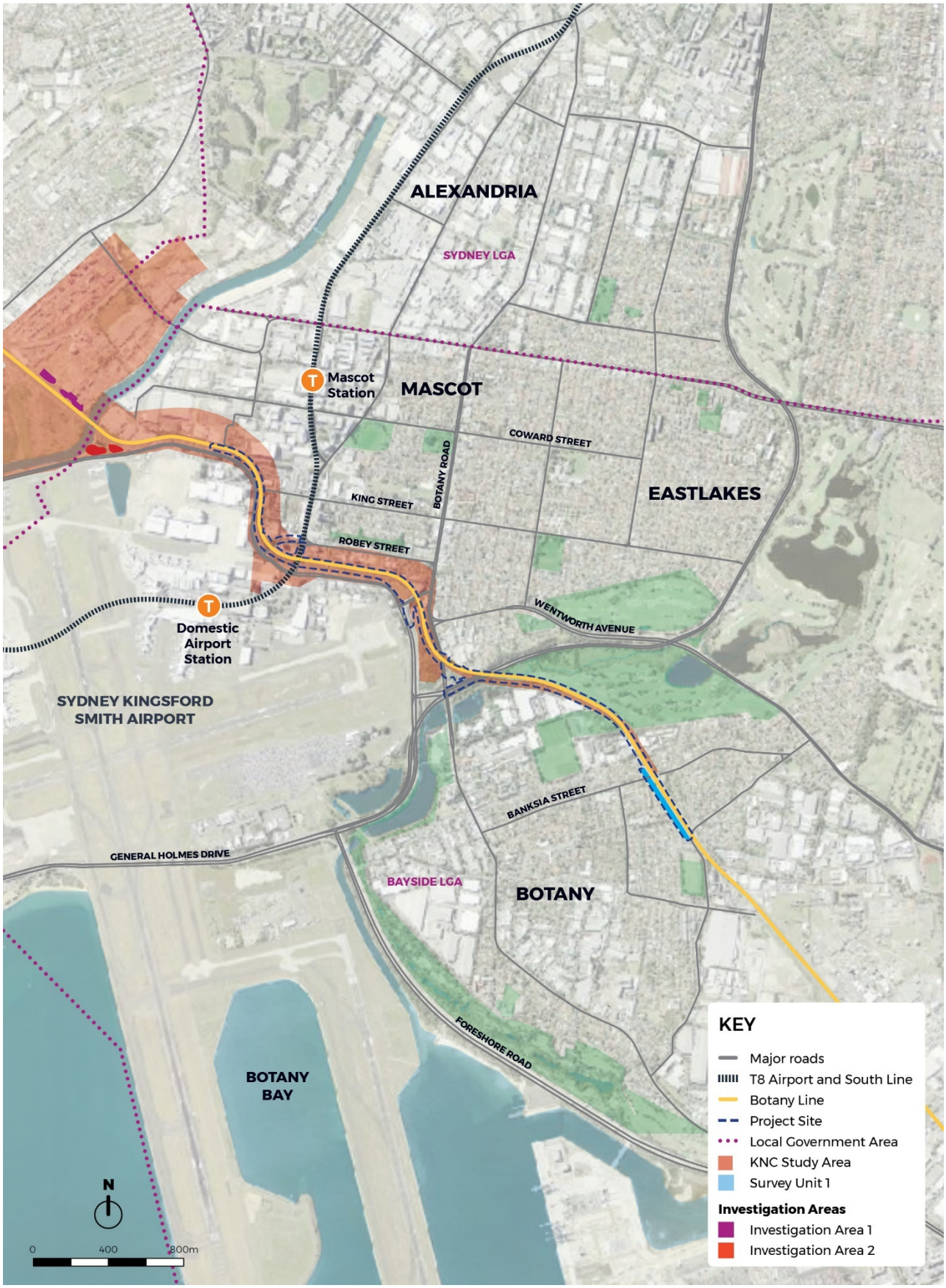


Figure 16.1 Aboriginal Archaeological Survey Report study areas

16.1.4 Risks identified

The preliminary environmental risk assessment undertaken for the project (provided in Appendix B) included potential risks associated with Aboriginal heritage. Potential risks were considered according to the impacts that may be generated by the construction and operation of the project. The likelihood, consequence and overall risk level of each potential risk were assessed, with avoidance and management measures defined for each potential risk. Further information on the risk assessment, including the approach, methodology and the full results, is provided in Appendix B.

The assessed risk levels prior to mitigation associated with potential Aboriginal impacts were:

- disturbance of known or unidentified items or places of Aboriginal heritage significance.

This potential risk and impact were considered as part of the assessment. The assessment also considered matters identified by the SEARs and identified by stakeholders (as described in Chapters 3 and 4). The residual risk levels, following implementation of the mitigation measures proposed in this EIS, are discussed in section 16.6.4.

16.2 Existing environment

16.2.1 Aboriginal historical and landscape context

The archaeological understanding of the early Aboriginal settlement of the Sydney Basin and surrounds is constantly expanding and developing.

Prior to European colonisation in 1788, the areas surrounding Sydney were occupied by the Eora people. The Eora inhabited a territory boarded by the coast to the east, Pittwater and the mouth of the Hawksbury River to the north and the Georges River and Botany Bay to the south. Due to their geographical location, the Eora subsisted generally on a marine based diet. Their occupation is evident today from various middens, rock shelter art and engravings along the coastline.

Estimates of the population of the Eora range from 1000 to 5000 individuals, a number that was irreversibly reduced due to the arrival of Europeans. The Eora were distributed into a number of different family and clan groups, with the Gadaigal people occupying the land closely associated with the project site. Their traditional occupation of the area is believed to be for at least 20,000 years prior to European arrival in 1788.

The project site is located within an area that was rich with resources, with the Cooks River and Gumbramorra Swamp a likely source of reliable fish and fresh water. Additionally, the Hawkesbury sandstone around the Cooks River would have provided shelter and the surrounding environment ample materials for tools and other material culture.

Observations of Aboriginal people living on the Cooks River made early after the British arrival in Australia indicate the importance of these riverine and estuarine environments for Aboriginal people. Watkin Tench noted a camp consisting of twelve huts near the Cooks River in 1788 (Muir 2013), while another account by James Backhouse details the construction of canoes using heat from fires in the 1830s (Backhouse 1838). Other accounts observed Aboriginal people in canoes and shell middens indicate the procurement of fish and shell fish for food (Backhouse 1838). The discovery of butchered dugong bones during the excavation of Alexandra Canal in the late 19th century highlights the ways in which Aboriginal people took advantage of their environments particularly during periods of climate change around 6,000 years ago (Etheridge et al. 1896).

16.2.2 Registered Aboriginal sites

The AHIMS register provides records of Aboriginal objects reported to Department of Premier and Cabinet in accordance with section 89A of the NPW Act. It contains information about Aboriginal places which have been declared by the Minister for the Environment to have special significance with respect to Aboriginal culture. Previously reordered objects and declared Aboriginal places are referred to by AHIMS as 'Aboriginal sites'.

An AHIMS search was undertaken on 4 December 2018 for a broad study area approximately 14 kilometres by 14 kilometres' centres on the project site. A total of 88 sites were identified. The closest Aboriginal site to the project site is the Bouy Botany Shell Midden AHIMS ID 45-6-0629), located 750 metres to the south west.

The results of the AHIMS search are described in Table 16.1.

Table 16.1 AHIMS search results by frequency

SITE TYPE	NUMBER OF SITES	PERCENTAGE OF SITES
Shell, artefact	26	28.41
PAD	22	22.73
Artefact	18	20.45
Art (pigment or engraved)	13	14.77
Artefact, PAD	3	3.41
Art (pigment or engraved), Artefact	1	1.14
Artefact, Aboriginal resource and gathering, non-human bone and organic material	1	1.14
Shell	2	1.14
Unknown (PAD?)	2	2.27
Aboriginal resource and gathering	1	1.14
Artefact, shell, burial	1	1.14
Aboriginal ceremony and dreaming, artefact, shell	1	1.14
Shell, artefact, art (pigment or engraved)	1	1.14
Total	**88**	**100.00**

16.2.3 Previous archaeological investigations

A number of archaeological investigations have been conducted in broad study area, including in the suburbs of Mascot, Marrickville, Tempe and Undercliff. A full summary of investigations is included in *Technical Report 10 – Aboriginal Archaeological Survey Report*.

In summary, the project site was originally part of Wangal clan territory. Aboriginal people would have utilised the rich resources of the estuarine environment and would likely have camped on the estuary's margins. Although there are no registered Aboriginal sites within the project site, Sheas Creek Dugong (AHIMS Botany ID 45-6-0751) is located around 800 metres to the north. Partial remains of a dugong skeleton, with cut marks, were identified during an excavation in 1896. The site also featured stone axes. The findings at this site demonstrate the use of marine resources by Aboriginal people in the area.

16.2.4 Archaeological survey

KNC Survey (2018)

In 2018, KNC completed an Aboriginal heritage assessment which included the project site. The assessment involved an archaeological survey (undertaken on 14 and 21 September 2016) and consultation with the La Perouse LALC and the Metropolitan LALC.

The survey extent included the following areas:

- Banksia Street to Southern Cross Drive, including the Botany Line and the southern boundary of the Eastlake Golf course
- Southern Cross Drive to Alexandra Canal, including the Botany Line, adjacent urban areas, road corridors, and riparian areas adjacent to Mill Stream
- Alexandra Canal to eastern areas of the suburbs of St Peters and Tempe (not within the project site).

The survey identified two areas with no visible disturbance to the ground surface and where intact sub-surface deposits could be present. These two areas are located to the west of Alexandra canal, outside the extent of the project site. The remainder of the assessment area was determined to be unlikely to contain Aboriginal objects or PADs.

Artefact Heritage Site Visits (2018)

In July 2018, Artefact Heritage completed a site visit of the study area. The site visit was considered a 'ground truthing' exercise. Subsequently a second site visit was undertaken on 8 November 2018 (including a representative of the Metropolitan LALC). This site visit confirmed the results of the KNC site survey and identified the southern section of the study area had not been included in the 2018 KNC assessment.

Artefact Heritage Survey (2019)

In 2019, Artefact Heritage completed an Aboriginal heritage assessment that included the previously unassessed southern section of the study area. The purpose was to ensure all areas potentially impacted by the project were assessed. The survey took place within Botany Line corridor, south of the pedestrian overpass at Banksia Road and north of Railway Road. A site officer representing the La Perouse LALC was invited to attend but was not available to participate.

The study area was restricted to within the rail corridor south of the pedestrian overpass at Banksia Road and north of Railway Road. The study area is located across a truncated sloping landform. The area has been levelled to accommodate the rail infrastructure. The general slope of the area is northeast to southwest towards Botany Bay. The original landscape would have been rolling coastal dunes, which is evident by the disturbed sands visible at the site. The vegetation has been cleared and replaced with gravel, ballast and grass cover. There is remnant or regrowth vegetation around the perimeter of the study area, none of sufficient age to have cultural markings.

Visibility in the survey unit was limited to areas along the western half that has been experiencing motor vehicle traffic and along the edge of the rail infrastructure that experiences foot traffic and is kept clear of vegetation. The entire landform has been heavily modified to accommodate its existing rail infrastructure. The slope has been truncated in the east of the site and built up in the west. Gas pipelines and electrical cables run the length of the site.

No new Aboriginal sites or areas of PAD were identified during the survey.

Following the completion of the 2019 survey, the LALC was contact to discuss the results of the survey and provided with photos taken during the survey. Comments from (Uncle) David Ingrey confirmed that the

survey undertaken by Artefact Heritage was sufficient, and they did not require an additional site visit due to the level of disturbance. No intangible cultural heritage values were identified.

16.2.5 Local archaeological context

No Aboriginal archaeological objects or areas of PAD were identified within the study area. However, archaeological evidence indicates that Botany Bay, the Cooks River and its tributaries were a focus for intensive Aboriginal occupation, due to the combination of maritime, estuarine and terrestrial resources available in the area (KNC 2018). The terraces surrounding these waterways are likely to have functioned as camp sites from which past Aboriginal people could have exploited these resources. The survivability of this archaeological evidence is dependent on low levels of soil disturbance (from both natural and anthropogenic factors) (KNC 2018).

16.2.6 Archaeological significance assessment

The archaeological surveys did not result in the identification of any Aboriginal sites or areas of PAD. Therefore, the study area is not considered to be of archaeological significance.

Unexpected Aboriginal archaeological material may however be present within the fill layer. Any Aboriginal objects retrieved from the fill would likely be assessed as holding low scientific significance due to a lack of archaeological context and integrity.

16.3 Assessment of construction impacts

No Aboriginal places or objects were identified within the project site. Furthermore, due to the highly disturbed nature of the ground, intact archaeological deposits are not likely to be present below the ground surface. Therefore, the proposed development is unlikely to impact any Aboriginal heritage items or places, potential Aboriginal archaeology or intangible cultural heritage values.

16.4 Assessment of operational impacts

No Aboriginal places or objects were identified within the project site. The project is unlikely to have any operational impacts on Aboriginal places, objects, potential Aboriginal archaeology or intangible cultural heritage values.

16.5 Cumulative impacts

As no Aboriginal places or objects have been identified within the project site, cumulative impacts on Aboriginal places or objects are considered unlikely.

16.6 Management of impacts

16.6.1 Approach

ARTC is committed to minimising the environmental impact of the project, including Aboriginal heritage values. Due to the majority of the project being confined to the highly disturbed rail corridor, impacts on Aboriginal heritage values are unlikely. Based on the outcomes of *Technical Report 10 – Aboriginal Archaeological Survey Report*, there have been no necessary project alterations to avoid or minimise impacts on Aboriginal sites or areas of archaeological potential, as the current project scope and area would not impact any known Aboriginal sites.

Further details on the approach to management of environmental impacts is provided in Chapter 24.

16.6.2 List of mitigation measures

The mitigation measures that would be implemented to address potential Aboriginal heritage impacts are listed in Table 16.2. This table also outlines which mitigation measures (during the construction stage) would be implemented during the enabling works and main construction works.

Table 16.2 Aboriginal cultural heritage mitigation measures

STAGE	IMPACT	MEASURE	ENABLING WORKS	MAIN CONSTRUCTION
Construction	Unexpected discovery of Aboriginal objects	An unexpected finds procedure will be prepared and include requirements for: • protecting any unexpected finds (including Aboriginal heritage items and human skeletal remains) encountered during construction activities • procedures to manage reporting and investigation when unexpected finds are encountered.	✓	✓
	Unexpected discovery of human remains	If suspected human skeletal remains are uncovered at any time throughout undertaking the proposed works, the unexpected finds procedure will be implemented.	✓	✓
Operation	Unexpected discovery of Aboriginal objects	The existing ARTC Standard Environmental Management Measures (under the Environmental Management System) will be implemented to manage the potential for unexpected discovery of Aboriginal objects or human remains.	N/A – Operation	N/A – Operation

16.6.3 Consideration of the interaction between measures

In addition to the measures for Aboriginal heritage described above, there are interactions between the mitigation measures for Non-Aboriginal heritage (Chapter 15). For example, unexpected finds protocols are both designed to prevent the damage or destruction of Aboriginal heritage and non-Aboriginal heritage items. All mitigation measures for the project are consolidated in Chapter 24 to ensure consistency in implementation.

16.6.4 Managing residual impacts

A residual risk analysis was undertaken taking into account the impact assessment summarised in this chapter and implementation of the mitigation measures as recommended in section 16.6.2. The residual risk levels were assessed to be low for the potential disturbance of known or unidentified items or places of Aboriginal heritage significance, given the project site has been significantly disturbed and no Aboriginal sites or PADs were identified in this assessment (see Appendix B).

17. LAND USE AND PROPERTY

17.1 Assessment approach

The approach to the land use and property assessment is provided in this section, including the guidelines and policies driving the approach and the methodology used to undertake the assessment.

17.1.1 Legislative and policy context to the assessment

Lands Acquisition (Just Terms Compensation) Act 1991

The *Lands Acquisition (Just Terms Compensation) Act 1991* provides a mechanism for the acquisition of land on just terms by state authorities. The act ensures compensation in line with market value for the acquisition of land, provides the establishment of procedures for the compulsory and temporary acquisition of land by state authorities to simplify and expedite the acquisition process, and encourages the acquisition of land by agreement rather than compulsory processes.

The Botany Rail Duplication Project requires widening of some sections of the existing rail corridor, necessitating a limited amount of property acquisition. The existing rail corridor is owned by the NSW Government (RailCorp) and leased by ARTC. Under the act, RailCorp would be the acquiring authority of the required land acquisition. This assessment outlines the requirement for the permanent and temporary acquisition of land for the purpose of construction and operation of the project.

Other plans and policies

The strategic context for the project is influenced by a number of strategic plans for transport, land use and freight undertaken at a national, state and regional level. Those strategies relevant to land use planning at a local and regional level include:

- NSW Ports' 30 Year Master Plan (NSW Ports, 2015)
- A Metropolis of Three Cities – the Greater Sydney Region Plan (Greater Sydney Commission, 2018a)
- Eastern City District Plan (Greater Sydney Commission, 2018b)
- Greater Sydney Services and Infrastructure Plan (Transport for NSW, 2018c)
- Sydney Airport Master Plan (SAMP) (SACL, 2019a).

A further discussion of the relevant strategies is included in section 5.1.3 and E1 in Chapter 5.

17.1.2 Methodology

Key tasks

The assessment of potential land use impacts associated with the construction and operation of the project involved:

- reviewing environmental planning instruments, policies and strategies
- reviewing, identifying, and mapping existing land uses within the study area based on a desktop review of GIS spatial data and aerial photography, including:
  - local land use zoning maps located within the Botany LEP
  - local land use zoning maps located within the State Environmental Planning Policy (Three Ports) SEPP (NSW Government, 2013)
  - *Sydney Airport Master Plan (2039)* (SACL 2019a) including land use zoning maps on Commonwealth land within the airport
  - properties or landholdings
- consideration of the potential for impacts on other land uses during construction and operation
- providing measures to mitigate and manage the impacts identified.

17.1.3 Risks identified

The preliminary environmental risk assessment undertaken for the project (provided in Appendix B) included potential land use and property risks. Potential risks were considered according to the impacts that may be generated by the construction and operation of the project. The likelihood, consequence and overall risk level of each potential risk were assessed, with avoidance and management measures defined for each potential risk. Further information on the risk assessment, including the approach, methodology, and the full results, is provided in Appendix B.

The assessed risk level for the majority of potential land use and property risks was medium to high. Risks with an assessed level of medium to high included:

- impacts on land use as a result of property acquisition
- impacts on land use due to billboard modification/relocation
- impacts on businesses due to temporary road closures, particularly full road closures associated with bridge closures
- impacts associated with the establishment of compound sites on adjacent private property.

These potential risks and impacts were considered as part of the assessment. The assessment also considered matters identified by the SEARs and identified by stakeholders (as described in Chapter 4). Issues raised by the stakeholders relating to land use and property included impacts on property acquisitions, adjustments and property values.

17.1.4 How potential impacts have been avoided or minimised

As described in Chapters 6 to 7, design development and construction planning has included a focus on avoiding or minimising the potential for environmental impacts during all key phases of the process.

Potential land use and property impacts have been avoided or minimised where possible by:

- confining direct works, proposed ancillary compounds and staging areas to the existing rail corridor to avoid the need for temporary and permanent property acquisitions
- considering the location and positioning of construction compounds, utilisation of existing access points to the rail corridor and minimising impacts associated with the private property
- limiting the timing of construction works to minimise impact on billboards, and consideration of permanent reinstatement in appropriate locations.

17.2 Existing environment

A description of the project site for the purpose of the Environmental Impact Statement is provided in Chapter 2. Section 17.2.2 describes existing land uses and properties within and immediately surrounding the project site. Future land uses are described in section 17.2.3.

17.2.1 Regional and local context

The project site is located about eight kilometres south of the Sydney CBD, traversing the suburbs of Mascot, Botany and Pagewood within the Bayside LGA. The land near the project site consists of a variety of relatively dense land use that includes major transport corridors (such as M1 and M5 Motorways), Sydney Airport, Port Botany and large areas of supporting industrial and commercial land uses.

Areas of medium to high density residential land use (including multi story apartment buildings) are located predominantly to the northwestern end of the project site. Lower density residential areas (mainly detached housing and low rise apartment buildings) are located towards the southeastern end of the project site. Large areas of recreational land uses (including golf courses, parks and open space) are also present in the area, predominantly to the east of the project site. The single biggest land use near the project is Sydney Airport which lies to the south, southwest and west of the project site and has a significant influence on the surrounding development.

The location of major land use features is included on Figure 17.1.

17.2.2 Existing land uses and zoning

Land use zones

Land use zonings within and near the project site are set by the following land use planning instruments, as shown on Figure 17.1.

Botany Bay Local Environmental Plan

Most of the project site is located within an active rail corridor used for transport (freight rail) purposes. Under the Botany Bay LEP, the project site is predominantly located on land zoned Infrastructure (SP2), with an area zoned Business Development (B5) adjacent to Joyce Drive (Figure 17.1).

The objectives of the SP2 (Infrastructure) land zoning is to provide for transport infrastructure and related land use. The objectives of B5 (business development) land zoning is to enable a mix of business and warehouse uses.

Land use zoning near the project site highlights the diverse land use in the suburbs of Botany, Mascot and Pagewood. Land use zoning within the area potentially influenced by the project includes Low to Medium Density Residential (RE2 and RE3), Public Recreation (RE1), General Industrial (IN1), Light Industrial (IN2), Special Activities (SP2) and Local Centre (B2).

Sydney Airport Master Plan 2039

Part of the project site is located on Commonwealth-owned land leased from the Australian Government for the operation of Sydney Airport. Therefore, the project would need to be consistent with the SAMP 2039, which provides a planning framework for the coordinated development of Sydney Airport (SACL 2019a). The area of the project site on Sydney Airport land would only be used during construction and would not form part of the operational land required by the project. Under the SAMP 2039, the area is zoned for business development (BD1) and Airport Terminal and Support Services (AD2).

Areas zoned BD1 have been identified as surplus to aviation requirements and thus reserved for the purpose of providing employment opportunities in accessible locations, supporting the local workforce and locating suitable business along significant corridors.

Areas zoned AD2 make up around 21 percent of Sydney Airport, and are designated to provide development to facilitate the growth of international, domestic and regional air traffic.

SEPP (Three Ports) 2013

The *State Environmental Planning Policy (Three Ports) 2013* land use zoning applies to land to the south of the project site. The Three Ports SEPP does not apply to any part of the project site.

Land uses within the project site

The project site consists primarily of the existing rail line between Mascot and Botany, which is owned by NSW Government and leased, managed and operated by ARTC. The project site includes some additional areas outside the rail corridor which are primarily required for construction activities and site compounds. The areas located outside the rail corridor consist of the following land uses:

- areas of landscaping located on the southern side of the rail corridor north of Qantas Drive between Robey Street and General Holmes Drive containing billboards as shown on Figure 17.1
- airport land located between General Holmes Drive and the rail corridor which is currently being leased for the purpose of a site compound for the Airport East works, as discussed in section 7.4.2
- road reserves (including roadways) of Robey Street, O'Riordan Street and General Holmes Drive
- vacant land south of the rail corridor which is bound by the rail corridor, Botany Road and Southern Cross Drive
- vegetated areas associated with Mill Stream and the Botany Wetlands east of Southern Cross Drive.

Land uses near the project site

There are a range of land uses near the project site, which have the potential to interact or be influenced by the project. These are described further below.

Transport and freight related uses

Sydney Airport is generally located to the south and west of the project site. Since 1921, when the Commonwealth Government purchased land in Mascot for the purpose of creating a public airfield, the airport has been progressively modified and expanded. Sydney Airport now occupies an area of around 907 hectares. The northwestern end of the project site adjoins Qantas and Joyce drives, which are located on Sydney Airport land. Development and land use within Sydney Airport land must occur in accordance with the Sydney Airport Master Plan (SACL, 2019a).

Other transport and freight related land uses in the vicinity of the project site include roads, passenger rail (the Sydney Trains T8 Airport and South Line which travel below ground across the project site) and Port Botany which is located about 2.5 kilometres south of the project site.

Commercial and industrial

A range of commercial and industrial land uses, including a number of airline and freight related businesses and premises, are located in the northwestern part of the study area in Mascot, broadly to the east of Alexandra Canal, north of the rail corridor and west of O'Riordan Street. Other commercial/light industrial areas in the vicinity of the project site are located in:

- Mascot – to the east of the project site in the area bounded by Wentworth Avenue, Botany Road and McBurney Avenue
- Botany – to the south of the project site in the area bounded by Mill Stream, Botany Road, Lord Street and the rail corridor (the Sir Joseph Banks Corporate Park)
- Banksmeadow – to the south of the southern end of the project site.

Accommodation

A number of hotels are located directly adjacent or close to the project site in Mascot. In the immediate vicinity of the project site these include:

- Stamford Plaza, located at the intersection of Qantas Drive and O'Riordan Street on the northern side of the rail corridor
- Citadines Connect and Quest hotels, located close to the project site on Robey Street and Baxter Road
- Branksome Hotel & Residences, located close to the project site on Baxter Road.

The locations of these and other hotels in the vicinity of the project site are shown on Figure 17.1.

Residential

The main residential areas are located near the northwestern end of the project site in Mascot and at southeastern end in Botany and Pagewood. The nearest residential land uses are:

- in Mascot, north of the rail corridor on Baxter Road (about 10–30 metres from the project site), east of the rail corridor on Botany Road (about 40 metres from the project site) and north of the rail corridor on McBurney Avenue (about 30 metres from the project site)
- in Botany, west of the rail corridor between Myrtle and Victoria streets (about 20 metres from the project site)
- in Pagewood, east of the rail corridor between Myrtle and Page streets (about 20 metres from the project site).

In Mascot, areas of low density housing interspersed with low rise apartment buildings are located to the east of O'Riordan Street. Areas to the west of O'Riordan Street, particularly in the vicinity of Mascot Station, are undergoing urban renewal, with a number of apartment and mixed use buildings developed, proposed or under construction. South of Southern Cross Drive, residential land uses consist mainly of low density housing interspersed with low rise apartment buildings.

Open space/recreation

An area of Botany Wetlands, managed by Sydney Water, is located on either side of the project site just to the south of Southern Cross Drive. Other areas of open space and recreation facilities are located south of Mill Stream at the southeastern end of the project site in Botany and Pagewood. These include Eastlake Golf Club, Botany Aquatic Centre, The Lakes and Bonnie Doon golf courses, Booralee Park, Gaiarine Gardens and Garnet Jackson Reserve.

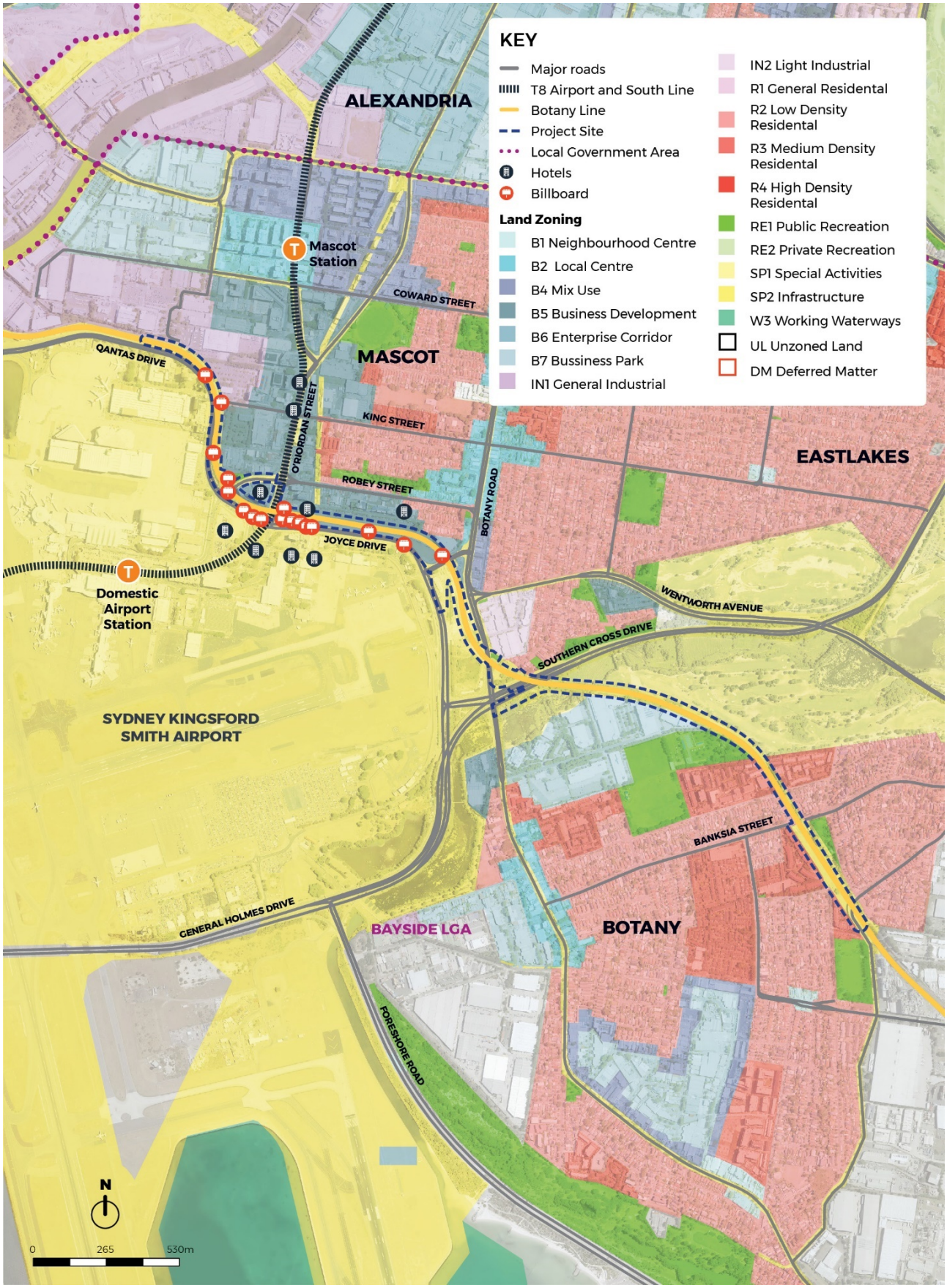


Figure 17.1 Land use

17.2.3 Future land uses

Relevant strategies directing future land use planning for the study area are summarised in section 5.1 (Strategic context).

Within project site

As identified in section 17.2.2, part of the project site is located within Sydney Airport and is therefore subject to the SAMP 2039 (SACL 2019a). This land is zoned for business development (BD1) and Airport Terminal and Support Services (AD2).

No specific proposals are identified for these areas, however the SAMP states that the northeast sector (adjacent to the rail corridor) can accommodate demand for 120,000 square metres of new hotel, office and commercial developments.

The remainder of the project site is located within an existing rail corridor.

Adjacent to project site

Future land uses in Mascot, Botany and Pagewood

The area to the north of the project around Mascot Station is currently subject to urban renewal and redevelopment of a number of sites. This area has been identified as part of the eastern economic corridor under the Eastern District Plan (Greater Sydney Commission, 2018b).

Redevelopment of this area has seen the development of growth areas around Green Square and Mascot. This redevelopment would likely continue to occur into former industrial areas located on the edge of this commercial core. This redevelopment has and will continue to also see an increase in residential dwellings predominately in the form of high densities close to Mascot.

With the redevelopment of areas around Mascot there is potential for further changes in land uses closer to the project site, such changes in land use have already started to occur in close proximity to the project with the new Branksome Hotel and Residences being developed between Robey Street and Baxter Road. The area previously consisted of a mixture of residential dwellings and some low scale commercial development.

A number of known future developments have been identified near the project site, including:

- the Sydney Gateway road project which includes the construction of new sections of high capacity limited road access linking the Sydney motorway network to Sydney Airport
- the WestConnex project which includes increases in capacity of the M5, connects the M5 with the M4, and provides connections to a future Sydney gateway road project
- the relocation of the Qantas Flight Training Centre from its location within Sydney Airport to landholdings in Mascot, immediately to the north of the Port Botany Rail Line
- the King Apartments, a proposed 12 story mixed use building including public car park, hotel and commercial offices located at 324 King Street Mascot, to the north of the Port Botany Rail Line.

Development within Sydney Airport

Development within the areas of the airport located to the south of the project is guided by the SAMP 2039. Under the plan, the northeast sector of the airport (which includes Terminals 2/3, would be subject to a wide range of developments including airside upgrade, relocation of support facilities and the development of further commercial spaces.

The SAMP 2039 also notes the provision of about 120,000 square metres of commercial development in the northeast sector of the airport near the project site. However, the only known and identified future development currently identified in the plan is a future approved 430 room hotel development located within the northeast sector, at the corner of Ninth Avenue and Qantas Drive.

17.2.4 Land ownership and property information

The existing rail corridor is owned by the NSW Government (Rail Corp) and leased by ARTC. The majority of the project would be undertaken within the existing rail corridor or on land for which ARTC has existing access agreements.

The project would also require works on land outside the corridor for both permanent and temporary use. This land is owned by a range of private landowners including SACL.

Land subject to acquisition as a result of the project has previously been identified in Table 6.5 in Chapter 6 of this EIS.

17.3 Assessment of construction impacts

17.3.1 Land use

Impacts to land use during construction would be associated with the change in land use to a construction work site and other construction facilities (such as compounds and material stockpile areas).

The majority of the project site is currently used as a transport corridor (ie Botany Line). Construction of the project would result in impacts on the use of the rail corridor. Due to the importance of the Botany Line, the project would be staged to avoid any potential impacts on the operation of the line, with any works impacting on the use of the corridor to be undertaken during designated possession periods when trains do not run along the line. This staging of the works would ensure that impacts on this transport corridor are kept to a minimum. Further discussion regarding the staging of the project is provided in Chapter 7 of this Environmental Impact Statement.

Construction works within the project site would result in impacts on a number of properties located outside the rail corridor. Impacts to land use during construction are considered to be minimal as the majority impacted properties are not used for any specific land use (including landscaped areas) and in many cases, are vacant. All proposed areas are also directly adjacent to the rail corridor. The temporary use of these properties is not considered to result in any land use impacts due to these areas not being used for any specific purposes currently. Following construction, these areas would be returned to the owners.

A number of existing advertising structures (used to support large advertising signs/billboards) would also be impacted by the project along Airport Drive and Qantas Drive. The location of billboards and likely extent of impact have been shown previously in Figure 6.7 in Chapter 6. Of the nineteen billboards located along Qantas Drive, and Joyce Drive, it is currently proposed that six would be retained, seven would be removed during construction and relocated at the completion of works, and the impacts on an additional six would be assessed during ongoing design and in consultation with owners of the land, lessors and lessees.

Further consideration of the business impacts of the billboard modifications are discussed in Chapter 19.

17.3.2 Property impacts

Property and land requirements for construction

As described in Chapter 6, the project would require the partial permanent land acquisition of seven properties to accommodate a wider rail corridor. These properties are located adjacent to the southern side of the rail corridor to the north of Qantas Drive and Joyce Drive. Property and land acquisition details are included in Table 17.1 with the location of properties shown on Figure 6.7 (Chapter 6).

The impacted land is largely vacant with the exception of some large advertising billboards (impacts on billboards is discussed in section 17.3.1) located on select parcels. The parcels have limited development potential due to their size (ie narrow) and positioning between the rail corridor and Qantas Drive–Joyce Drive. As such, any future developments of land impacted by the project are likely limited to developments such as the existing billboards. The minor reduction of the size of these parcels of land is not considered to result in any impacts on the current development potential due to the current restriction on this land because of its size and location between major transport infrastructure.

Overall the permanent partial acquisition of properties is not considered to result in any substantial property impacts as development potential of these properties would largely be unchanged due to the existing nature of the properties which currently limited the development potential of the land. The acquisition of privately owned land would be managed in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991*.

Table 17.1 Permanent land acquisition requirements

LOT/DP	TOTAL AREA (m^2)	APPROX. IMPACTED AREA (m^2)	EXISTING LAND ZONING	OWNER
Lot 2 DP 1039806	18,110	400	B5 – Business development	Private
Lot 1 DP 1039806	29,970	580	B5 – Business development	Private
Lot 401 DP 1215182	1,778	250	B5 – Business development	Private
Lot 52 DP1097377	7,086	270	B5 – Business development	Private
Lot 201 DP 777213	2,917	160	B5 – Business development	Private

Temporary occupation requirements for construction

As described in Chapter 7, construction of the project would require the temporary occupation of some land to facilitate construction. Temporary leases would be in the form of construction easements which would allow the use of these areas during construction, including for the use of construction compounds (such as those currently being used for the Airport East project adjacent to General Holmes Drive), crane pads and temporary billboard removal (and replacement activities). Land considered for temporary occupation would typically be located adjacent to the existing rail corridor and in generally cleared areas. The land would be rehabilitated and returned to the respective landowners on completion of the project. The location of proposed construction work areas and compounds are shown on Figure 7.7 in section 7.4.

The occupation of these properties in general would result in temporary land use and property impacts. Following construction, all land would be rehabilitated to its original condition and returned to the affected land owners.

Site access

A number of access locations would be established along the project site, these would either use existing locations or proposed access locations, where necessary. The location of existing and proposed new access gates is shown on Figure 7.2 in Chapter 7. New access locations include, adjacent to Robey Street bridge, Qantas Drive and Joyce Drive. The construction of these access gates would require the construction of new driveway access from the adjacent road network.

17.3.3 Cumulative impacts

The project would result in limited changes in land use in the long term and therefore would not contribute to any cumulative land use changes in the region. Any short-term impacts on land use would also be limited, with the majority of the project located within the rail corridor, not resulting in a substantial change to existing land uses.

17.4 Assessment of operational impacts

17.4.1 Land use

Direct impacts on land use

Operation of the project would result in minimal direct impacts on land use. The project would involve the continued use of a rail corridor for transport purposes. Direct operational impacts on land use would relate to the required property acquisition described in section 17.3.2. By maximising the use of existing rail corridor land, the need for property acquisition has been minimised.

The impacts due to changes of land use associated with the acquisition of land as part of the project are generally considered to be minimal. The majority of land to be impacted is currently unoccupied (with the exception of the billboards), directly adjacent to the rail corridor and is of a size which means use of this land for any other purposes is limited.

Impacts on future land use

The operation of the project would not result in any substantial impacts on the future land use opportunities in the study area.

17.4.2 Property impacts

While permanent land acquisitions are required to allow operation of the project, property acquisition would occur during the project planning and pre-construction phases of the project.

A number of additional corridor access roads are proposed to be used for maintenance access to the corridor. The location of these access roads is included in Table 6.4 in Chapter 6. The provision of new access roads is unlikely to have property impacts as the gates are located with access to the existing road network.

17.4.3 Cumulative impacts

The assessment of potential cumulative impacts, summarised in Chapter 24 (Cumulative impacts), considered the potential for impacts taking into account other projects being undertaken.

The project would result in limited changes in land use in the long term and therefore does not contribute to any cumulative land use changes in the region. Any short-term impacts on land use would also be limited, with the majority of the project located within the rail corridor, not resulting in a substantial changes to existing land uses.

17.5 Management of impacts

17.5.1 Approach

ARTC is committed to minimising the environmental impact of the project and is investigating opportunities to reduce actual impact areas where practicable. Due to the majority of the project being confined to the rail corridor, there is limited impact on land use and properties throughout much of the project area. However, due to the temporary and permanent partial land acquisitions required during both construction and operational stages, and modifications/relocations of billboards, there are opportunities to minimise impacts and disruptions.

ARTC has, where possible, sought to minimise impacts on land use and property through a number of measures including design considerations to minimise permanent impacts on private property outside the rail corridor, consideration of the location and positioning of construction compounds, utilisation of existing access points to the rail corridor, and minimising impacts associated with the billboards including reinstatement and any required relocations.

17.5.2 List of mitigation measures

The mitigation measures that would be implemented to address potential land use and property impacts are listed in Table 17.2. This table also outlines which mitigation measures (during the construction stage) would be implemented during the enabling works and main construction works.

Table 17.2 Mitigation measures

STAGE	IMPACT	MEASURE	ENABLING WORKS	MAIN CONSTRUCTION
Design	Property acquisition	The overall disturbance footprint will continue to be refined during detailed design to identify areas where it could be minimised to reduce impacts on existing land uses. Detailed staging of the project will also be determined during detailed design and will aim to minimise the time that affected land uses are impacted during construction.	N/A – Design phase	N/A – Design phase
	Property acquisition	The relevant property owners will be consulted in relation to the acquisition of properties required to facilitate the project. All acquisitions required for the project will 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.	N/A – Design phase	N/A – Design phase

STAGE	IMPACT	MEASURE	ENABLING WORKS	MAIN CONSTRUCTION
	Establishment of compound sites within private property	Temporary occupation of required site compounds will be negotiated under legal agreement with property owners. On completion of the project, the land will be returned to the owners for continued future use.	N/A – Design phase	N/A – Design phase
	Billboard modification/ relocation	The overall disturbance footprint will be refined during detailed design to identify areas where the footprint could be minimised to reduce impacts on billboards and to minimise modification or relocation where possible.	N/A – Design phase	N/A – Design phase
Construction	Billboard modification/ relocation	The removal, and reinstatement of billboards will be undertaken in consultation with land owners and billboard owners.	✓	✓
	Billboard modification/ relocation	As a priority, billboards will be replaced like for like. If replacement and relocation are not available, the affected parties will be appropriately compensated under the *Land Acquisition (Just terms Compensation) Act 1991.*	✓	✓
	Access to private property/ businesses/ Sydney Airport	Consultation will be carried throughout construction with the surrounding businesses, the local community and key stakeholders including Bayside Local Council, Sydney Airport and other potentially impacted stakeholders to advise them in advance of proposed works and any temporary access arrangements that may be required.	✓	✓
	Access to private property/ businesses/ Sydney Airport	Prior to any impact on access, alternative arrangements will be negotiated with the affected parties in order to enable continued access and to minimise disruption as much as reasonably possible.	✓	✓
	General construction activities	Affected property owners and businesses will be provided with advanced notification of relevant project schedules, construction works and changes to access arrangements.	✓	✓

17.5.3 Consideration of the interaction between measures

Mitigation measures to manage the potential for air quality, noise, dust, socio-economic, waste, and health and safety impacts would also assist in minimising the potential for land use and property impacts in relation to any amenity impact on properties.

17.5.4 Managing residual impacts

Due to the limited changes in land use and the majority of the works being positioned within the existing rail corridor, any residual land use impacts are considered minimal.

18. LANDSCAPE AND VISUAL

This chapter provides a summary of the landscape character and visual impact assessment undertaken by IRIS Visual Planning + Design. The full assessment is provided as *Technical Report 11 – Landscape and Visual Impact Assessment*.

18.1 Assessment approach

A summary of the approach to the assessment is provided in this section, including the legislation, guidelines and policies guiding the approach and the methodology used to undertake the assessment.

18.1.1 Legislative and policy context to the assessment

The assessment was undertaken with reference to the requirements summarised below.

Better Placed, Office of the NSW State Government Architect

The Office of the NSW State Government Architect has prepared a suite of documents under the title, 'Better Placed' that aim to improve the urban design quality of places in NSW. These documents include:

- *Better Placed: An integrated design policy for the built environment of NSW, State Government Architect NSW* (2018a)
- *Better Placed: Draft Good Urban Design Strategies for realising Better Placed objectives in the design of the built environment, State Government Architect NSW* (2018a)
- *Better Methods: Evaluating Good Design, Implementing Better Placed design objectives into projects* (2018c).

These documents are intended to inform those involved in the design, planning, and development of the built environment in NSW. The overriding policy establishes the objectives and expectations in relation to design and creating good places.

Botany Bay Local Environmental Plan, 2013

This Plan (City of Botany Bay 2013a) aims to make local environmental planning provisions for land in the City of Botany Bay LGA. Relevant aims include:

"(d) to identify and conserve those items and localities that contribute to the local built form and the environmental and cultural heritage of Botany Bay,
(e) to protect and enhance the natural and cultural landscapes in Botany Bay,
(f) to create a highly liveable urban place through the promotion of design excellence in all elements of the built environment and public domain,
(g) to protect residential amenity. (clause 1.2.2)".

Botany Bay Development Control Plan, 2013

The DCP (City of Botany Bay 2013b) aims to guide future development within the Bayside Council LGA.

The objectives of this DCP include several references to amenity, liveability and public domain quality, including:

- *"to create a highly liveable urban place, through promotion of design excellence in all elements of the built environment and public domain*
- *to minimise negative impacts of development on the amenity of adjoining properties, in particular to reduce the land use conflict between residential and non-residential uses*
- *to ensure that new development protects and enhances the public domain".*

The DCP identifies nine character precincts in the council area. The Botany Line traverses three of these character precincts, which are: Mascot, Botany and Pagewood.

EIA-N04 Guidelines for Landscape Character and Visual Impact Assessment, NSW State Government, Roads and Maritime Services (2018)

This guideline includes a detailed methodology for landscape character and visual impact assessment of road infrastructure projects. The methodology used for the assessment was based generally upon the principles contained in this guideline.

The Guidance Note for Landscape and Visual Assessment (GNLVA), Australian Institute of Landscape Architects Queensland (2018)

This industry document offers guidance including definitions of key terms used for landscape and visual assessment. This document has been used to provide general principles and guidance for the scoping element of the landscape character and visual assessment.

Other guidance

The following guidelines provide useful definitions and design standards with regard to visual impact at night:

- *AS4282 Control of the obtrusive effects of outdoor lighting, Standards Australia* (1997)
- *Guidance for the reduction of obtrusive light, Institution of Lighting Engineers* (UK) (2011).

18.1.2 Methodology

Key tasks

The landscape and visual impact assessment included the following key tasks:

- identification of the existing visual environment, including identification of landscape character areas and the sensitivity of key receptors. A site inspection was completed to select viewpoints and take photographs
- an assessment of the impact on landscape character during construction and operation
- an assessment of the daytime visual impact during construction and operation
- an assessment of night time visual impact during construction and operation (including light spill)
- identification of mitigation measures.

Landscape character impact assessment

Landscape character in the urban context refers to the overall character and function of a place. It includes all elements within the public realm and the interrelationship between these elements and the people who use it.

Landscape character can be directly or indirectly impacted by a project. To address these impacts, an assessment was carried out by identifying the landscape character, the sensitivity of the character area and the likely magnitude of change expected as a result of the project (ie the visual modification). An overall assessment of the level of impact was then made based on the sensitivity and modification levels based on the assessment matrix shown in Table 18.1.

Landscape sensitivity refers to the value placed on a landscape and the level of service it provides to the community. The landscape sensitivity criteria were defined as follows:

- **National** – Precinct containing a landscape feature protected with national or international legislation.
- **State** – Precinct containing a landscape feature or urban place that is heavily used or is iconic to the State.
- **Regional –** Precinct containing a landscape feature or urban place that is heavily used and valued by residents of a major portion of a city or a non-metropolitan region.
- **Local** – Precinct containing a landscape feature or urban place valued and experienced by concentrations of residents or local recreational users, or providing a considerable service to the community.
- **Neighbourhood** – Precinct containing a landscape feature valued and appreciated primarily by a small number of residents or providing a noticeable service to the community.

Landscape modification refers to the change to the landscape character that would occur as a result of the project. The landscape modification criteria were defined as follows:

- **Considerable reduction or improvement** – Substantial portion of the landscape is changed.
- **Noticeable reduction or improvement** – A portion of the landscape is changed.
- **No perceived reduction or improvement** – Either the landscape quality is unchanged or, if it is, it is largely mitigated by proposed public realm improvements.

Visual impact assessment

Visual impact assessment considers visual amenity as experienced by the users of the study area. It aims to identify the range of views to the site which may be impacted, including views from residential areas, commercial areas, parks and streets.

An assessment was carried out identifying visual receivers, the sensitivity of the receivers and the likely visual modification expected as a result of the project. An overall assessment of the level of impact was then made based on the sensitivity and modification levels contained in the assessment matrix shown in Table 18.1.

Sensitivity criteria for visual receivers were defined as follows:

- **National** – Heavily experienced view to a national icon.
- **State** – Heavily experienced view to a feature or landscape that is iconic to the State.
- **Regional –** Heavily experienced view to a feature or landscape that is iconic to a major portion of a city or a non-metropolitan region, or an important view from an area of regional open space.
- **Local** – High quality view experienced by concentrations of residents, local recreational users, local commercial areas or large numbers of road or rail users.
- **Neighbourhood** – Views where visual amenity is not particularly valued by the wider community. This would include views from private residences and local streets.

Visual modification describes the extent of change resulting from the project and the visual compatibility of these new elements with the surrounding landscape. The criteria for visual modification were defined as follows:

- **Considerable reduction or improvement** – Substantial part of the view is altered.
- **Noticeable reduction or improvement** – Alteration to the view is clearly visible.
- **No perceived reduction or improvement** – Either the view is unchanged or, if it is, the change in the view is generally unlikely to be perceived by viewers.

The assessment matrix for landscape and visual impact levels is shown in Table 18.1.

Table 18.1 Landscape and visual impact levels

		SENSITIVITY LEVEL				
		National	**State**	**Regional**	**Local**	**Neighbourhood**
MODIFICATION LEVEL	**Considerable reduction**	Very high adverse	Very high adverse	High adverse	Moderate adverse	Minor adverse
	Noticeable reduction	Very high adverse	High adverse	Moderate adverse	Minor adverse	Negligible
	No perceived change	Negligible	Negligible	Negligible	Negligible	Negligible
	Noticeable improvement	Very high beneficial	High beneficial	Moderate beneficial	Minor beneficial	Negligible
	Considerable improvement	Very high beneficial	Very high beneficial	High beneficial	Moderate beneficial	Minor beneficial

The assessment of night time impact also considered the *Guidance for the reduction of obtrusive light, Institution of Lighting Engineers (UK)* (2011), as well as *AS4282 Control of the obtrusive effects of outdoor lighting*, Standards Australia (1997).

Study area

The study area for the landscape character and visual impact assessment is the potential visual catchment of the project, extending generally from areas along the existing Botany Line from Mascot in the northwest, to Botany and Pagewood in the southeast. The study area is shown on Figure 18.1.

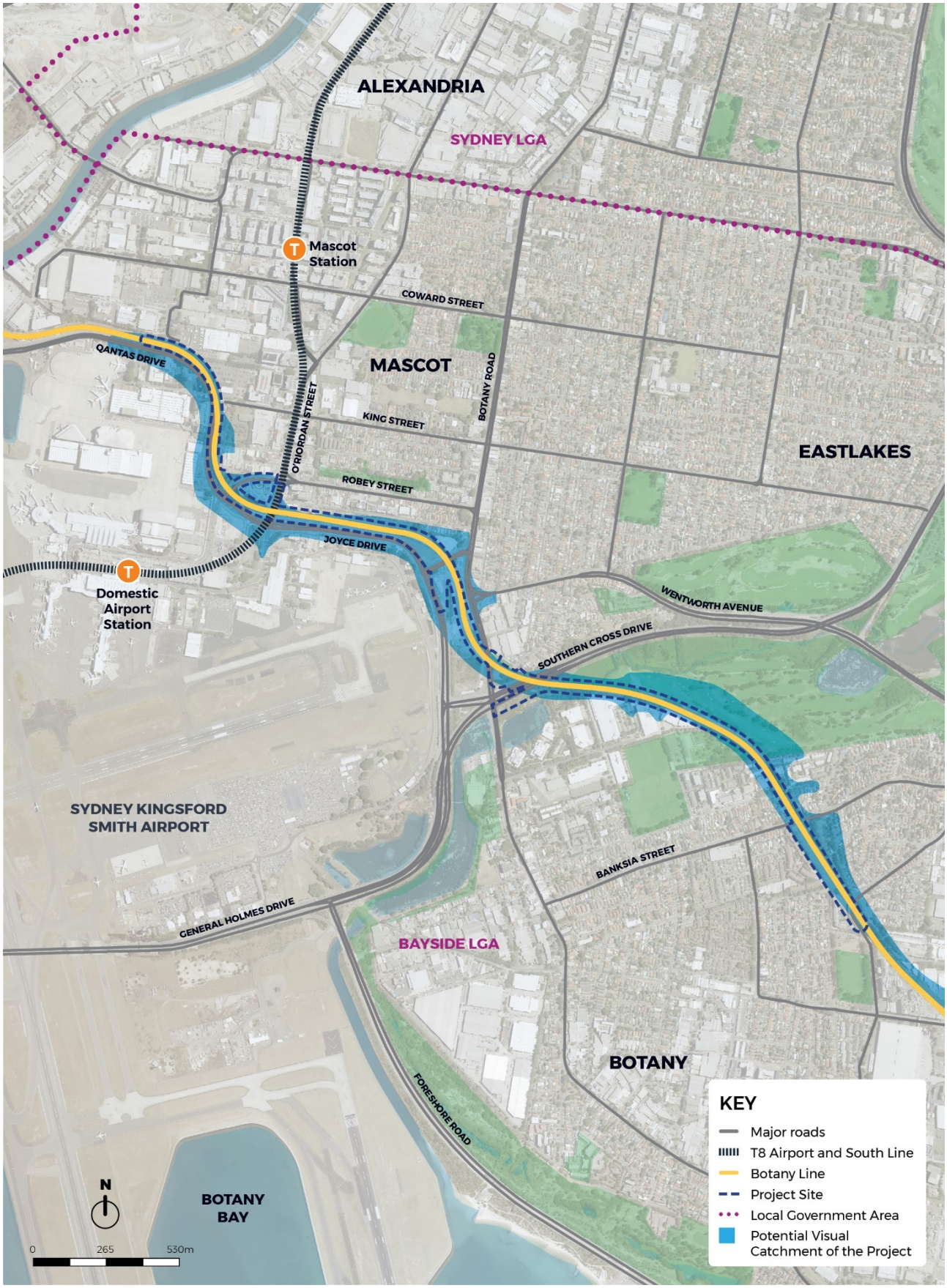


Figure 18.1 Landscape character and visual impact assessment study area

18.1.3 Risks identified

The preliminary environmental risk assessment undertaken for the project (provided in Appendix B) included potential risks associated with landscape character and existing views. Potential risks were considered according to the impacts that may be generated by the construction or operation of the project. The likelihood, consequence and overall risk level of each potential risk were assessed, with avoidance and management measures defined for each potential risk. Further information on the risk assessment, including the approach, methodology and the full results, is provided in Appendix B.

Prior to assessment and identification of mitigation measures, risks with an assessed level of medium or above include:

- visual impacts on nearby residents and business owners due to the presence of construction compounds and work areas
- light impacts from out-of-hours work during construction
- adverse impacts on landscape character during construction
- impacts on visual amenity due to the introduction of built elements, including new bridges and embankments, and the removal of vegetation which currently provides some screening.

These potential risks and impacts were considered as part of the assessment. The assessment also considered matters identified by the SEARs and stakeholders (as described in Chapters 3 and 4). The residual risk levels, following implementation of the mitigation measures proposed in this EIS, are discussed in section 18.6.4.

18.1.4 How potential impacts have been avoided or minimised

As described in Chapters 6 and 7, design development and construction planning for the project has included a focus on avoiding or minimising the potential for environmental impacts during all key phases of the process. This included:

- the location of construction compounds and other construction areas to avoid impacts on areas of sensitive landscape character and visual amenity. Where possible, these areas have been positioned to avoid trees and within previously disturbed areas
- where construction compounds and other construction areas have been identified outside the rail corridor, these sites have been selected to be positioned within public land wherever possible or areas which have previously been disturbed and therefore are locations with less sensitive landscape character and visual amenity
- the construction methodology for the project, in combination with the rail alignment for the project, seeks to minimise impacts on existing billboards during construction.

18.2 Existing environment

The project passes through the Bayside LGA between Sydney Airport in the northwest and Botany Bay in the southeast. The Botany Line travels through the mixed-use suburbs of Mascot and Botany with industrial, commercial and residential uses and the mainly residential suburb of Pagewood.

The landscape character and visual environment of the study area is characterised by its highly developed urban nature. The landscape is dominated by Sydney Airport and its facilities, which include large expanses of open and paved areas (the runways and surrounding land), roads, large terminal and freight facilities, and various other buildings and infrastructure. The airport is highly visible from numerous viewpoints in the study area.

The rail corridor, along with the existing motorways, creates strong dividing lines through the area, physically and visually separating the airport from the medium to high density hotel and commercial precinct of Mascot.

As the Botany Line crosses over Southern Cross Drive (M1 motorway) into Botany, it interfaces with the Eastlake golf course to the north and industrial uses to the south. The rail line passes residential areas south of Myrtle Street to Botany.

The project site is predominantly located within and adjacent to the existing rail corridor and views to the site are limited.

18.2.1 Landscape character precincts

Several landscape character precincts were identified for the Botany Bay area in the *Botany Bay Development Control Plan 2013* (City of Botany Bay 2013b). These were adopted as the landscape character areas for the assessment as they accurately reflect the different landscape characteristics of the study area. The precincts are:

- Mascot character precinct
- Botany character precinct
- Pagewood character precinct.

These character precincts are discussed further in this section and their locations are shown on Figure 18.2.

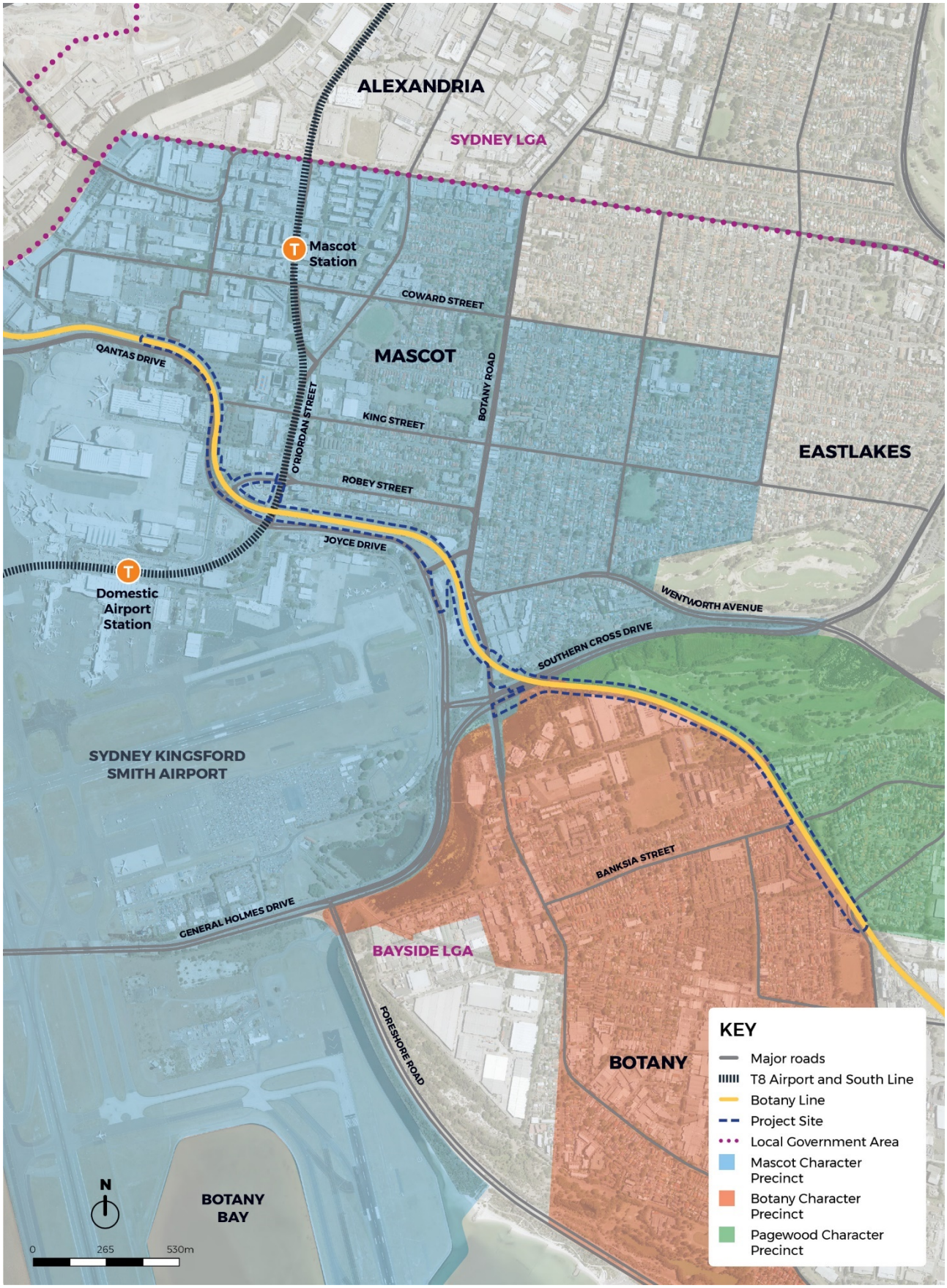


Figure 18.2 Location of project and character precincts

Mascot character precinct

This precinct includes Sydney Airport and nearby commercial, light industrial and retail development associated with the airport. It extends to the north of Southern Cross Drive across an area of detached and semi-detached single storey dwellings set among high-rise airport-related developments, including hotels and multi-storey car parks and office buildings. O'Riordan Street, Robey Street and Botany Road include shops, cafes and restaurants. There are also offices located along main routes leading to the airport.

Corridors of mature trees are positioned along and adjacent to the existing rail corridor, including between O'Riordan Street and Robey Street and along Qantas Drive. These trees provide a visual separation between the airport and adjacent residential, commercial and retail development. They also provide amenity within this otherwise densely urban landscape.

The existing rail corridor consists of a single track on an embankment. There are a mix of bridges and level crossings at road intersections. The O'Riordan Street, Robey Street and Botany Road underbridges are listed on the Transport for NSW S170 Heritage Register, providing visual reminders of early welding techniques for steel bridge and reinforced concrete construction. These bridges are considered to have aesthetic significance. However, a substantial part of the fabric of these bridges has been covered by advertising signage, reducing their aesthetic quality.

This character area is dominated by vehicles resulting in low street tree cover, disjointed footpaths with broad signalised pedestrian crossings. Construction works currently underway have diverted footpaths in several locations in the vicinity of O'Riordan Street, reducing legibility and comfort for pedestrians. The scale of the airport and associated facilities, mix of uses in this precinct and existing character of large-scale linear infrastructure create a relatively high visual absorption capacity (the potential for a landscape or scene to absorb a particular change without a noticeable loss of valued attributes).

Botany character precinct

The Botany Wetlands and Water Reserves landscape is listed on the State Heritage Register and consists of a series of interconnected open freshwater ponds, former water supply dams, some shallow swamp areas and adjacent lands used for recreation (golf). The wetlands, including distinctive freshwater wetlands and Banksia scrub, are an integral part of this precinct and have special interest as a landmark cultural and recreational landscape for the regional community. This reserve represents a substantial tract of greenspace with important landscape attributes including extensive areas of water, wetlands, plantings, archaeological features, dunes, remnant indigenous vegetation and fauna – providing notable scenery.

Much of the wetlands landscape in this precinct is inaccessible for public recreation. The vegetation in and adjacent to the wetlands largely encloses views and provides a visual buffer between the project and adjacent industrial, commercial and residential uses, particularly at Mill Pond. The project site passes through the wetlands and Mill Stream via a bridge, consisting of a single-track concrete bridge with three-spans of rail planks.

South of the wetlands, there is a mixture of land uses. This includes light industry along Lord Street, an Aquatic Centre along Myrtle Street and medium density residential precincts along the railway line between Myrtle Street and Bay Street, and between Banksia and Morgan streets. The heritage listed Booralee Park is a focal point for a precinct of low density residential development south and east of Bay Street.

Low density residential properties along Ellis Street are located opposite the rail corridor. A footbridge, with stairs and large ramping structures, provides a connection to Banksia Street and areas to the north.

Publicly accessible areas of the Botany character area are dominated by large roads with low street tree cover, disjointed footpaths with broad signalised pedestrian crossings. The existing rail corridor forms a strong north and eastern border to this precinct. The presence of the existing freight rail corridor and the mix of existing uses increases the absorption capacity of this landscape to accommodate development.

Pagewood character precinct

This precinct is predominantly low density residential development, extending northeast from the Botany Line. This includes mainly one and two storey detached dwellings of varying architectural styles and periods. There are several low–medium rise apartment blocks and townhouse developments along Myrtle and Bay streets, adjacent to the rail corridor. Those along Myrtle Street overlook Eastlake golf course.

The precinct contains a large area of open space, including Eastlake golf course, Botany Wetlands and water reserves and Gaiarine Gardens. The Botany Line is located along the south and eastern boundary of the precinct. The rail corridor forms a strong visual edge to this precinct, which is otherwise relatively coherent in its residential character with leafy gardens and parkland. The absorption capacity of this landscape to accommodate development is lessened by the finer grained development and consistency of built form type.

18.2.2 Existing views

The following viewing locations were selected as representative of the range of views to the project (see Figure 18.3 for viewpoint locations). They include views to represent groups of receivers including adjacent residents and users of hotels, parks, footpaths and roads.

Representative viewpoints:

1. View north across the intersection of Joyce Drive and O'Riordan Street intersection
2. View south along Robey Street
3. View south along O'Riordan street
4. View from upper café level of the Citadines Connect Sydney Airport Hotel
5. View southwest from Baxter Road
6. View along Myrtle Street (east of track)
7. View along Myrtle Street (west of track)
8. View along Bay Street (east of track)
9. View east from Ellis Street
10. View south from Banksia Street footbridge
11. View west from Gaiarine Gardens
12. View west from Ocean Street.

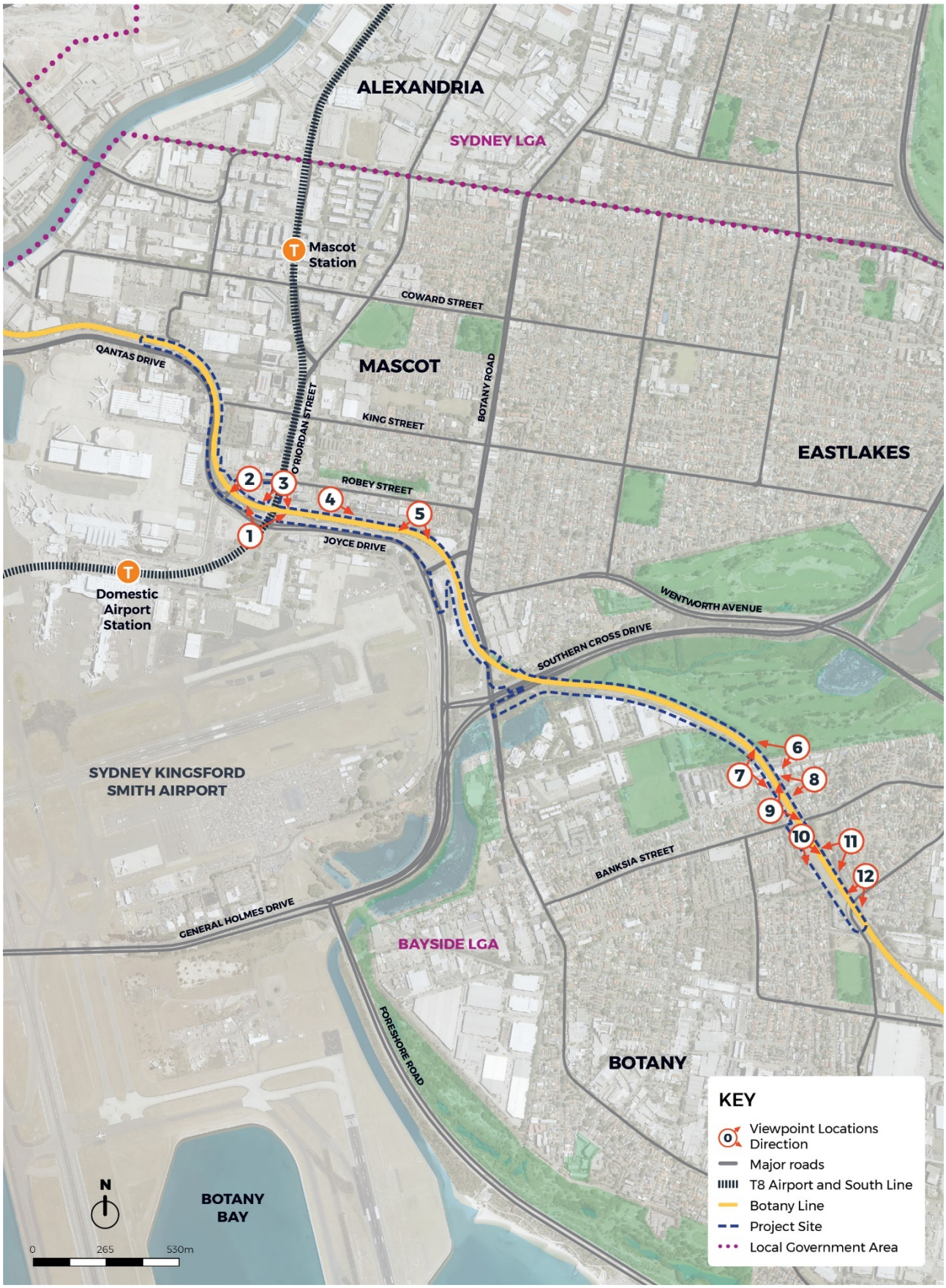


Figure 18.3 Viewpoint location plan

18.2.3 Visual conditions at night

Existing night time conditions can be described using the environmental zones identified in *Guidance for the reduction of obtrusive light* (Institution of Lighting Engineers UK, 2011), which are:

- E0: Protected dark landscapes
- E1: Intrinsically dark landscapes
- E2: Low district brightness areas
- E3: Medium district brightness areas
- E4: High district brightness areas.

The existing visual night time conditions of the character precincts for the project are discussed below.

Mascot character precinct

This precinct is an area of E4: High district brightness due to the concentration of lighting at Sydney Airport and adjacent brightly lit commercial, light industrial and retail buildings within Mascot. The major roads of Botany Road, Joyce and Qantas Drives, and O'Riordan Street are brightly lit with streetlights, billboard lighting and vehicle headlights all contributing to the dynamic night time scene. There would also be train headlights from existing freight train movements along the Botany Line.

Botany character precinct

This precinct is an area of E3: Medium district brightness, where there is a lower level of lighting associated with the predominantly low and medium rise residential development in Botany. The headlights of trains passing along the existing Botany Line would increase the night time brightness of areas in close proximity to the rail corridor. This precinct also includes light industrial and commercial uses at Lord and Bay Streets, and the Botany Aquatic Centre beside the Botany Line, which would be brightly lit at night. However, the northern part of this precinct at Mill Stream and the golf course would be predominantly dark at night. The street lighting and vehicle headlights from adjacent roads (Southern Cross Drive and Botany Road) would spill into these open space areas.

Pagewood character precinct

This precinct is an area of E3: Medium district brightness, it is located to the east of the existing Botany Line, including the Eastlake golf course and low and medium rise residential buildings at Pagewood. Streetlights within the residential areas and the train headlights along the existing Botany Line would further add to the night scene. Mature vegetation along the edge of the rail corridor would assist with reducing the light spill to adjacent residential areas. The lighting from residential areas contrasts with the low-lit natural area along Mill Stream and adjacent golf course, in the northern part of the precinct.

18.3 Assessment of construction impacts

A number of early and enabling works would be required to be undertaken prior to the main civil and track work. The enabling works relevant to landscape and visual impacts are:

- construction works related to track realignment/slewing track, utility service relocation and protection compound site set up
- temporary removal of billboards
- vegetation removal along and adjacent to the existing rail corridor through Mascot and Botany.

The construction works relevant to landscape character and visual impact are:

- construction of the new and upgraded track, drainage and signalling
- demolition and construction of new bridges and retaining walls
- reinstatement of billboards and signage infrastructure.

18.3.1 Landscape impact

Table 18.2 provides a summary of the assessment of landscape impacts of each character precinct during construction.

This shows that due to the scale of work within the Mascot character precinct and its sensitivity, there would be a moderate adverse landscape character impact during construction and there would be minor adverse landscape character impacts in the Botany and Pagewood character precincts.

Table 18.2 Summary assessment of landscape impacts during construction

CHARACTER PRECINCT	SENSITIVITY	MAGNITUDE	IMPACT	COMMENTS
Mascot character precinct	Regional	Noticeable reduction	Moderate adverse	Construction works within the Mascot character precinct, includes widening of the rail corridor, installation of retaining walls and new track, several bridge replacements, the removal of trees along the southern side of the rail corridor, and the location of site compounds and material storage areas at prominent intersections. Overall, the level of modification would result in a noticeable reduction in the landscape quality of this precinct during construction. While this precinct has a relatively high visual absorption capacity, the character of the construction works would reduce the quality of the landscape particularly where the trees are removed, and new bridges constructed. As this is a landscape of regional sensitivity, this would result in a **moderate adverse landscape** impact during construction.

CHARACTER PRECINCT	SENSITIVITY	MAGNITUDE	IMPACT	COMMENTS
Botany character precinct	Local	Noticeable reduction	Minor adverse	Construction activities within this precinct would be generally located within and adjacent to the existing rail corridor. It would include removal of vegetation, widening of earth embankments, construction of retaining walls and establishment of site compounds, material storage areas and site compounds. The scale of work would be greater in the vicinity of the urban road corridors of Botany Road and Southern Cross Drive, where it is compatible with the scale of the urban road corridors. Works to construct the Mill Stream bridge would be visually contained by the surrounding open space and vegetation, as would the works along the rail corridor in the vicinity of the industrial areas of Botany around Lord Street. It is expected that there would be a noticeable reduction in the character of this precinct during construction. As this precinct is of local sensitivity, this would result in a **minor adverse landscape impact** during construction.
Pagewood character precinct	Neighbourhood	Considerable reduction	Minor adverse	Works within this precinct includes installation of an access track, removal of a small amount of vegetation and establishment of a material storage and laydown area. It is expected that there would be a considerable reduction in the landscape character of the southern edge of this precinct due to the introduction of construction activities in close proximity to neighbouring properties. As this precinct is of neighbourhood sensitivity, there would be a **minor adverse landscape impact** during construction.

18.3.2 Visual impact

Table 18.3 provides a summary of the assessment of visual impacts at each representative viewpoint during construction.

This indicates that during construction there would be a moderate adverse impact in views in the vicinity of the airport including from the Joyce Drive and O'Riordan Street intersection, Robey Street and O'Riordan Street. This is due to the removal of trees, and the scale of works required for bridgeworks, retaining walls and embankment construction occurring on the south and west of the existing rail corridor. In these locations construction activity and site compounds would comprise a large portion of these views.

In views generally from Botany Road east to the residential areas of Botany, there would be minor adverse visual impacts during construction. This includes views from adjacent roads, residential and recreation areas. In these areas the works would be of a smaller scale and contained within the rail corridor. There would also be more vegetation retained along the interface with the open space areas.

Table 18.3 Summary assessment of visual impacts during construction

VIEWPOINT	SENSITIVITY	MAGNITUDE	IMPACT	COMMENTS
Viewpoint 1: View north across the Joyce Drive and O'Riordan Street intersection 	Regional	Noticeable reduction	Moderate adverse	Construction activity would extend across much of this view. This would include establishment of the construction work area (including site fencing and hoarding), construction compound, removal of existing billboards, installation of a concrete retaining wall and removal of some trees along the rail corridor in this vicinity. After the bridge, tracks, retaining walls and signalling have been installed, finishing works would be visible. Due to the absorption capacity of this urban landscape, the project would create a noticeable reduction in the amenity of this view, which is of regional sensitivity, resulting in a **moderate adverse visual impact** during construction.
Viewpoint 2: View south along Robey Street 	Local	Considerable reduction	Moderate adverse	Construction activity such as establishment of the construction work area (including site fencing and hoarding) and removal of some trees and vegetation alongside the Stamford Hotel would be visible in this view. Other modifications would include a new access gate alongside the southern bridge abutment and demolition of the Robey Street bridge. Construction of the proposed twin single span concrete bridge would also be seen, along with retaining walls. After the bridge, tracks, retaining walls and signalling have been installed, finishing works would be visible. Due to the scale of the works, removal of trees and the close proximity to the adjacent commercial and retail areas of Mascot, there would be a considerable reduction in the amenity of this view. As this is a view of local sensitivity, this would result in a **moderate adverse visual impact** during construction.

VIEWPOINT	SENSITIVITY	MAGNITUDE	IMPACT	COMMENTS
Viewpoint 3: View south along O'Riordan Street 	Local	Considerable reduction	Moderate adverse	Construction activity such as establishment of the construction work area (including site fencing and hoarding) and removal of billboard signs which would be seen in this view. Other modifications would include demolition of the O'Riordan Street bridge and replacement with a twin single span concrete bridge. After completion of the bridges, tracks and signalling would be installed, and the finishing works, including works to rectify the adjacent roads, foot and cycle paths would be visible. The works would introduce a construction character that would extend across much of this view. Overall this change would create a considerable reduction in the amenity of this view, which is of local sensitivity, resulting in a **moderate adverse visual impact** during construction.
Viewpoint 4: View from upper café level of the Citadines Connect Sydney Airport Hotel 	Neighbourhood	Noticeable reduction	Negligible	The construction activity would be seen in the background of views from the hotels to the north of the rail corridor such as the Citadines Connect Sydney Airport Hotel. The existing trees along the southern side of the rail corridor would be removed during enabling works. The billboard extending over the rail corridor would, be retained. This construction activity would be seen from the upper level café and hotel rooms facing the rail corridor. Overall, this change would create a noticeable reduction in the amenity of this view, which is of neighbourhood sensitivity, resulting in a **negligible visual impact** during construction.

VIEWPOINT	SENSITIVITY	MAGNITUDE	IMPACT	COMMENTS
Viewpoint 5: View southwest from Baxter Road 	Neighbourhood	Noticeable reduction	Negligible	Construction activity would be visible in the middle to background of this view, including fencing and hoarding and the associated removal of some vegetation along the existing rail embankment. Works to construct embankments to widen the rail corridor and install the new track would be visible through the existing foreground elements. This activity would be seen from the road corridor, footpaths and from adjacent south facing rooms from adjacent residences, offices and hotel rooms. Overall, this change would create a noticeable reduction in the amenity of this view, which is of neighbourhood sensitivity, resulting in a **negligible visual impact** during construction.
Viewpoint 6: View along Myrtle Street (east of track) 	Neighbourhood	Considerable reduction	Minor adverse	Construction activity such as establishment of the construction work area (including site fencing and hoarding) would be visible at the end of Myrtle Street. Other modification would include installation of a material storage and laydown area within the rail corridor north of Myrtle Street, trimming of vegetation which overhangs the rail corridor in this section of the project site and installation of a new access road alongside the golf course. Construction of the rail corridor embankments to widen and install the new track would occur on the western side of the rail corridor. Overall this construction activity would create a considerable reduction in the amenity of this view, which is of neighbourhood sensitivity, resulting in a **minor adverse visual impact** during construction.

VIEWPOINT	SENSITIVITY	MAGNITUDE	IMPACT	COMMENTS
Viewpoint 7: View along Myrtle Street (west of track) 	Neighbourhood	Considerable reduction	Minor adverse	Construction activity such as establishment of the construction work area (including site fencing and hoarding) would be visible at the end of Myrtle Street. A new access gate would be installed at the end of Myrtle Street and vehicles, machinery and plant would be seen accessing the site, and within the work area undertaking construction activities to widen the existing embankment to the west (towards Myrtle Street) and install the new track. Overall this construction activity would create a considerable reduction in the amenity of this view of adjacent residences, which is of neighbourhood sensitivity, resulting in a **minor adverse visual impact** during construction.
Viewpoint 8: View along Bay Street (east of track) 	Neighbourhood	Considerable reduction	Minor adverse	Construction activity such as establishment of the construction work area (including site fencing and hoarding) would be seen at the end of Bay Street, in the middle ground of the view. Some construction vehicles would be seen entering the project site in this view. Earthworks and vegetation clearing to widen the rail embankment and install a new access road would be seen in close proximity from rooms and balconies at the second and third level of properties adjacent to the rail corridor. Overall this construction activity would create a considerable reduction in the amenity of this view, which is of neighbourhood sensitivity, resulting in a **minor adverse visual impact** during construction.

VIEWPOINT	SENSITIVITY	MAGNITUDE	IMPACT	COMMENTS
Viewpoint 9: View east from Ellis Street 	Neighbourhood	Considerable reduction	Minor adverse	Construction activity including heavy vehicles, machinery and plant travelling along Ellis Street, entering the work area and within the rail corridor would be visible from this view. Construction activity visible in this area would also include earthworks and clearing of vegetation to widen the rail embankment and install the new track and construction of access roads on both sides of the track. Traffic management controls would be seen along Ellis Street, and may include temporary lane closure. Overall, this construction activity would create a considerable reduction in the amenity of this view, which is of neighbourhood sensitivity, resulting in a **minor adverse visual impact** during construction.
Viewpoint 10: View south from Banksia Street footbridge 	Neighbourhood	Considerable reduction	Minor adverse	Construction activity within the rail corridor, including fencing, hoarding and a storage and compound area, would be seen in this view. The storage and compound area would extend approximately 200 metres along the western side of the rail corridor towards the Stephen Road overbridge. Construction of the new track would also be visible, merging into the existing track, to the east. Installation of a new access track would also be seen to the west of the track, in a U-turn formation towards the main site access gate at the corner of Banksia and Ellis Street. The vegetation alongside the track perimeter would be retained and filter views from adjacent properties, including the residences between Banksia and Morgan Streets and visitors to Gaiarine Gardens. Overall, this construction activity would create a considerable reduction in the amenity of this view, which is of neighbourhood sensitivity, resulting in a **minor adverse visual impact** during construction.

VIEWPOINT	SENSITIVITY	MAGNITUDE	IMPACT	COMMENTS
Viewpoint 11: View west from Gaiarine Gardens 	Local	Noticeable reduction	Minor adverse	The existing rail corridor would be partly converted to a work area and would be seen in the background of this view. Site fencing and hoarding would be visible along the site perimeter. A storage and compound area would extend approximately 200 metres along the western side of the rail corridor. The vegetation along the rail corridor boundary and within the park would be retained and would continue to filter views to the rail corridor. However, due to the close proximity of construction activity, there would be a noticeable reduction in the amenity of this view, which is of local sensitivity, and a **minor adverse visual impact** during construction.
Viewpoint 12: View west from Ocean Street 	Neighbourhood	Noticeable reduction	Negligible	Construction activity at the western side of the Botany Line would be visible in the middle to background of the view. This would include a major compound and materials storage area with site offices and staff parking, internal access road, storage of construction equipment and stockpiles. Vegetation along the edge of the rail corridor, in the foreground of this view, would be retained and filter views to the compound in the background. Overall, this construction activity would create a noticeable reduction in the amenity of this view, which is of neighbourhood sensitivity, resulting in a **negligible visual impact** during construction.

18.3.3 Visual impact at night

Table 18.4 provides a summary of the assessment of night time visual impacts during construction.

This indicates that at night there would be a negligible visual impact on views to the site from within the Mascot character precinct. Although there would be night works undertaken for bridge and road works, the setting is brightly lit and there would be a high capacity for this work to be absorbed. There would, however, be a minor adverse visual impact on the Botany and Pagewood landscape character precincts during night works. This is due to a greater contrast between the existing night setting and the potential lighting of the night works.

Table 18.4 Summary assessment of night time visual impacts during construction

CHARACTER PRECINCT	SENSITIVITY	MAGNITUDE	IMPACT	COMMENTS
Mascot character precinct	High district brightness (E4)	Noticeable reduction	Negligible	There would be lighting visible above the hoardings surrounding the construction work areas and site compound. This lighting would be seen from adjacent streets, residential and commercial areas as well as hotels that have elevated views over the work area. The brightly lit areas of Botany Road, Joyce and Qantas Drives, and O'Riordan Street, would assist in the absorption of the lighting. Overall, the works would result in a noticeable change to the surrounding night scene. As this precinct is of high district brightness environment, the proposed lighting would result in a **negligible visual impact** at night.
Botany character precinct	Medium district brightness (E3)	Noticeable reduction	Minor adverse	There would be some lighting above the work area and compound between Banksia Street and the Stephen Road overbridge which is likely to be seen from Myrtle and Ellis streets, and from the adjacent commercial and residential buildings to the west of the Botany Line. This lighting may also be seen from the upper levels of adjacent buildings and residences between the Banksia Street and the Stephen Road overbridge. There would also be 24-hour deliveries of large equipment, accompanied by traffic control crews with lighting. Overall, the works would result in a noticeable change to the amenity of the views at night in the vicinity to the Botany Line. As this precinct is of medium district brightness environment, the proposed lighting would result in a **minor adverse visual impact** at night.

CHARACTER PRECINCT	SENSITIVITY	MAGNITUDE	IMPACT	COMMENTS
Pagewood character precinct	Medium district brightness (E3)	Noticeable reduction	Minor adverse	Some lighting would be visible above the hoardings and fencing surrounding the construction work area and compound between Banksia Street and the Stephen Road overbridge. However, the upper levels of adjacent residential buildings to the east of the Botany Line may have elevated views over the work area and compound. Overall, there would be a noticeable reduction in the amenity of views from areas adjacent to the site. As this precinct is of medium district brightness environment, the proposed lighting would result in a **minor adverse visual impact** at night.

18.4 Assessment of operational impacts

The main sources of landscape character and visual impact during operation would be:

- wider rail corridor including new rail infrastructure
- additional train movements
- service roads and access.

18.4.1 Landscape impact

Table 18.5 provides a summary of the assessment of landscape impacts of each character precinct during operation.

This shows that the Mascot character precinct would have a moderate adverse landscape impact. This precinct is important to the region as an entry to Sydney and to the airport, and therefore has a higher landscape character sensitivity. The loss of vegetation along the rail corridor, which contributes to the character of the arrival experience, would adversely impact the character of this precinct. The Botany character precinct would have a minor adverse impact on landscape character due to the close proximity of new structures to residential areas and loss of vegetation in the Botany Wetlands.

The project would be more readily absorbed into the Pagewood character precinct, as widening of the existing rail corridor in this precinct would represent an incremental increase in change from the existing character.

Table 18.5 Summary assessment of landscape impacts during operation

CHARACTER PRECINCT	SENSITIVITY	MAGNITUDE	IMPACT	COMMENTS
Mascot character precinct	Regional	Noticeable reduction	Moderate adverse	The project would be located within an area with a strong character of linear infrastructure associated with the existing rail corridor, Qantas and Joyce Drive. The existing mature vegetation would be replaced by a retaining wall and new access gate and the visual influence of the freight rail on the character of this precinct would be slightly increased in this area. Overall, it is expected that there would be a noticeable reduction in the landscape character of this precinct, which is a landscape of regional sensitivity, resulting in a **moderate adverse landscape impact** during operation.

CHARACTER PRECINCT	SENSITIVITY	MAGNITUDE	IMPACT	COMMENTS
Botany character precinct	Local	Noticeable reduction	Minor adverse	The project would generally be built on the southern side of the existing rail corridor. The higher concentration of rail elements within the existing rail corridor would have a greater influence within the precinct, reinforcing the strong line of the rail corridor as a northern boundary to this precinct. The existing Mill Stream bridge would be retained and there would be a new bridge located alongside the existing bridge. Overall, it is expected that there would be a noticeable reduction in the character of this precinct during operation. As this is a landscape of local sensitivity, there would be a **minor adverse landscape impact** during operation.
Pagewood character precinct	Neighbourhood	Noticeable reduction	Negligible	Works include widening of the existing rail corridor and a new access track along the eastern side of the rail corridor. While being consistent with the existing rail corridor use, there would be an increase in the amount of freight activity within the existing rail corridor. The material storage and laydown area would be reinstated as rail reserve and cleared areas would be revegetated similar to the preconstruction environment. There would be an ongoing reduction in amenity due to the trees having been removed during construction to accommodate the works. Overall, it is expected that there would be a noticeable reduction in the landscape character of this precinct during operation. As this is a landscape of neighbourhood sensitivity, there would be a **negligible landscape impact** during operation.

18.4.2 Visual impact

Table 18.6 provides a summary of the assessment of visual impacts during operation.

This shows that during operation, the project would be largely absorbed into the character of views, due to the existing highly urban character of areas to the west of the site and the reinstatement of the billboards, which largely screen views the bridges at Robey Road and O'Riordan Street. This would result in negligible visual impacts in views to the site from adjacent residential areas, open space and roads. There would be a minor adverse visual impact from Robey Street due to the removal of both vegetation and the Robey Street underbridge.

Table 18.6 Summary assessment of visual impacts during operation

VIEWPOINT	SENSITIVITY	MAGNITUDE	IMPACT	COMMENTS
Viewpoint 1: View north across the Joyce Drive and O'Riordan Street intersection	Regional	No perceived change	Negligible	The proposed O'Riordan Street bridge would be seen in the middle ground of this view. It would be a twin single span concrete bridge with large concrete beams spanning across O'Riordan Street. The new structures would be similar in appearance to the existing bridge. Freight trains would be seen in this view, crossing the new twin bridges. There may be some limited trees and understorey streetscape planting reinstated along the verge of Qantas and Joyce Drive. The impacted billboards would be reinstated generally in the same location, where feasible, as they are currently located, situated to maximise views towards them. Overall, this change would result in no perceived change in the amenity of this view, which is of regional sensitivity, resulting in a **negligible visual impact** during operation.
Viewpoint 2: View south along Robey Street	Local	Noticeable reduction	Minor adverse	The proposed Robey Street bridge would be visible in the centre of this view, including two large precast concrete beams spanning across Robey Street with concrete headstocks and abutments. The new structures would be similar in scale and appearance to the existing bridge. Freight trains would be seen intermittently, travelling across the new twin bridges. Concrete retaining walls extending from the bridge abutments would be visible either side of the bridge. The new bridges would be more visually prominent in the view due to the additional width of two bridges which would be more visually heavy engineering style structures. New fencing would also be seen along the rail corridor, with new planting installed where feasible to visually integrate the retaining walls and embankments into the existing setting and screen views from adjacent commercial properties. The existing trees on the southern side of the track would continue to filter views to the airport at the background of the view. Overall, there would be a noticeable reduction in the amenity of this view which is of local sensitivity, resulting in a **minor adverse visual impact** during operation.

VIEWPOINT	SENSITIVITY	MAGNITUDE	IMPACT	COMMENTS
Viewpoint 3: View south along O'Riordan Street	Local	No perceived change	Negligible	The billboard would be reinstated on the proposed O'Riordan Street bridge subject to consultation with the owner. This billboard would be reinstated generally in the same location and replaced like for like. Although the O'Riordan Street bridge would be replaced, the works would be largely screened by the reinstated billboard and absorbed into this highly urban view. This would result in no perceived change in the amenity of this view, which is of local sensitivity, and a **negligible visual impact** during operation. If the billboards cannot be replaced on the bridge or in its immediate vicinity, it would be relocated along the existing rail corridor and combined with existing structures (such as bridges) where practicable in order to minimise the potential to introduce structures in areas where there are minimal existing structures and infrastructure. In this instance, the O'Riordan Street bridge would be visible from this location. However, due to the high visual absorption capacity of this urban view, which includes heavily trafficked roads and the existing rail corridor, this outcome would not reduce the amenity of this view. Therefore, there would be no perceived change in the amenity of the view, which is of local sensitivity, resulting in a **negligible visual impact** during operation.
Viewpoint 4: View from upper café level of the Citadines Connect Sydney Airport Hotel	Neighbourhood	Noticeable reduction	Negligible	Additional freight trains would be seen in the background of this view, travelling along the widened rail corridor. The existing vegetation would remain. The view to additional rail infrastructure would be seen at a distance and would be consistent in character with the existing rail corridor and freight train activity in the view. As only a relatively small area of this view would be modified, the works would be largely absorbed into this highly urban view. This would result in no perceived change in the amenity of this view which is of neighbourhood sensitivity, and a **negligible visual impact** during operation.

VIEWPOINT	SENSITIVITY	MAGNITUDE	IMPACT	COMMENTS
Viewpoint 5: View southwest from Baxter Road	Neighbourhood	Noticeable reduction	Negligible	The widened rail corridor on an embankment would be visible in the background of view, with trains seen travelling across the view and would be consistent in character with the existing rail corridor and freight train activity in the view. These elements would be closer to the viewer. There would also be unobstructed, elevated views over the rail corridor from the south-facing rooms and balconies of the medium rise hotel development in Baxter Road and would be consistent in character with the existing rail corridor and freight train activity in the view. Overall, this would result in a noticeable reduction in the amenity of this view, which is of local sensitivity, resulting in a **negligible visual impact** during operation.
Viewpoint 6: View along Myrtle Street (east of track)	Neighbourhood	Noticeable reduction	Negligible	Additional freight trains may be seen in the middle ground of this view, filtered through the existing vegetation. The materials storage and laydown area would be reinstated and revegetated. Overall this would result in a noticeable reduction in the amenity of this view, which is of neighbourhood sensitivity, resulting in a **negligible visual impact** during operation.
Viewpoint 7: View along Myrtle Street (west of track)	Neighbourhood	Noticeable reduction	Negligible	Additional freight trains may be seen in the middle ground of this view, filtered through the existing vegetation. The materials storage and laydown area would be reinstated and revegetated. Overall this would result in a noticeable reduction in the amenity of this view, which is of neighbourhood sensitivity, resulting in a **negligible visual impact** during operation.
Viewpoint 8: View along Bay Street (east of track)	Neighbourhood	Noticeable reduction	Negligible	The project would be visible from the rooms and balconies at the second and third level of properties adjacent to the rail corridor, with no vegetation filtering these views. There would be views across a wider rail embankment, with two tracks carrying additional trains. On balance, there would be a noticeable reduction to the amenity of this view, which is of neighbourhood sensitivity, resulting in a **negligible visual impact** during operation.
Viewpoint 9: View east from Ellis Street	Neighbourhood	Noticeable reduction	Negligible	There would be views across a wider rail embankment in the foreground of this view, with additional tracks and trains. The project would be visible from the street as well as the gardens, rooms and balconies at the first and second level of properties adjacent to the rail corridor. The rail corridor and trains would be closer to these residential properties, however, the existing vegetation would filter these views. Overall, there would be a noticeable reduction to the amenity of this view, which is of neighbourhood sensitivity, resulting in a **negligible visual impact** during operation.

VIEWPOINT	SENSITIVITY	MAGNITUDE	IMPACT	COMMENTS
Viewpoint 10: View south from Banksia Street footbridge	Neighbourhood	No perceived change	Negligible	The project would be seen in the centre of this view, merging with the existing track beside Gaiarine Gardens. A new access track would be seen to the west of the track (left of view), in a U-turn formation leading to the main site access gate at the corner of Banksia and Ellis Street (out of view). The remainder of the site compound and materials storage area would be reinstated as grassed rail verge. The vegetation along the rail corridor boundaries would be retained and continue to filter views from adjacent uses, including residences between Banksia and Morgan Streets (right of view) and visitors to Gaiarine Gardens (left of view). Although a wider rail corridor and more freight trains would be seen in this view, travelling along both tracks, there would be no perceived reduction to the amenity of this view. This is a view of neighbourhood sensitivity, resulting in a **negligible visual impact** during operation.
Viewpoint 11: View west from Gaiarine Gardens	Local	No perceived change	Negligible	The dense, mature vegetation at the boundary of the existing rail corridor and Gaiarine Gardens would continue to filter and screen views to the rail corridor. There would be glimpses to additional freight trains travelling along the Botany Line in the background of this view, beyond the vegetation. Overall, there would be no perceived reduction to the amenity of this view, which is of local sensitivity, resulting in a **negligible visual impact** during operation.
Viewpoint 12: View west from Ocean Street	Neighbourhood	No perceived change	Negligible	The compound to the west of the existing rail corridor would be reinstated, following the completion of construction. The additional track would not be visible from this location. Overall, there would be no perceived reduction to the amenity of this view. This is a view of neighbourhood sensitivity, resulting in a **negligible visual impact** during operation.

18.4.3 Visual impact at night

Table 18.7 provides a summary of the assessment of night time visual impacts during operation.

This indicates that during operation, the project would be largely absorbed into the character of views, due to the existing highly urban character of areas to the west of the site, and the reinstatement of the billboards, which would largely screen views of the proposed bridges at Robey Road and O'Riordan Street. This would result in negligible visual impacts in views to the site from adjacent residential areas, open space, roads. There would be a minor adverse visual impact from Robey Street due to the removal of both vegetation and the Robey Street underbridge.

Table 18.7 Summary assessment of night time visual impacts during operation

CHARACTER PRECINCT	SENSITIVITY	MAGNITUDE	IMPACT	COMMENTS
Mascot character precinct	High district brightness (E4)	Noticeable reduction	Negligible	The Mascot character area in the vicinity of the project site is well lit and there are existing trains with headlights moving along the existing rail corridor. However, the project would result in additional trains with vehicle headlights seen travelling on the widened, dual track Botany Line between Mascot and Southern Cross Drive in Botany. Views to the train headlights would be filtered in some areas by existing street trees. Overall, it is expected there would be a noticeable reduction in the amenity of views at night due to the additional trains that might be seen during operation of the project. As this is a high district brightness environment, these would be a **negligible visual impact** to this precinct at night.
Botany character precinct	Medium district brightness (E3)	Noticeable reduction	Minor adverse	Headlights from increased train movements along the Botany Line may be visible from adjacent residential, light industrial and commercial buildings to the west of the Botany Line. Some views to the trains at night would be partly filtered through retained vegetation along the edge of the rail corridor. The new bridges at Mill Stream and Southern Cross Drive would require some removal of vegetation, opening up views to the trains in adjacent light industrial and commercial buildings along Lord Street. Overall, it is expected that during operation there would be a noticeable reduction in the amenity of views at night in the Botany character precinct. As this is a medium district brightness environment, there would be a **minor adverse visual impact** overall.

CHARACTER PRECINCT	SENSITIVITY	MAGNITUDE	IMPACT	COMMENTS
Pagewood character precinct	Medium district brightness (E3)	Noticeable reduction	Minor adverse	Headlights from increased train movements along the Botany Line may be visible from between Southern Cross Drive and Page Street. The residences adjacent to the Botany Line between Myrtle and Banksia streets would have views to the trains, filtered through any retained vegetation along the rail corridor. As the golf course would not be used at night, and the club house is located approximately 800 metres northeast of the Botany Line, this part of the precinct would be unaffected. Overall, this work would result in a noticeable change in the amenity of views at night, particularly from the residential areas along the rail corridor. As this is a medium district brightness environment, there would be a **minor adverse visual impact** to this precinct at night.

18.5 Cumulative impacts

18.5.1 Overview

The methodology of the cumulative impact assessment and details of other projects considered are detailed in Chapter 24. A summary of the predicted cumulative impacts which relate to landscape character and visual amenity are described below.

18.5.2 Cumulative construction impacts

Landscape character

The Botany landscape character would be further changed by the proposed Sydney Gateway road project and completion of the Airport East and Airport North Projects. The Airport East and North Projects would be completed prior to construction of the project. The scale of these upgraded works is consistent with the highly urban character of the precinct and complex road system in the vicinity of the Airport.

If approved, construction of the Sydney Gateway road project would be concurrent with the construction of the project, increasing the influence of construction activity on the Botany character precinct in the western areas of the project, particularly in the vicinity of the bridge replacement and retaining wall works in Robey Street, O'Riordan Street and Qantas Drive. This would increase the adverse landscape character impact on this precinct.

Visual impact

If approved, construction of the Sydney Gateway road project would be seen in views to construction of the project, adding to the scale and extent of construction activity seen in views from Qantas Drive, Robey Street, and Qantas Drive. The location of the Sydney Gateway road project would inhibit the reinstatement of vegetation on Joyce Street between Robey Street and O'Riordan Street. These views would impact road users, including the arrival experience to Sydney from the Airport, adjacent commercial areas and hotels.

18.5.3 Cumulative operational impacts

Landscape character

During operation, the Sydney Gateway road project and the project combined would contribute to the intensification of the urban character of this area of the site. The Sydney Gateway road project would reduce the space available to the project to reinstate vegetation along the rail corridor along Qantas Drive between Robey and O'Riordan Streets, that would otherwise have softened and screened views to the project. Therefore, the combined effect of these projects would result in an increased adverse landscape character impact.

Visual impact

Upon completion, the Sydney Gateway project and this project would combine to alter views to the vehicular entry to Sydney from the airport. In the areas where both the project and Sydney Gateway road project would be seen, there would be an increased adverse visual impact.

18.6 Management of impacts

18.6.1 Approach

As described in Chapter 6 (Project features and operation) and Chapter 7 (Construction), design development and construction planning has focused on avoiding or minimising the potential for environmental impacts during all key phases of the process.

The urban design and landscaping principles would incorporate specific measures to respond to the identified landscape character and visual impacts. In addition, this project would be aligned with the urban design concepts of the Sydney Gateway road project where the projects interface.

A full description of the approach to environmental management and mitigation is provided Chapter 25.

18.6.2 List of mitigation measures

The mitigation measures that would be implemented to address potential landscape character and visual impacts are listed in Table 18.8. This table also outlines which mitigation measures (during the construction stage) would be implemented during the enabling works and main construction works.

Table 18.8 Mitigation measures

STAGE	IMPACT	MEASURE	ENABLING WORKS	MAIN CONSTRUCTION
Design	Landscape character and visual impact of proposed retaining walls	Proposed retaining wall finishes will be selected to align with the projects urban design and landscaping principles and aim to minimise adverse visual impact. These treatments will be aligned with the urban design concepts of the Sydney Gateway road project between O'Riordan and Robey Streets.	N/A – Design phase	N/A – Design phase
	Landscape character and visual impact of proposed bridges	The proposed twin bridges at Robey and O'Riordan Streets and Southern Cross Drive will be designed to minimise visual clutter. All bridges will incorporate measures to discourage graffiti.	N/A – Design phase	N/A – Design phase
	Landscape impact from relocation of Billboards	As a priority, billboards will be replaced like for like. Where they cannot be replaced like for like, they would be shifted in space to allow like for like placement on a new location in immediate vicinity of their current location. Where they cannot be placed in their immediate vicinity, they would be relocated along the existing rail corridor and combined with existing structures (such as bridges), where practicable, in order to minimise potential to introduce structures in areas where there are minimal structures and infrastructure (ie clustering instead of introducing impacts on higher sensitivity areas).	N/A – Design phase	N/A – Design phase
Construction	Landscape character and visual impact from residential properties	Shade cloth screening on site boundary fencing will be provided where works or compound sites are being undertaken in close proximity to residential areas to screen street level views into the construction site, such as: • Myrtle Street • Bay Street • Ellis Street • Banksia to Morgan Street.	✓	✓
	Visual impact from construction lighting at night	Temporary lighting required during the construction period will be sited and designed to avoid light spill into residential properties. Particular consideration will be given to works near Baxter Road, McBurney Avenue and between Myrtle Street and Stephen Road which are located close to residential properties and hotels.	✓	✓

18.6.3 Consideration of the interaction between measures

In addition to the measures for managing impacts on landscape character and visual amenity described above, there are interactions between the mitigation measures for land use and property (Chapter 17) and social impacts (Chapter 19).

All mitigation measures for the project will be consolidated and described in the relevant management plan. The plan would identify measures that are common between different aspects. Common impacts and common mitigation measures will be consolidated to ensure consistency and implementation.

18.6.4 Managing residual impacts

A residual risk analysis was undertaken following the impact assessment summarised in this chapter. The results of the residual risk analysis are provided in Appendix B. Residual risks with an assessed level of medium or above are summarised below:

- visual impacts on nearby residents and business owners due to the presence of construction compounds and work areas
- adverse impacts on landscape character during construction.

Despite measures taken to avoid and mitigate impacts, the project would result in some unavoidable residual adverse impacts. These impacts relate to the construction phase and would therefore be temporary.
The mitigation and management measures proposed are expected to manage the potential for landscape character and visual impacts.

19. SOCIAL

This chapter provides a summary of the social impact assessment. A full copy of the assessment is provided as *Technical Report 12 – Social Impact Assessment*.

19.1 Assessment approach

A summary of the approach to the assessment is provided in this section, including the legislation, guidelines and policies driving the approach and the methodology used to undertake the assessment. A more detailed description of the approach and methodology is provided in *Technical Report 12 – Social Impact Assessment*.

19.1.1 Policy context to the assessment

Social Impact Assessment Guidelines

Social Impact Assessment Guidelines for State significant mining, petroleum production, and extractive industry development (Department of Planning and Environment (DPE), 2017b) provide the definition for social impact based on the *SIA principles and methods endorsed by the International Association for Impact Assessment* (Vanclay, 2003 and Vanclay F, et al, 2015). This guidance provides a discussion which identifies that all issues which affect people, both directly and indirectly as a result of a project, are relevant to a robust social impact assessment. The guideline defines social impact as “a consequence experienced by people, due to changes associated with a State significant project” (DPE, 2017b). This social impact assessment has considered the definitions and issues raised in this guidance.

Environmental Impact Assessment Practice Note: Socio-economic assessment

Environmental Impact Assessment Practice Note: Socio-economic assessment (Roads and Maritime Services, 2013) provides a practical method for scoping the potential social issues of a project. This method has been used as a guide in identifying potential issues and impacts.

19.1.2 Methodology

Key tasks

The assessment involved:

- confirming the study area for the purposes of the assessment
- describing the existing social environment of the study area, including developing a demographic profile for communities in the study area with the potential to be affected by the project
- identifying and mapping community infrastructure and facilities with the potential to be affected by the project
- reviewing information on the project, including the indicative construction methodology and the proposed operational features and details
- reviewing other technical papers prepared for the EIS to understand the nature, scale and significance of potential impacts and identify resultant social impacts
- assessing the potential social impacts and benefits of the project in accordance with the SEARs and relevant principles and guidelines
- taking into account issues raised by the community and relevant stakeholders (described in Chapter 4 (Consultation))
- identifying measures to mitigate the potential impacts.

A detailed description of the assessment methodology is provided in Chapter 3 of *Technical Report 12 – Social Impact Assessment*.

Study area

The project site and its surrounds were analysed to identify the study area for this social impact assessment. The study area is based on consideration of the communities that live, work and visit this area and are therefore considered most likely to be impacted by the project. The study area for assessing demographic characteristics and values of the local community included:

- Bayside LGA
- the following suburbs:
  - Mascot
  - Pagewood
  - Botany.

In addition the community infrastructure facilities such as parks, health and education centres within 500 metres of the project site were identified.

19.1.3 Risks identified

The preliminary environmental risk assessment undertaken for the project (provided in Appendix B) included potential risks associated with social impacts. Potential risks were considered according to the impacts that may be generated by the construction and operation of the project. The likelihood, consequence and overall risk level of each potential risk were assessed, with avoidance and management measures defined for each potential risk. Further information on the risk assessment, including the approach, methodology and the full results, is provided in Appendix B.

Prior to assessment and identification of mitigation measures, risks with an assessed level of medium or above include:

- impacts on businesses (and deliveries) due to road closures, particularly full road closures associated with bridge works
- business impacts due to changes to advertising billboards located along Qantas Drive and Joyce Drive
- impacts on local amenity due to increased frequency of trains.

These potential risks and impacts were considered as part of the assessment. The assessment also considered matters identified by the SEARs and stakeholders (as described in Chapters 3 and 4). The residual risk levels, following implementation of the mitigation measures proposed in this EIS, are discussed in section 19.6.

19.1.4 How potential impacts have been avoided or minimised

As described in Chapters 6 and 7, design development and construction planning for the project has included a focus on avoiding or minimising the potential for environmental impacts during all key phases of the process. Measures taken to avoid or minimise impacts which relate to the social environment include:

- where possible, the construction access points and construction traffic routes would be directed away from sensitive areas and would consider these land uses when defining the use and operation of specific construction compounds
- the potential for construction noise and vibration impacts have been minimised by:
    - locating the construction access points and construction traffic routes away from sensitive areas
    - considering the surrounding land uses when defining the use and operation of specific construction compounds
    - locating construction compounds and other construction areas within the existing rail corridor wherever possible
    - potential noise and vibration impacts during operation have been minimised by proposing a lubrication procedure to reduce high frequency wheel squeal from operational trains. The procedure would involve the application of a friction modifying agent (lubricant) to the top running surface of the rail where it would be picked up by the wheels of passing trains.

19.2 Existing environment

19.2.1 Overview of the existing social environment

The study area is located within Bayside LGA and incorporates three suburbs: Mascot, Pagewood and Botany. The LGA contains diverse land uses, including Botany Wetlands, Port Botany, and Sydney Airport. Mascot and Botany feature a mix of residential, commercial and industrial areas, while Pagewood is primarily residential. A demographic profile for each suburb is provided in *Technical Report 12 – Social Impact Assessment*.

Bayside LGA is one of the fastest growing areas of Sydney, with suburbs in the LGA experiencing significant recent population growth. In recent years Mascot has experienced increasing levels of high density development, particularly in areas close to Sydney Airport and Mascot Train Station. Residential areas in the LGA have developed around these dedicated land uses, resulting in the interface between residential and industrial areas in some parts of the LGA. This is particularly noticeable in the residential areas close to industries that require 24-hour access, such as Port Botany and Sydney Airport, and their supporting infrastructure.

Mascot accommodates culturally and linguistically diverse people while Pagewood has high levels of social housing, as well as a slightly higher proportion of people who identify as needing assistance. Both Pagewood and Botany have a high proportion of households occupied by couples with children and single parents with children.

19.2.2 Connectivity

Bayside LGA currently experiences large volumes of traffic on local roads associated with Port and Sydney Airport, as well as regional through traffic and local area traffic. The study area is heavily connected with roads and freight and passenger rail routes.

There are several cycle ways identified by Roads and Maritime Services on the Cycleway Finder website (Roads and Maritime Services, 2018a) which travel through Mascot and Botany. These are identified as low difficulty, on-road cycle options for local residents, and provide access to city-bound cycle routes. The closest shared use paths are Alexandra Canal (one kilometre to the west of the project site) and Bourke Road Cycleway (about 600 metres north of the project site) shared use path, both located in Mascot.

Pedestrian footpaths are available alongside most roads within the study area. A footbridge crosses over the Botany Line on Banksia Street linking Botany and Pagewood residential areas.

19.2.3 Economic centres within the LGA

Sydney Airport and Port Botany support a significant workforce and associated businesses in the local and wider region. Based on worker data for Bayside LGA, the LGA employs around 74,000 workers, with 23.9 percent who are also residents in the area.

From a social perspective, the port is a major source of employment supporting 21,000 jobs (NSW Ports, 2015) and supplies goods to businesses in metropolitan Sydney and the Greater Sydney Region (Transport for NSW, 2018d, ARTC, 2018) which also support employment.

19.2.4 Community values

Community values refer to tangible and intangible characteristics and aspects of a community, such as amenity, character, lifestyle, access, connectivity, community cohesion, and community health and safety. A project may affect these aspects by changing noise levels, visual amenity, traffic conditions and access, movement across the community, the use and enjoyment of community spaces, and by requiring relocation as a result of property acquisition.

According to the *Botany Bay Planning Strategy 2031* (City of Botany Bay, 2009) and consultation on the *Community Strategic Plan 2030* (Bayside Council, 2018) the local community values the heritage character, good quality urban design and amenity of local residential areas. The community aspires to have more walking paths, cycling routes and transport corridors throughout the LGA to support local connectivity. Currently, Bayside Council does not have any active transport plans or strategies publicly available. The strategy (City of Botany Bay, 2009) recognises the potential challenge presented to residential amenity by future expansion of airport and port activities, and the resulting truck and rail freight.

19.2.5 Community infrastructure

Community infrastructure near the project is primarily pocket parks and larger recreation spaces, including golf courses and sports facilities. The area also contains a high number of accommodation facilities (hotels), due to the proximity of the project to Sydney Airport. Other available facilities are typical of an urban area including health facilities, emergency services, places of worship, community centres, education and child care services. Table 19.1 list the community facilities within around 500 metres of the project site.

Table 19.1 Community infrastructure

FACILITY TYPE	FACILITY NAME	MAP REF	FACILITY TYPE	FACILITY NAME	MAP REF
Emergency services	Fire and Rescue NSW Botany Fire Station	25	Education and child care services	Botany Public School	32
Recreation facilities	Botany Aquatic Club	26		Hippo's Friends Child Care Centre	33
	Eastlake Golf Club	27		Botany Bay Pre-School	34
	The Lakes Golf Club	1		All Star Early Learners	35
Open space	Dransfield Avenue Reserve	3		John Brotchie Memorial Nursery School	36
	Gaiarine Gardens	28		Pagewood Kindergarten	37
	Booralee Park	29		Pagewood Public School	38
	Coleman Reserve	4		Toybox Early Learning	22
	L'Estrange Park	2	Health services	Mascot Medical and Dental Services	24
	John Curtin Memorial Park	6	Accommodation facilities	Stamford Plaza Sydney Airport	10
	McBurney Avenue Reserve	5		8Hotels – Felix Hotel	11
	Botany Wetlands	30		Ibis Budget Sydney Airport	12
	Garnet Jackson Reserve	31		Mantra Hotel and Sydney Airport	13
	Robey Street Reserve	7		Quest Mascot	14
Community centres	Komuniteti Shqiptar Ne Sydney	8		Holiday Inn Sydney Airport	15
	Mascot Library	9		Ibis Sydney Airport	16
Places of Worship	Life Passion Church	39		Adina Apartments	17
	St Matthew's Anglican in Botany	40		Travelodge Hotel Sydney Airport	18
	Citygate Fellowship Church	21		Pullman Hotel Sydney Airport	19
				The Branksome Hotel	20

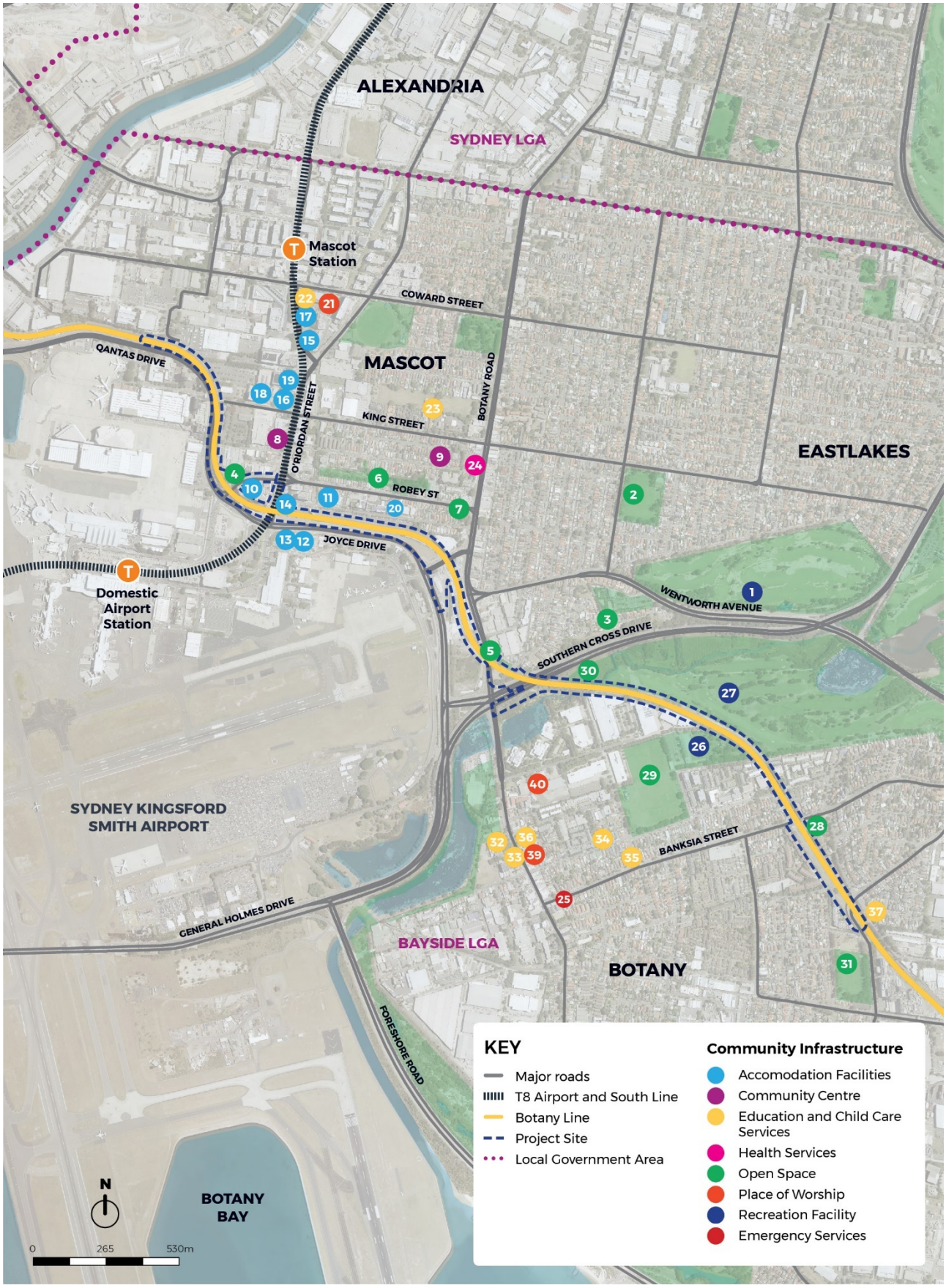


Figure 19.1 Location of community infrastructure

19.3 Assessment of construction impacts

19.3.1 Employment and economy

The peak construction workforce is estimated to be about 270 people during non-possession work and about 405 people during possession work. This would result in direct employment opportunities for skilled workers across Greater Sydney including roles such as engineers, designers and construction workers in the short term. Skilled workers in the local study area may benefit from these employment opportunities.

As an indirect result of the increase in construction workers in the local study area, there may be increased expenditure at local businesses, such as food, beverage and retail services close to the project site. An increase in patronage has the potential to provide increased income generation opportunities to these types of local businesses, benefitting business owners in the short term.

A number of billboards are located near Sydney Airport between Qantas Drive and Joyce Drive benefitting advertising agencies and Sydney Airport Corporation Limited through leasing arrangements. As discussed in section 6.6, some billboards may need to be removed during construction. Following completion of construction, all of the impacted billboards would be reinstated generally in the same location as they are currently positioned. No social impact is expected as a result of this change.

The additional workforce in the local study area would place pressure on availability of existing parking spaces. This may affect some local business owners and workers who drive to work. This may also reduce availability of street parking for customers of some businesses that do not have dedicated parking spaces, which could reduce income for business owners. Additional off-site parking for the construction workforce will be made available to reduce these impacts.

19.3.2 Amenity

'Amenity' refers to the pleasant or normally satisfactory aspects of a location which contribute to its overall character and the enjoyment of residents or visitors. Construction of the project may result in the following amenity impacts being experienced by members of the community surrounding the project site:

- increase in noise levels as a result of construction plant and equipment, including during out of standard construction hours such as on Sundays and during the night
- increase in traffic movements and congestion (and associated road traffic noise), around the project site and construction haulage routes
- increase in dust generated during construction
- changes in the visual outlook in the vicinity of compounds and construction work areas.

These potential impacts and relevant mitigation measures are considered in Chapter 8 (Traffic, transport and access), Chapter 9 (Noise and vibration), Chapter 10 (Air quality) and Chapter 18 (Landscape and visual amenity). Amenity impacts would be temporary and managed by the mitigation measures outlined in these chapters.

19.3.3 Access

As described in Chapter 8 (Traffic, transport and access), construction of the project would result in temporary impacts on traffic and access within the study area, and an increase in both heavy and light vehicle movements on the local and regional road network. This would impact existing access for residents, visitors, customers, businesses, and service providers along and around the project site. These impacts would include:

- changes to access for pedestrians and cyclists around the construction work areas
- altered movement patterns and traffic routes in some areas due to temporary road closures and diversions
- changed access or increased travel time to community places and facilities.

Changes to traffic, pedestrian and cyclist access could result in a temporary increase in the distance travelled, increased travel times, inconvenience and delays for some community members.

These potential impacts would be temporary and would be minimised as far as possible by the implementation of the construction traffic, transport, and access management measures provided in section 8.5.

19.3.4 Community infrastructure

Several open spaces and recreation facilities are located adjacent to or near the project site, including: Coleman Reserve, McBurney Avenue Reserve at Botany Road, Botany Wetlands, Booralee Park, Garnet Jackson Reserve, Gaiarine Gardens, Eastlake Golf Club and Botany Aquatic Centre (see Figure 19.1). Construction activities would likely affect the amenity of these facilities including temporary increased noise, vibration and dust as well as changes to the visual environment such as views of construction activities and removal of vegetation within the existing rail corridor. This may cause nuisance and reduce some people's ability to utilise the outdoor spaces at optimum function or enjoyment. These sites are, however, already impacted by noise from the airport and adjacent roads. Overall, given the existing amenity of these open spaces, the above changes are expected to result in a minor social impact for users of the reserves.

McBurney Avenue Reserve is a small passive open space that provides connectivity between McBurney Avenue and Botany Road. The reserve is likely to be used as a pedestrian thoroughfare, and may also be used by local residents and workers for passive recreation. The reserve is being considered as a material storage area during construction. If the reserve is utilised as a storage area, public access would be restricted to the existing walking paths only. Users may not be able use the park for passive recreation, and may choose to visit an alternate park.

Several education and child care services are located along proposed haulage routes which would experience increased heavy vehicle movements. These include Botany Public School, Hippo's Friends Child Care Centre, Botany Bay Pre-School, All Star Early Learners and John Brotchie Memorial Nursery School. As these facilities are located either adjacent to or near these routes, there is potential for concerns about actual or perceived safety risks to students and children at these facilities.

19.3.5 Summary of social impacts during construction

Table 19.2 summarises the potential social impacts during construction and indicates the potential nature, type, duration and predicted level of impact.

Table 19.2 Summary of social impacts during construction

SOCIAL IMPACT CATEGORY	SOURCE OF IMPACT	POTENTIAL SOCIAL IMPACT	NATURE, TYPE AND DURATION OF IMPACT	LEVEL OF IMPACT
Employment and economy	Construction workforce required for the project (about 270 people during non-possession work and about 405 people during possession work).	Direct employment opportunities for skilled workers across Greater Sydney.	Positive Direct Short term	N/A
Employment and economy	Spending by construction workforce at local businesses, such as food, beverage and retail services close to the project site.	Increased income generation for local businesses.	Positive Indirect Short term	N/A
Employment and economy	Parking restrictions for local business owners, employees, and customers of the business.	Potential increase in time it takes to park, and added nuisance for local business owners' employees and customers to the business, which could reduce income.	Negative Direct Short term	Negligible to Minor.
Amenity	Temporary and sporadic increased noise at residential properties and local businesses near Joyce Drive and Botany Road, as well as in Botany and Pagewood, from construction activities within the existing rail corridor and construction compounds.as well as heavy vehicles along haulage routes on local roads.	Reduced amenity of nearby residential properties and local businesses could reduce the enjoyment of outdoor areas.	Negative Direct Temporary	Minor impact on residents, owners and employees of local businesses, with potential for medium-minor impact on vulnerable groups.
Amenity	Temporary and sporadic increased noise at some accommodation facilities in Mascot, from construction activities within the existing rail corridor.	Reduced amenity for users of accommodation facilities could reduce the enjoyment of outdoor areas and result in people closing windows while indoors.	Negative Direct Temporary	Negligible intermittent impact on users of accommodation facilities.
Amenity	Temporary and sporadic vibration that exceeds human comfort in residential areas adjacent to the project corridor.	Reduced amenity of nearby residential properties, local businesses and accommodation facilities.	Negative Direct Temporary	Minor and intermittent, with potential for medium-minor impact on vulnerable groups.

SOCIAL IMPACT CATEGORY	SOURCE OF IMPACT	POTENTIAL SOCIAL IMPACT	NATURE, TYPE AND DURATION OF IMPACT	LEVEL OF IMPACT
Amenity	Temporary and sporadic noise and vibration at residential areas adjacent to the rail corridor, as well as accommodation facilities, due to construction works during the night time.	Potential sleep disturbance for some residents and hotel guest.	Negative Direct Temporary	Medium-minor on residents and hotel users, with potential for medium impact on vulnerable groups.
Amenity	Nearby residential areas would experience changes to visual amenity as a result of direct views of construction activities, equipment and compounds, and the removal of vegetation within the existing rail corridor which may currently screen some of these views from residences.	It is likely that residents currently experience views of the rail corridor and passing trains and therefore may not be as sensitive to visual changes during construction such as views of construction infrastructure. However, the removal of screening trees and vegetation may be a more obvious change. This may affect the values of some of these residents, in particular residents of Botany and Pagewood where the character change will be most noticeable.	Negative Direct Short term	Minor impact.
Amenity	Dust may be generated by construction activities and heavy vehicle movements.	Increased dust may lead to some residents altering their way of life, such as closing windows of houses or vehicles, or spending limited time in backyards or on balconies. Residents and employees of local businesses may also need to spend more time cleaning indoor or outdoor surfaces due to settling dust. This may lead to a temporary nuisance.	Negative Direct Temporary	Minor impact with potential for medium-minor impact on vulnerable groups.
Access	Construction would result in increased construction traffic, road or lane closures, and changes to access arrangements near construction compounds.	Access changes are likely to temporarily increase travel times for people's daily commutes or usual trips.	Negative Direct Temporary	Minor impact.

SOCIAL IMPACT CATEGORY	SOURCE OF IMPACT	POTENTIAL SOCIAL IMPACT	NATURE, TYPE AND DURATION OF IMPACT	LEVEL OF IMPACT
Access	Construction would result in changes to increased construction traffic, road or lane closures and changes to access arrangements near construction compounds.	Access changes are likely to temporarily increase travel times for people's commutes and trips by bus and cycling. Increased travel times may reduce time that people can spend undertaking activities that are important to them.	Negative Direct Temporary	Minor impact.
Access	Construction would result in temporary footpath closures/diversions as well as road traffic changes.	Appropriate diversions would be provided to maintain pedestrian access along roads affected by the project. At times, changed traffic conditions could deter some people, particularly vulnerable groups, from taking usual routes or making some trips at certain times. Vulnerable groups such as children, older people and people with a need for assistance may have less capacity to adapt to or navigate the changes.	Negative Direct Temporary	Minor impact on residents, employees of local businesses and community members, with potential for medium-minor impact on vulnerable groups.
Access	Sufficient parking for construction workers would be provided within the project site.	Alternate parking sites would decrease the demand for street parking by construction workers near the project site and reduce the potential for nuisance to local Mascot, Botany and Pagewood residents who utilise street parking.	Negative Direct Temporary	Negligible
Community infrastructure	McBurney Avenue Reserve potentially utilised for alternative parking and staff facilities for construction workforce.	Restricted or loss of public access may lead to reduced access for users of the reserve.	Negative Direct Temporary	Negligible
Community infrastructure	Increased construction traffic along haulage routes located adjacent or near education and childcare facilities.	Potential for concerns about actual or perceived safety risks to students and children at education and childcare facilities located along haulage routes due to increased heavy vehicle movements.	Negative Direct Temporary	Minor

SOCIAL IMPACT CATEGORY	SOURCE OF IMPACT	POTENTIAL SOCIAL IMPACT	NATURE, TYPE AND DURATION OF IMPACT	LEVEL OF IMPACT
Community infrastructure	Construction activities would likely affect the amenity of open space and recreation facilities including temporary increased noise, vibration and dust as well as changes to the visual environment. Construction would also result in changes to access for road users visiting Booralee Park, Garnet Jackson Reserve, Gaiarine Gardens and Botany Aquatic Centre, including increased traffic, road or lane closures, and changes to access arrangements near construction compounds.	Temporary amenity changes could reduce the enjoyment for some users particularly for passive and leisure activities. Increased travel times could inconvenience private vehicles, public or active transport. This could potentially deter some local users, particularly vulnerable users living in Botany and Pagewood, from accessing some facilities due to real or perceived barriers to travel generated by increased construction traffic.	Negative Direct Temporary	Minor impact to users within some areas of Booralee Park, Garnet Jackson Reserve, Gaiarine Gardens, Botany Aquatic Centre and Eastlake Golf Club.

19.4 Assessment of operational impacts

19.4.1 Employment and economy

The duplication of the Botany Line would unlock additional rail network capacity (with improved freight travel times along the Botany Line), resulting in a potential increase in the number of freight rail services supporting the movement of goods. The increased rail capacity has the potential to reduce the number of trucks in the region. The reduction of heavy vehicle traffic on the road network would have the potential to improve road network capacity for general traffic, which may also result in potential road safety advantages (due to reduced truck movements).

Based on the above, the project is expected to result in employment and economic benefits to Greater Sydney communities. According to the *Port Botany Duplication Development Phase Project Proposal Report* (ARTC, 2018), the resulting efficiency to the freight network would streamline costs in the supply chains for businesses across NSW.

Less congestion on the local road network would benefit the many workers who currently travel by road through the local study area, including those employed in airport and port-related industries, surrounding employment areas as well as passengers travelling via the airport for business purposes. The removal of trucks from the road network also leads to economic benefits, saving on accident costs and reducing local pollution (ARTC, 2018).

19.4.2 Amenity

There is the potential for operational noise impacts at selected locations adjacent to the rail corridor. Several locations have been identified (see section 9.4) where noise levels were predicted to exceed relevant noise criteria. The urban nature of the study area means that many receivers are close to major existing sources of transportation noise and already subject to relatively high existing noise levels.

The project is predicted to result in increased rail noise levels in study area, due to increased train speeds, higher frequency of trains and as a result of the new track being closer to certain receivers. The increased noise levels result in a number of areas where receivers are predicted to exceed relevant noise criteria. These areas are generally near curved track and include:

- around King Street
- near Baxter Road
- near Botany Road and McBurney Avenue
- along Myrtle Street.

There are social impacts associated with changes to the views from receivers near the project (ie visual impacts) that include:

- views of additional rail infrastructure
- loss of vegetation – where vegetation is re-instated, it is expected that the visual change would be lessened over time as the vegetation matures.

Changes to air quality during the operation of this project are not anticipated (see section 10.4).

19.4.3 Access

Given that the project would be within the existing rail corridor, changes to access and connectivity of residents, employees of local businesses and general community members are not expected.

Changes to the road network and on-road cycle routes that occur during construction would be restored to their condition prior to the construction of the project. There would be no permanent impact to existing active transport routes and the project would not preclude future links within the study area.

19.4.4 Community infrastructure

Community infrastructure close to the project site is already impacted by rail noise. Noise generated by additional train movements during operation is unlikely to affect users of the open space or education and child care services facilities near the project site.

19.4.5 Flooding

Flooding impacts have the potential to result in social impacts associated with the risk of floods to people as well as economic impacts from flood related damages to buildings, vehicles and other stored material.

The current design for the project may result in an increase of peak flood levels of around two centimetres for the northern portion of the development at 104 Bay Street and the north-eastern portion of the development at 15 Begonia Street (see section 13.4.2).

As discussed in section 13.4.2, the potential flooding impacts and associated social or economic costs from a two-centimetre increase in peak flood levels (compared to the existing scenario) are difficult to quantify. A small increase in flood levels may be sufficient to create an impact (where there was previously none) or change the degree of impact, for example if the water height reaches doorways or basement carpark entry points or results in an increase in depths of above-floor inundation, or leads to an increase in water volume or flow into basement carparks. Further design development will be undertaken in detailed design to mitigate the identified potential flooding impacts, and in doing so, avoid the potential for additional social and economic impacts due to the project (see section 13.6.2). Table 19.3 summarises the potential social impacts during operation and indicates the potential nature, type, duration and predicted level of impact.

Table 19.3 Summary of social impacts during operation

SOCIAL IMPACT CATEGORY	SOURCE OF IMPACT	POTENTIAL SOCIAL IMPACT	NATURE, TYPE AND DURATION OF IMPACT	LEVEL OF IMPACT
Employment and economy	Increased freight rail efficiency and improved efficiency of Sydney's and the wider economic supply chain and movements of goods to businesses in Greater Sydney and the wider region.	Indirect benefit to business owners and employees in the Greater Sydney region through increased productivity, leading to regional economic growth.	Positive Indirect Long term	N/A
Amenity	Increased noise and vibration generated by train movements during the daytime.	Nearby residents and employees of local businesses already experience noise and vibration from the existing rail operations and may not be as sensitive to the amenity change from additional train movements during the day time. For some residents and employees of local businesses, the gradual increase in the number of occurrences could be noticeable and cause nuisance.	Negative Direct Long term	Minor impact.
Amenity	Increased noise and vibration generated by train movements during the night time.	Potential sleep disturbance for some residents and users of accommodation facilities can lead to tiredness.	Negative Direct Long term	Medium-minor impact, with the potential for medium impact on vulnerable groups.
Amenity	Decrease in noise associated with idling locomotives during day and night.	Potential improvement to the noise levels associated with freight movements, due to the lack of idling freight trains. However, this is not likely to be noticeable to the local community as there will be an increase in noise associated with the increase in number of freight trains.	Positive Indirect Long term	N/A
Amenity	Visual changes resulting from the new second track within the rail corridor, and increased number of trains that may be visible to nearby residential areas and accommodation facilities.	Where reinstated vegetation is not possible, some residents' views overlooking the rail corridor would be permanently altered.	Negative Direct Long term	Negligible impact.

SOCIAL IMPACT CATEGORY	SOURCE OF IMPACT	POTENTIAL SOCIAL IMPACT	NATURE, TYPE AND DURATION OF IMPACT	LEVEL OF IMPACT
Amenity	Operational impacts on air quality are not expected as a result of the project.	Negligible social impacts on residents and vulnerable groups as a result of the operation of the project.	Negative Direct Long term	Negligible impact.
Access	Container movements transported by heavy road vehicles is expected to reduce due to an increase in rail capacity, leading to less congestion on the local road network.	Less congestion could improve traffic flow and increase people's connectivity to various destinations in the local study area for personal and business purposes, including visiting the airport, port, employment areas, community infrastructure and social networks.	Positive Indirect N/A	N/A
Community infrastructure	Amenity of community infrastructure, located adjacent to the project site as a result of noise generated by additional train movements during operation.	Increased number of noise occurrences due to additional train movements is unlikely to affect users of local community facilities.	Negative Direct Long term	Negligible impact.
Flooding	Increase of peak flood levels by two centimetres at residential developments.	Potential risk of floods to people as well as economic impacts from flood related damages to buildings, vehicles and other stored material due to additional peak flood levels.	Negative Direct Long term	Negligible impact.

19.5 Cumulative impacts

19.5.1 Overview

The methodology of the cumulative impact assessment and details of other projects considered are detailed in Chapter 24. A summary of the predicted cumulative impacts which relate to the social context of the study area are described below.

19.5.2 Cumulative construction impacts

Should the construction of the project occur concurrently with other major developments, there is potential for several cumulative social impacts to occur:

- increased demand for construction workforce due to resourcing across projects, which would lead to more job and income generation opportunities available to residents across Greater Sydney
- further demand for services and increased expenditure at local and regional businesses through purchases made by the combined construction workforce and procurement of local goods and services for construction, which would benefit business owners
- increased noise and vibration on residential properties and accommodation facilities near O'Riordan Street, Baxter Road and Joyce Drive from the concurrent construction with Sydney Airport developments and Sydney Gateway road project, which could lead to further nuisance and annoyance felt by these residents
- increased occurrence of delays on roads due to combined construction vehicle movements affecting road users on the local road network.

In the event the construction of the project occurs after construction of other major developments in the vicinity have completed construction, there is a potential for the affected community to experience construction fatigue. This is likely to impact the residents and workers in Mascot, who may have the highest exposure to construction related activities from consecutive or concurrent projects in their area. There is potential for these social impacts to be greater on vulnerable groups, who may be more sensitive to changes.

19.5.3 Cumulative operational impacts

Operation of the Botany Rail Duplication project together with Sydney Gateway road project would lead to increased freight efficiency to both Sydney Airport and Port Botany, which would likely increase the economic benefits for Greater Sydney and the wider region. This includes indirect economic benefits for supporting industries, such as intermodal terminals and logistics businesses, through the increase in rail freight efficiency.

Residences and accommodation facilities located near the Joyce Drive and O'Riordan Street intersection would potentially be affected by operational noise from both Botany Rail Duplication and Sydney Gateway road project. Community members may perceive noise impacts, which can affect people's sense of pride and enjoyment of their properties and surroundings.

The operation of the Botany Rail Duplication project and other developments in the local area would result in increased local and regional connectivity due to new road connections and extensions, combined with the increase in rail modal share for freight movements. Reduced traffic congestion and improved connectivity on the local road network due to decreased freight truck movements may lead to shorter travel times for local residents and community.

Local businesses, in particular those located in town centres such as Mascot, and businesses along Botany Road may benefit from improved amenity as a result of reduced freight truck movements and the remaining freight trucks taking an alternate route and bypassing the Mascot town centre. This may benefit owners, employers and customers by creating a more pleasant environment in the area.

19.6 Management of impacts

19.6.1 Approach

The project site is primarily located in a semi-industrial and commercial area of Sydney with few urban residential areas and community uses nearby. The project's social impacts are therefore less than would be associated with a densely populated residential project area. The project has purposely been designed to avoid or minimise social impacts where possible (see section 19.1.4).

Based on the outcomes of the impact assessment, most impacts generated by the project are expected to result from construction activities. Construction impacts would mainly relate to reduced amenity due to noise near residential properties and community infrastructure facilities, dust, visual impacts, as well as access changes leading to inconvenience for road users on the local road network. Amenity impacts would be temporary, and managed by the mitigation measures outlined in Chapter 8 (Traffic, transport and access), Chapter 9 (Noise and vibration), Chapter 10 (Air quality) and Chapter 18 (Landscape and visual amenity).

A full description of the approach to environmental management and mitigation is provided in Chapter 25.

19.6.2 List of mitigation measures

The mitigation measures that would be implemented to address potential social impacts are listed in Table 19.4. This table also outlines which mitigation measures (during the construction stage) would be implemented during the enabling works and main construction works.

Table 19.4 Mitigation measures

STAGE	IMPACT	MEASURE	ENABLING WORKS	MAIN CONSTRUCTION
Construction	Changes to amenity and access due to construction	The community will be informed about changes to amenity and access through the community and stakeholder engagement plan. The plan will include: • communication with residents to provide an overview of the project and the likely nature, extent and duration of amenity and access changes as a result of construction. Particular attention will be given to ensuring any vulnerable groups are appropriately targeted. These may include families with children, people with need for assistance, older people, people with disability, people with mobility difficulties or medical conditions, and culturally and linguistically diverse people in Mascot • communication of measures to minimise construction fatigue experienced by residents, businesses and general community members (such as construction respite periods associated with out of standard construction hours works, if required) • communication of the complaints and enquiry procedure through which community members can contact the project to raise any concerns regarding amenity and access changes, such as the ARTC Enviroline.	✓	✓
	Amenity and access changes affecting community infrastructure facilities and users due to construction	Targeted communication on measures to minimise impacts on amenity and access will be carried out with the following stakeholders: • Bayside Council, about timing of the most noise intensive works and changed traffic conditions that may affect public open space areas and active transport routes within the LGA • community infrastructure and accommodation facilities (hotels) if direct impacts are identified such as temporary changes to access or utility services.	✓	✓

STAGE	IMPACT	MEASURE	ENABLING WORKS	MAIN CONSTRUCTION
Operation	Amenity change (noise) due to operation	The operational noise and vibration review (ONVR) will include a consultation strategy to seek feedback from directly affected landowners on the noise and vibration mitigation measures. This would the use of the Enviroline mechanism for communication with local residents and businesses impacted by at-property noise mitigation measures.	N/A – Operation	N/A – Operation

19.6.3 Consideration of the interaction between measures

In addition to the measures to minimise the social impacts described above, there are interactions between the mitigation measures for Chapter 8 (Traffic, transport and access), Chapter 9 (Noise and vibration), Chapter 10 (Air quality), Chapter 13 (Hydrology and flooding) and Chapter 18 (Landscape and visual amenity).

All mitigation measures for the project will be consolidated and described in the appropriate management plan. The plan would identify measures that are common between different aspects. Common impacts and common mitigation measures will be consolidated to ensure consistency and implementation.

19.6.4 Managing residual impacts

A residual risk analysis was undertaken following the social impact assessment summarised in this chapter. The results of the residual risk analysis are provided in Appendix B. Residual risks relating to noise impacts are discussed in section 9.6. No other residual risks have been identified with an assessed level of medium or above.

Despite measures proposed to avoid and mitigate impacts, the project would still result in some minor unavoidable residual adverse impacts. These impacts mainly relate to the construction phase and would be temporary.

20. RESOURCES AND WASTE MANAGEMENT

20.1 Assessment approach

The approach to the resources and waste management assessment is provided in this section, including the legislation, guidelines and policies driving the approach and the methodology used to undertake the assessment.

20.1.1 Legislative and policy context to the assessment

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

The POEO Act establishes the procedures for environmental control, and for issuing environmental protection licences regarding matters such as waste, air, water and noise.

Schedule 5 of the POEO Act defines waste as:

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

The Waste Regulation controls matters such as the obligations of consignors (producers and agents), transporters and receivers of waste in relation to waste transport licensing and tracking requirements.

Under the Waste Regulation, the NSW EPA has issued ‘The Australian Rail Track Corporation excavated material order 2019’ and ‘The Australian Rail Track Corporation excavated material exemption 2019’. This order and exemption applies to ARTC excavated material (soils, sand, ballast, rock or aggregate derived through activities within the ARTC rail corridor) for application to land for the purposes of certain earthworks, building or maintenance of railway infrastructure and certain public road related activities.

It is an offence under the Waste Regulation to transport waste generated in NSW more than 150 kilometres from the place of generation for disposal, unless the waste is transported to one of the two lawful disposal facilities nearest the place of generation.

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

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

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

The Australian Dangerous Goods Code (National Transport Commission, 2015) defines a set of requirements for the transport of dangerous goods defined in the code. In NSW, the Dangerous Goods (Road and Rail Transport) Regulation 2009 gives effect to the Australian Dangerous Goods Code.

Waste classification

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

NSW Waste Avoidance and Resource Recovery Strategy 2014–21

Consideration was given to the *NSW Waste Avoidance and Resource Recovery Strategy 2014–21* (EPA, 2014b). The primary goal of this strategy is to enable NSW to improve environment and community well-being by reducing the environmental impact of waste and using resources more efficiently. This strategy is informed and driven by the waste hierarchy defined in the WARR Act. It is supported by various regulations and policies including the POEO Act and Waste Regulation. To support the primary goal of the strategy, the project would be constructed and operated with consideration to the waste hierarchy. Additionally, any waste generated from the project would be disposed of in accordance with regulatory requirements.

20.1.2 Methodology

The assessment involved:

- reviewing the regulatory framework for waste management
- identifying potential waste generating activities
- identifying the likely classification of waste generated by the project in accordance with relevant legislation and guidelines
- estimating quantities of waste, where feasible
- identifying available waste management options
- identifying waste management measures for construction and operation.

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

20.1.3 Risks identified

The preliminary environmental risk assessment undertaken for the project (summarised in Appendix B) included potential risks associated with resources and waste management. Potential risks were considered according to the impacts that may be generated by the construction and/or operation of the project. The likelihood, consequence and overall risk level of each potential risk were assessed, with avoidance and management measures defined for each potential risk. Further information on the risk assessment, including the approach, methodology, and the full results, is provided in Appendix B.

Prior to assessment and identification of mitigation measures, the following risks were identified with an assessed level of medium or above:

- increased electricity and fuel use during construction and operation
- increased demand on local and regional resources during construction.

The residual risk levels, following implementation of the mitigation measures proposed in this EIS, are discussed in section 20.5.4.

20.1.4 How potential impacts have been avoided or minimised

As described in Chapters 6 and 7, design development and construction planning have included a focus on avoiding or minimising the potential for environmental impacts during all key phases of the process.

Potential resource and waste management impacts have been avoided or minimised where possible by maximising the amount of on-site reuse of spoil, where practicable and subject to testing for contaminants. In addition, the project design seeks to optimise the capping of existing asbestos containing material to minimise the generation of contaminated waste (due to excavation/disturbance of the identified asbestos contaminated fill material) and therefore minimise the quantity of contaminated waste requiring off-site disposal.

Utility management has adopted a risk-based approach to avoiding or minimising impacts associated with the relocation or adjustment of services. Where adjustments have been avoided there has been a reduction in associated waste and stockpiling of materials.

20.2 Assessment of construction impacts

20.2.1 Resource use

Construction of the project would require various materials and pre-cast elements. Major construction materials required would include:

- structural/embankment fill material
- capping material
- ballast
- concrete sleepers
- rail, rail weld and rail fastening materials (metals)
- bedding materials for trenches and pits
- aggregate for concrete, asphalt and bitumen
- cement and concrete
- steel – reinforcing steel and structural steel
- wood for use in formwork and other temporary structures
- water
- precast concrete including pipes, culvert segments, pits and barriers
- mechanical and electrical equipment for rail signals
- plastic rail pads and insulators
- conduits and cables – optical fibre
- pre-fabricated metal handrails.

Materials would be sourced from appropriately licensed facilities and commercial suppliers in nearby areas. None of the materials proposed to be used are considered to be in short supply. Material quantities would be determined throughout the detailed design phase prior to start of construction and reduced where possible through efficient design, construction and procurement processes.

It is estimated that the project will require around:

- 5,000 concrete sleepers
- 9,370 cubic metres (m^3) ballast
- 55 rail lengths (at 110 metres per length)
- 5,700 m^3 capping material
- 14,400 m^3 structural/embankment fill material
- 8,000 m^3 concrete
- 1,700 tonnes steel (reinforcing and structural)
- 12 beams, 12 through girders, 3,000 square metres pre-cast elements
- 415 lineal metres reinforced concrete pipe and 22 reinforced concrete pits.

Equipment and vehicles on the construction site would consume a large quantity of fuel. It is estimated that the following would be used for construction during the enabling and main works:

- Diesel combustion, stationary energy purposes – diesel use has been estimated at around 6,500 L/week for the duration of the construction period for mobile and stationary plant and equipment. This equates to around 1,200 kL over the 3.5 year construction period. This covers construction of the track works, bridge works and ancillary infrastructure.
- Diesel combustion, transport purposes – diesel use for employee commuting was estimated at around 345 kL over the construction period, based on number of employees during possession and non-possession periods.
- Diesel use for transporting plant and equipment to site was estimated as 478 kL over the construction period, based on average heavy truck movements.

Electricity needs on site would be minor and connection of the construction site offices to the local power grid would be sufficient. A generator would be used where it is not possible to obtain power from the local grid. It is estimated that around 1,100 kilowatt hours of power would be used to construct the project. Some generators may be necessary for emergency power supply.

Construction of the project would require water for the following activities:

- dust suppression
- compaction of excavated fill material
- road sweepers
- potable use in office amenities.

Non-potable and potable water would be used to construct the project. This would be sourced from reusable non-potable water on site where possible (eg harvested rainwater), or from local potable water sources (eg water mains via metered standpipes or temporary piped water supply). No surface or groundwater would be extracted for construction.

20.2.2 Waste generation and management

Waste generation and classification

The key waste generating activities during construction along with potential key waste streams and likely classification of waste streams is provided in Table 20.1. Some waste streams such as excavated soil, spoil and aggregates would be subject to sampling and analysis in accordance with the *Waste Classification Guidelines* (EPA, 2014a) to confirm the waste classification of the material, whether it meets the criteria for virgin excavated natural material (VENM), excavated natural material (ENM) or waste exemptions (see section 20.1.1) and the appropriate disposal method.

Waste would be generated in all stages of construction. The types of waste and quantities would vary depending on the activity type.

The overall volumes of typical construction waste streams are expected to be comparable to other similar infrastructure projects. Standard waste management strategies (which address waste generation, storage, disposal and reuse) would be implemented during construction, and would aim to reduce the generation of construction waste and reuse waste where possible. Table 20.1 provides the details of potential waste streams and estimates of waste quantities (where possible), noting that it is difficult to quantify potential waste streams with certainty at this stage in the project, and particularly given opportunities for waste minimisation and reuse will be prioritised over disposal but require assessment on a case-by-case basis during construction (such as for reuse of topsoil).

Table 20.1 Expected wastes to be generated during construction

ACTIVITY	POTENTIAL WASTE STREAMS	INDICATIVE VOLUMES	LIKELY CLASSIFICATION OF WASTE STREAMS
Activities at construction offices and compounds	Putrescibles (food and other organic waste)	< 10 tonnes (based on average waste consumption per staff for the duration of project)	General solid waste (putrescible)
	Paper, cardboard, plastics, glass and printer cartridges and other office waste	< 6 tonnes	General solid waste (non-putrescible)
	Grey water, sewerage	< 800 litres	Liquid waste
Maintenance of construction plant, vehicles and equipment	Adhesives, lubricants, waste fuels and oils, engine coolant, containers, batteries, hoses	< 2 tonnes	General solid waste (non-putrescible) Hazardous waste Liquid waste
	Plastic film wrap and other packaging	Minimal	General solid waste (non-putrescible)
Early and enabling work			
Track realignment/slewing	Metals (cut rail, welding offcuts)	2.9 km of new track (2 x rails) and 100 m of crossovers	General solid waste (non-putrescible)
	Spoil comprising VENM or ENM	See below as part of total spoil volume.	General solid waste (non-putrescible)[1]
	Contaminated soils (including asbestos contaminated soil) and acid sulfate soils	4,000 m^3	Restricted solid waste or general solid waste (non-putrescible)[1]
	Ballast	TBC as part of detailed design	General solid waste (non-putrescible) or restricted solid waste[1]
	Rail clips, pads and insulators	Clips: 2.9 km / 0.6 m x 4 Pads and insulators: 2.9 km / 0.6 m x 2	General solid waste (non-putrescible)
	Plastic film wrap and other packaging	Minimal	General solid waste (non-putrescible)

ACTIVITY	POTENTIAL WASTE STREAMS	INDICATIVE VOLUMES	LIKELY CLASSIFICATION OF WASTE STREAMS
Utility service relocation and/or protection	Vegetation/green waste	TBC as part of detailed design	General solid waste (non-putrescible)
	Aggregates	See below as part of total spoil volume	General solid waste (non-putrescible)[1]
	Pipe/conduit and cable offcuts	Minimal	General solid waste (non-putrescible)
	Excess spoil comprising VENMENM	See below as part of total spoil volume	General solid waste (non-putrescible)[1]
	Contaminated soils and acid sulfate soils	See below as part of total spoil volume	Restricted solid waste or general solid waste[1]
	Concrete ground level troughing segments	2.9 km	General solid waste (non-putrescible)
	Concrete, metal framed utilities pit lids	60	General solid waste (non-putrescible)
	Plastic film wrap and other packaging	Minimal	General solid waste (non-putrescible)
Billboard removal	Billboard materials (wood, paper, plastic)	None	General solid waste (non-putrescible)
	Reinforcing steel, concrete, structural steel	15 tonnes	General solid waste (non-putrescible)
	Concrete footings or structures	10 m^3	General solid waste (non-putrescible)
	Plastic film wrap and other packaging	Minimal	General solid waste (non-putrescible)
Site establishment	Vegetation/green waste	TBC as part of detailed design	General solid waste (non-putrescible)
	Top soil	Will be reused where possible. See below as part of total spoil volume for soil not reusable.	General solid waste (non-putrescible)[1]
	General debris/litter	Minimal	General solid waste (non-putrescible)
	Plastic film wrap and other packaging	Minimal	General solid waste (non-putrescible)

ACTIVITY	POTENTIAL WASTE STREAMS	INDICATIVE VOLUMES	LIKELY CLASSIFICATION OF WASTE STREAMS
Main construction and commissioning works including track and bridge work			
Installation of new track, upgrade of existing track and installation of new crossovers	Excess spoil comprising VENMENM	See below as part of total spoil volume	General solid waste (non-putrescible)[1]
	Metals (cut rail, metal offcuts)	Included for track / slewing	General solid waste (non-putrescible)
	Wood (formwork)	Minimal	General solid waste (non-putrescible)
	Aggregates	See below as part of total spoil volume	General solid waste (non-putrescible)
	Concrete, asphalt and aggregate	See below as part of total spoil volume	General solid waste (non-putrescible)
	Plastic film wrap and other packaging	Minimal	General solid waste (non-putrescible)
Construction of new bridges and demolition of existing bridges	Excess spoil comprising VENMENM	See below as part of total spoil volume	General solid waste (non-putrescible)[1]
	Contaminated soils and acid sulfate soils	See below as part of total spoil volume	Restricted solid waste or general solid waste[1]
	Metals, steel reinforcement	150 kg for existing O'Riordan bridge quantities	General solid waste (non-putrescible)
	Concrete, asphalt and aggregate	TBC as part of detailed design	General solid waste (non-putrescible)
	Bricks and mortar	Minimal	General solid waste (non-putrescible)
	Structural steel	TBC as part of detailed design	General solid waste (non-putrescible)
	Plastic film wrap and other packaging	Minimal	General solid waste (non-putrescible)
Signalling and electrical work	Pipe/conduit offcuts Electrical/cable offcuts	Minimal	General solid waste (non-putrescible)
	Electrical and signalling components	TBC as part of detailed design	General solid waste (non-putrescible)
	Metal signal cabinets	10 (approximately)	General solid waste (non-putrescible)
	Concrete and steel reinforcement	10 m^3	General solid waste (non-putrescible)
	Plastic film wrap and other packaging	Minimal	General solid waste (non-putrescible)

ACTIVITY	POTENTIAL WASTE STREAMS	INDICATIVE VOLUMES	LIKELY CLASSIFICATION OF WASTE STREAMS
Finishing and rehabilitation work			
Finishing work	Metals (damaged fencing, work signs)	TBC as part of detailed design	General solid waste (non-putrescible)
	Vegetation/green waste	TBC as part of detailed design	General solid waste (non-putrescible

1 This would be confirmed through sampling and analysis in accordance with the *Waste Classification Guidelines* (EPA, 2014a)

Based on the current estimated proposed cut (31,600 m^3) and fill (15,120 m^3 of fill and 14,400 m^3 structural fill) requirements for the project, there may be an excess of spoil material, subject to confirmation of the reusability of the cut material (around 380 m^3). Spoil excavated as part of the project would be tested and classified.

It is estimated that around 4,000 m^3 of potentially contaminated (asbestos) material would be excavated, which would require disposal at an appropriately licensed facility that is lawfully able to accept it.

Waste handling and management

Relevant legislation and policies outline the requirements which would be adopted for construction waste management, see section 20.1.1. The proposed waste handling and management measures for construction waste streams are provided in Table 20.2.

Table 20.2 Management of construction waste

WASTE TYPE	MANAGEMENT
Spoil comprising virgin excavated natural material (VENM) or excavated natural material (ENM)	Excavated materials would be reused on site or in other projects off site as engineering fill where practicable and where it meets the VENM and ENM criteria. Where excavated materials cannot be reused (on site or in other projects off site) or reinstated, it would be classified and taken off site to a waste management facility that is lawfully permitted to accept that type of waste for reuse, recycling or disposal.
Contaminated spoil and acid sulfate soils	In situ testing of soils in areas of potential contamination concern would be undertaken to determine the appropriate waste classification. Acid sulphate soils would be managed in accordance with the Acid Sulfate Soil Management Plan (ASSMP) that would be developed for the project. This management plan is described in section 12.5. Soils contaminated with asbestos would be managed in accordance with the asbestos management plan (AMP) that would be developed for the project. This includes removal of some material and the remaining in situ portion to be capped with a layer of material. The AMP is described further in section 12.5.

WASTE TYPE	MANAGEMENT
General construction waste (concrete, asphalt, timber formwork, scrap metals, cable and packaging materials etc)	General construction waste would be managed in accordance with the waste hierarchy. Waste would be segregated and stockpiled on site, with materials such as concrete, asphalt, timber, plastic, and metals separated for reuse or recycling. Electrical waste would be stored for collection by an authorised contractor for recycling off site, where feasible, or disposal at an appropriately licenced facility. All construction waste would be classified in accordance with the *Waste Classification Guidelines* and directed to a waste management facility that is lawfully permitted to accept that type of waste or reused in other projects in accordance with the requirements of any applicable resource recovery order and exemption.
Ballast material from existing tracks	Where possible, ballast from existing tracks would be reused elsewhere on ARTC network or within the project site as capping on access tracks. Otherwise, depending on the level of contamination, ballast would be sent to a construction and demolition waste recycling facility or disposed of at an appropriately licenced facility.
Plain track concrete sleepers removed for crossover/turnout bearers	Where possible, concrete sleepers would be reused elsewhere on the ARTC network. Otherwise they would be sent to a construction and demolition waste recycling facility or reused in other projects in accordance with the requirements of any applicable resource recovery order and exemption.
Timber sleepers and bearers removed for plain track concrete sleepers or concrete/timber turnout bearers.	Timber sleepers would be recycled in accordance with ARTC resource recovery order and exemption.
Liquid waste	Sewage and grey water would be disposed of in sewers or transported to an appropriately licenced liquid waste treatment facility.
Adhesives, lubricants, waste fuels and oils, engine coolant	Waste from construction vehicle and plant maintenance activities would be collected and stored in designated waste storage areas for collection by an authorised contractor for off-site disposal. Where feasible, containers holding oil, grease and lubricants would be washed prior to disposal or stored separately for disposal as hazardous waste. Waste oil and oil filters would be stored in recycling bins and collected by an authorised contractor and recycled off site, where feasible.
Paint and containers – spray cans, paint tins etc	Used paint and paint containers would be stored in an appropriately bunded area for collection by an authorised contractor for disposal.
Office waste including kitchen waste, paper, cardboard, plastics, glass	Waste containing food would be stored appropriately (covered), and regularly removed from site for disposal to reduce the likelihood of attracting pests and vermin (including birds). Recyclable materials such as paper, cardboard, plastics, glass, ferrous, and non-ferrous containers would be stored at recycling bins for collection by an authorised contractor, and recycled off site. Where recycling is not feasible, waste would be collected and stored in designated waste storage areas for collection by an authorised contractor for off-site disposal at a licenced waste facility.

WASTE TYPE	MANAGEMENT
Green waste	As far as practicable, green waste would be chipped, mulched and reused for vegetation management or dust suppression on site, reused in other projects in accordance with the requirements of any applicable resource recovery order and exemption or collected by an authorised contractor and recycled off site. Noxious weeds would be disposed of in accordance with relevant guidelines/requirements.
Top soil	As far as practicable and subject to suitability, topsoil would be reused in rehabilitation/reinstatement work or reused in other projects in accordance with the requirements of any applicable resource recovery order and exemption.

Off-site recycling and disposal locations

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

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

A larger number of licenced facilities in Sydney are lawfully able to accept general solid waste (non-putrescible) and vegetation/green waste. Waste facilities in Sydney licenced to lawfully accept special waste such as asbestos include:

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

The Kemps Creek Resource Recovery Park is the only facility in Sydney lawfully able to accept restricted solid waste.

A specialist contractor would be used for the collection and treatment/disposal of any hazardous waste.

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

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

Stockpile management

Stockpiling would be restricted to material storage and laydown areas shown in Figure 7.7a to d. Stockpile management would be in accordance with *Managing Urban Stormwater – Soils and Construction* (Landcom 2004). The size of stockpiles would be determined by material quantity requirements, space availability, stockpile stability and safety, indicative volumes and restrictions are outlined in Table 20.3. Stockpile siting and management would include the following parameters:

- will be no higher than three metres
- will be sited as far as practical from sensitive receivers and where possible equipment i.e. site compound buildings, sited between the stockpile and receiver
- will be located in areas which are not subject to frequent inundation by floodwater and ideally outside the 1% AEP flood extent
- will not be sited next to schools or day care facilities
- will be temporary and material not needed for ongoing maintenance will be removed at completion of construction.

Table 20.3 Indicative stockpile volumes and constraints

PROJECT WORK AREA	
Cooks Loop to O'Riordan Street (see Figure 7.7a)	Limited opportunity for stockpiles due constraints from adjacent land and roads.
O'Riordan Street to Botany Road (see Figure 7.7b)	There would typically be space for a volume of material storage of up to 2,500 m^3 available in the laydown area to the west of General Holmes Drive. This could comprise a combination of structural fill, capping or ballast and also be utilised for sleeper/drainage pipe/CSR conduit or GST storage.
Botany Road to Myrtle Street (see Figure 7.7c)	There would typically be space for a volume of material storage of up to 3,500 m^3 available in the Botany Road triangle storage and compound area. This could comprise a combination of structural fill, capping or ballast and could be sleeper storage once the earthworks are completed or materials such as rail clips, conduits, drainage pits etc.
Myrtle Street to Stephen Road (see Figure 7.7d)	There would typically be space for a volume of material storage of up to 3,500 m^3 available in the Banksia Street storage and compound site. This could comprise a combination of structural fill, capping or ballast or could be concrete sleeper storage once the earthworks are completed.
Other areas within the project site	The remaining areas of the project site are extremely spatially constrained and would unlikely be suitable to store large quantities of materials such as stockpiles.

20.3 Assessment of operational impacts

20.3.1 Resource use

During operation, the project would consume electricity as a result of:

- rail operations
- rail signals
- minor maintenance activities.

20.3.2 Waste generation and management

Waste generation

Standard ARTC maintenance activities would be undertaken during operations. Typically, these activities would include minor maintenance works, such as bridge and culvert inspections, rail grinding and track tamping, through to major maintenance, such as reconditioning of track and topping up of ballast as required.

Table 20.4 summarises the expected wastes to be generated during operation and their likely waste classification. Volume is anticipated to be low and similar to existing maintenance activities.

Table 20.4 Expected wastes to be generated during operation

ACTIVITY	POTENTIAL WASTE STREAMS	LIKELY CLASSIFICATION OF WASTE STREAMS
Regular weekly maintenance	Sleepers	General solid waste (non-putrescible)
	Rail jewellery – pads, clips, screws, insulators associated with replaced sleepers	General solid waste (non-putrescible)
	Scrap rail and associated weld kit rubbish	General solid waste (non-putrescible)
Quarterly maintenance	Sleepers	General solid waste (non-putrescible)
	Rail jewellery – pads, clips, screws, biscuits associated with replaced sleepers	General solid waste (non-putrescible)
	Rail dust, scrap rail and associated weld kit rubbish	General solid waste (non-putrescible)
Major works	Fouled ballast/capping/general fill	General solid waste (non-putrescible) or restricted solid waste[1]
	Worn rail, turnout components on a larger scale	General solid waste (non-putrescible)
	Sleepers and associated jewellery	General solid waste (non-putrescible)

1 This would be confirmed through sampling and analysis in accordance with the *Waste Classification Guidelines* (EPA, 2014a)

Waste handling and management

All operational waste would be managed in accordance with relevant legislative and policy requirements, as outlined in section 20.1.1. The proposed waste handling and management measures for operational waste streams are provided in Table 20.5.

Table 20.5 Management of operational waste

WASTE TYPE	MANAGEMENT
Concrete sleepers	Waste concrete sleepers would be segregated and sent to a construction and demolition waste recycling facility for recovery.
Timber sleepers	Timber sleepers would be disposed of or recycled in accordance with ARTC resource recovery order and exemption.
Rail jewellery including plates, fasteners, pads and insulators	Where practicable, rail jewellery would be sorted to separate potentially recyclable materials such as metals. Recyclable materials would be stored in separate recycling bins for collection by an authorised contractor, and recycled off site. Where recycling is not feasible, waste would be collected and stored in designated waste storage areas for collection by an authorised contractor for off-site disposal at a licenced waste facility.
Scrap rail, rail dust, turnout components	As far as practicable, used/damaged rails would be segregated and collected by an authorised contractor and recycled off site at a metals recycling facility. Where recycling is not feasible, waste would be collected by an authorised contractor for off-site disposal at a licenced waste facility.
Fouled ballast/ capping/general fill	Where possible, ballast would be reused elsewhere on ARTC network as: • bottom ballast for track work • capping on access tracks. Otherwise ballast would be sent to a construction and demolition waste recycling facility.

Off-site recycling and disposal locations

The options for recycling and disposal of construction waste would also apply for operational waste. These are described in section 20.2.2.

20.4 Cumulative impacts

20.4.1 Overview

The methodology of the cumulative impact assessment and details of other projects considered is detailed in Chapter 24. A summary of the predicted cumulative impacts which relate to waste and resource use is described below.

20.4.2 Cumulative construction impacts

Other projects and activities occurring locally and regionally would also generate demand for resources. However, none of the resources proposed to be used are considered to be in short supply.

Similarly, other projects and activities would also generate demand for resource recovery, recycling and disposal capacity, such as excess spoil. However, as discussed in section 20.2.2, there are numerous facilities lawfully able to accept waste from this and other projects. These facilities are considered to have significant capacity.

Therefore, no significant impact is expected as a result of the interaction of the construction of the project with other proposed activities (including projects) locally and regionally.

20.4.3 Cumulative operational impacts

Operational resource use and waste generation are expected to be minimal and therefore no issues are expected as a result of the interaction of the operation of the project and other proposed activities (including projects) locally and regionally.

20.5 Management of impacts

20.5.1 Approach

Waste would be managed in accordance with the construction environmental management plan for the project. The construction environmental management plan will include the following:

- strategies to reduce waste volumes
- waste management, segregation and handling measures
- spoil disposal locations (within the corridor where possible, or at appropriate external disposal sites)
- procedures for the assessment, classification, management and disposal of all waste in accordance with the *Waste Classification Guidelines* (EPA, 2014a)
- responsibilities of key project personnel
- waste monitoring requirements
- compliance record generation and management
- reporting requirements.

Further details on the approach to management is provided in Chapter 24.

20.5.2 List of mitigation measures

The mitigation measures that would be implemented to manage resources and waste are listed in Table 20.6. This table also outlines which mitigation measures (during the construction stage) would be implemented during the enabling works and main construction works.

Table 20.6 Mitigation measures

STAGE	IMPACT	MEASURE	ENABLING WORKS	MAIN CONSTRUCTION
Design	Spoil generation	Measures to minimise excess spoil generation will be investigated at detailed design. This would include a focus on optimising the design to minimise spoil volumes and the reuse of material on-site.	N/A – Design phase	N/A – Design phase
Construction	Resource use	Where feasible and practicable, construction material will be sourced from within the Sydney region.	✓	✓
	Stockpile management	The size of stockpiles will be determined by material quantity requirements, space availability, stockpile stability and safety, indicative volumes and restrictions. Stockpile siting and management will include the following parameters: • will be no higher than three metres • will be sited as far as practical from sensitive receivers and where possible equipment i.e. site compound buildings, sited between the stockpile and receiver • will be located in areas which are not subject to frequent inundation by floodwater and ideally outside the 1% AEP flood extent • will not be sited next to schools or day care facilities • will be temporary and material not needed for ongoing maintenance will be removed at completion of construction.	✓	✓

STAGE	IMPACT	MEASURE	ENABLING WORKS	MAIN CONSTRUCTION
	Enabling works waste generation and resource use	Site EMPs will be prepared before any enabling works begin. The Site EMPs will detail how waste would be managed during enabling works activities that could generate significant waste eg billboard removal and vegetation clearance. The Site EMPs will include: • all key early and enabling works waste streams • classification of waste streams in accordance with the *Waste Classification Guidelines* (EPA, 2014a) • applicable resource recovery orders and exemptions including the existing 'The Australian Rail Track Corporation excavated material order 2019' and 'The Australian Rail Track Corporation excavated material exemption 2019' • waste identification, handling and segregation procedures • proposed waste reuse, recovery, recycling and disposal measures • waste tracking, record keeping and reporting requirements • key sources of construction related resource use • energy conservation and energy efficiency practices to be implemented.	✓	
	Main construction works waste generation and resource use	The CEMP will consider management of all construction waste including spoil in accordance with the waste management hierarchy. The CEMP will include: • all key construction waste streams • classification of waste streams in accordance with the *Waste Classification Guidelines* (EPA, 2014a) • applicable resource recovery orders and exemptions including the existing 'The Australian Rail Track Corporation excavated material order 2019' and 'The Australian Rail Track Corporation excavated material exemption 2019' • waste identification, handling and segregation procedures • spoil disposal locations, on-site spoil management and off-site transport protocols • proposed waste reuse, recovery and recycling and disposal measures • waste tracking, record keeping and reporting requirements • key sources of construction related resource use • energy conservation and energy efficiency practices to be implemented.		✓

STAGE	IMPACT	MEASURE	ENABLING WORKS	MAIN CONSTRUCTION
	Main construction works waste generation and resource use	Construction waste will be minimised by accurately calculating materials brought to the site and limiting materials packaging.	✓	✓
	Main construction works waste generation and resource use	All waste will be assessed, classified, managed and disposed of in accordance with the *Waste Classification Guidelines* (EPA, 2014a).	✓	✓
	General waste management	Waste and recycling segregation bins will be located at various locations within the project site, if space permits, to facilitate segregation and prevent cross contamination.	✓	✓
Operation	Operational waste generation	The existing ARTC Standard Environmental Management Measures (under the Environment Management System), which include measures for identification, classification, management and disposal of waste will be implemented to manage operational waste generation.	N/A – Operation	N/A – Operation
		All waste would be assessed, classified, managed and disposed of in accordance with the *Waste Classification Guidelines* (EPA, 2014a).	N/A – Operation	N/A – Operation

20.5.3 Consideration of the interaction between measures

There are interactions between the mitigation measures for waste management and contamination (provided in Chapter 12), soils and water quality (provided in Chapter 14) and air quality (provided in Chapter 10). The project specific sustainability initiatives described in Chapter 24 are also relevant to the management of waste. Together, all these measures would ensure appropriate handling of waste materials to minimise the potential for impacts on the community and environment.

20.5.4 Managing residual impacts

A residual risk analysis was undertaken following the impact assessment summarised in this chapter. The results of the residual risk analysis are provided in Appendix B and summarised below. No residual risks were identified with an assessed level of medium or above.

Classifications and reuse/recycling/disposal locations would be confirmed during detailed design. However, it is recognised that in the event of an unexpected find relating to contaminated land, there is potential for a change in the anticipated volumes of potentially contaminated spoil to be generated. All spoil material would be assessed in accordance with *Waste Classification Guidelines* (EPA, 2014a) and reused or disposed of at a licenced waste management facility in accordance with its waste classification.

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

21. RISKS, HEALTH AND SAFETY

This chapter considers potential risk, health and safety impacts on the local community and Sydney Airport. This chapter provides a summary of the following three technical reports: *Technical Report 13 – Health Impact Assessment*, *Technical Report 14 – Hazard and Risk Assessment* and *Technical Report 15 – Airport Operations Assessment*.

21.1 Assessment approach

A summary of the approach to the assessment is provided in this section, including the legislation, guidelines and policies driving the approach and the methodology used to undertake the assessment. A more detailed description of the approach and methodology is provided in the relevant technical report (as specified in the sections below).

21.1.1 Legislative and policy context to the assessment

The assessments were undertaken with reference to the following legislation, policy and guidelines.

Department of Planning, NSW, 2011, Applying SEPP 33: Hazardous and Offensive Development Application Guidelines

Department of Planning NSW (DoP 2011a), Applying SEPP 33: Hazardous and Offensive Development Application Guidelines (Applying SEPP 33) provides the process for assessing if developments are potentially hazardous or offensive, including threshold levels that trigger the potentially hazardous or offensive status.

As the project is State Significant Infrastructure, Applying SEPP 33 (DoP 2011a) does not apply to the project. These guidelines provide a process of identifying a potentially hazardous development by ascertaining storage and transport screening thresholds that is used in this assessment and is detailed in *Technical Report 14 – Hazard and Risk Assessment*.

Department of Planning, NSW, 2011, Hazardous Industry Planning Advisory Paper No 4 – Risk Criteria for Land Use Safety Planning and Hazardous Industry Planning Advisory Paper No 6 – Guidelines for Hazard Analysis

Department of Planning, NSW, 2011, Hazardous Industry Planning Advisory Paper No 4 – Risk Criteria for Land Use Safety Planning (HIPAP No 4) and *Hazardous Industry Planning Advisory Paper No 6 – Guidelines for Hazard Analysis* (HIPAP No 6) are only used if Applying SEPP 33 (DoP 2011) indicates a development is potentially hazardous.

Standards Australia, 2018, AS/NZS 2885.6, Pipelines – gas and liquid petroleum, part 6: Pipeline safety management

Standards Australia, 2018, AS/NZS 2885.6, Pipelines – gas and liquid petroleum, part 6: Pipeline safety management (AS/NZS 2885.6) describes how an owner of a dangerous goods transport pipeline should design, operate and maintain a pipeline in a safe manner. This document is relevant to the project, as AS/NZS 2885.6 indicates that any development in the vicinity of a pipeline is considered a threat and requires management through completion of a safety management study. This is considered in the management and mitigation approach to the project and is detailed in *Technical Report – 14 Hazard and Risk Assessment*.

Airports Act 1996 and regulations

The project construction includes temporary construction compounds on areas of Commonwealth-owned land leased by Sydney Airport. The Airports Act and associated regulations provide the assessment and approval process for development on Commonwealth-owned land for the operation of Sydney Airport. *Sydney Airport Curfew Act 1995* establishes a curfew period for Sydney Airport. This exists from 11 pm until 6 am on the following day. The assessment detailed in *Technical Report 15 – Airport Operations Assessment* has considered the requirements of the Acts in relation to the project and relevant consultation and consents and how the curfew period may affect the construction period of the project.

Airports (Protection of Airspace) Regulations 1996

Under the *Airports (Protection of Airspace) Regulations 1996*, a system has been established for the protection of airspace at and around regulated airports in the interests of the safety, efficiency or regularity of existing or future air transport operations. The regulations define prescribed airspace for an airport, which includes the airspace above any part of either an obstacle limitation surface or procedures for air navigation services – aircraft operations surfaces (PANS-OPS). These regulations apply to both on-airport and off-airport developments.

This assessment detailed in *Technical Report 15 – Airport Operations Assessment* considers potential activities or equipment from the project during construction or operation which may impact the obstacle limitation surface.

Civil Aviation Act 1988 and regulations

The *Civil Aviation Act 1988* establishes a regulatory framework for maintaining, enhancing and promoting the safety of civil aviation and establishing CASA. The *Civil Aviation Regulations 1988* and *Civil Aviation Safety Regulations 1998* are administered by CASA. They provide regulatory controls over civil aviation safety. *Manual of Standards Part 139 – Aerodromes* and *Part 172 – Air Traffic Services* are relevant to the project and have been considered in this assessment.

Regulation 94 of the *Civil Aviation Regulation 1989* also provides CASA the authority to require lights in the neighbourhood of an aerodrome, which may cause confusion, distraction or glare to pilots in the air, to be extinguished or modified. This may apply to either the project's construction lighting or to operational lighting from train movements or maintenance activities. Impacts from lighting are detailed in *Technical Report 15 – Airport Operations Assessment*.

Sydney Airport Master Plan 2039

Sydney Airport Master Plan 2039 (Sydney Airport 2019), outlines the strategic direction for development of the airport over the next 20 years. The project has been assessed for consistency with the master plan (see *Technical Report 15 – Airport Operations Assessment*).

National Airports Safeguarding Framework

The *Australian Government Department of Infrastructure, Regional Development and Cites* (DIRDC) (no date) *National Airports Safeguarding Framework* (NASF) is a national land use planning framework. The NASF provides guidance to state, local and territory governments on assessment and approvals for land use and development on and around airports.

The project passes under the approach and departure paths for one of the runways at Sydney Airport. The guidelines B, C, E, F, G and I are considered in this assessment. The potential impacts of the project have been reviewed against the guidelines and assessment made of any mitigation measures that may reduce or eliminate impacts (see *Technical Report 15 – Airport Operations Assessment*).

Sydney Airport Wildlife Management Plan

Sydney Airport has implemented a Wildlife Management Plan which provides guidance to minimise the hazard to aircraft operations created by the presence of wildlife on or in the vicinity of the airport. This plan is considered when assessing the construction and operational activities for project features which may encourage wildlife that could cause a risk to airport operations (see *Technical Report 15 – Airport Operations Assessment*).

EnHealth Health Impact Assessment Guidelines

EnHealth Health Impact Assessment Guidelines (enHealth 2017) provides an introduction to the health impact assessment process, the different types of assessments that can be undertaken, the principles that may need to be addressed in an assessment, the roles of those involved in an assessment and general information on the preparation of a health impact assessment. This guidance has informed the content and the methodology selected for this assessment and is described further in *Technical Report 13 – Health Impact Assessment*.

EnHealth Environmental Health Risk Assessment: Guidelines for Assessing Human Health Risks from Environmental Hazards

EnHealth Environmental Health Risk Assessment: Guidelines for Assessing Human Health Risks from Environmental Hazards (enHealth 2012) provides an Australian framework and approach for the conduct of the assessment of environmental health risks. This approach has been used for this assessment and is described further in *Technical Report 13 – Health Impact Assessment*.

Health Impact Assessment: A Practical Guide

Health Impact Assessment: A Practical Guide (Harris 2007) provides a more practical overview of the health impact assessment process in Australia. The document outlines the key phases and steps involved in conducting an assessment, the key concepts and the different levels of assessment. This guide has provided background information to the assessment process and is described further in *Technical Report 13 – Health Impact Assessment*.

21.1.2 Methodology

Key tasks

A desktop level assessment was undertaken to identify potential impacts on the health and safety of the surrounding community and operations of Sydney Airport as a result of the construction and operation of the project. The assessment involved:

- reviewing the relevant regulatory framework and applicable guidelines
- describing the existing environment, specifically the key characteristics relevant to understanding the existing health of the community surrounding the project, existing infrastructure including relevant Sydney Airport operations
- assessing the impacts of constructing and operating the project on the health of the community. In particular impacts associated with changes in air quality, noise and other impacts that have the potential to affect the health and wellbeing of the community (see *Technical Report 13 – Health Impact Assessment*)

- assessing the key hazards and risks associated with the use of dangerous goods and transportation of dangerous goods through high pressure pipelines during construction and operation of the project as defined in Applying SEPP 33 (DoP 2011a) and AS/NZS 2885.6 (see *Technical Report 14 – Hazard and Risk Assessment*)
- assessing the potential impacts from the construction and operation of the project on airport operations at Sydney Airport (see *Technical Report 15 – Airport Operations Assessment*)
- providing mitigation measures for implementation during construction and operation.

The assessment focuses on those construction and operational activities with the potential to result in health and safety impacts on surrounding communities, land uses, and the environment (also known as 'off-site receivers'). The assessment does not take into account potential health and safety risks to on-site workers associated with normal construction operations, as these are regulated by workplace health and safety legislation (including the *Work Health and Safety Act 2011*) and are not relevant to approval of the project under Division 5.2 of the of the EP&A Act.

Study area

As the health impact assessment has relied on the assessments undertaken as part of other technical studies, the study areas evaluated in relation to health impacts are the same as the study areas considered in each of the individual technical studies (see Chapters 8, 9, 10, 12 and 19).

The study area for key hazards and risks associated with the use of dangerous goods and transportation of dangerous goods through high pressure pipelines has considered utility infrastructure and use of materials within and immediately adjacent to the project site (see *Technical Report 14 – Hazard and Risk Assessment*).

The project site is located close to Sydney Airport. The study area considered in *Technical Report 15 – Airport Operations Assessment* includes the project site and the area above the project site in relation to Sydney Airport obstacle limitation surface.

21.1.3 Risks identified

The preliminary environmental risk assessment undertaken for the project (provided in Appendix B) included potential risks associated with hazards, health and safety. Potential risks were considered according to the impacts that may be generated by the construction or operation of the project. The likelihood, consequence and overall risk level of each potential risk were assessed, with avoidance and management measures defined for each potential risk. Further information on the risk assessment, including the approach, methodology and the full results, is provided in Appendix B.

Prior to assessment and identification of mitigation measures, risks with an assessed level of medium or above include:

- impacts from transport, storage and use of hazardous substances and dangerous goods
- impact from spills or accidents during the transport, storage and use of hazardous substances and dangerous goods
- impact on utilities including pipelines
- reduced safety for road users and pedestrians during construction particularly in the vicinity of houses and businesses.

These potential risks were considered as part of the assessment, which also considered matters identified by the SEARs and stakeholders (as described in Chapters 3 and 4). The residual risk levels, following implementation of the mitigation measures proposed in this EIS, are discussed in section 21.6.4.

21.1.4 How potential impacts have been avoided or minimised

As described in Chapters 6 and 7, design development and construction planning for the project has included a focus on avoiding or minimising the potential for environmental impacts during all key phases of the process.

Potential hazard and risk impacts have been avoided or minimised where possible by the current design for the project adopting a risk-based approach associated with the relocation and adjustment of public utilities affected by the project. The framework approach includes a hierarchy of:

- avoiding impacts
- protecting utilities in their current location
- utilities relocation or adjustment.

21.2 Existing environment

The existing environment with regards to traffic and access, noise, air quality, contamination and social impacts is described in Chapters 8 (traffic and transport), 9 (Noise and vibration), 10 (Air quality), 12 (Contamination) and 19 (Social) respectively. Other aspects relevant to the consideration of health and safety impacts are discussed below.

Section 8.2 provides a description of the existing rail operations within the project site.

21.2.1 Sensitive receivers

Sensitive receivers include members of the community travelling through the study area or residents or businesses situated in close proximity to the project site and operational rail corridor.

When considering potential health impacts within a community, health impact assessment considers the whole population as well as specific sensitive or vulnerable groups within the population. These communities and their related sensitive or vulnerable groups are:

- community groups:
    - residents
    - recreational users (such as cyclists and users of recreational open space)
    - commercial and industrial (eg businesses within the project area that may be directly impacted by property acquisitions)
- sensitive and vulnerable groups within the community groups:
    - young children (in particular children under the age of 5 years, but also including children up to 14 years)
    - older populations (greater than 65 years of age)
    - disabled and those with pre-existing medical conditions
    - disadvantaged (socio-economically disadvantaged).

A detailed profile of the local communities is provided in section 19.2.

21.2.2 Existing health of the population

The population considered in this assessment includes all individuals who live, work or attend schools (or child care facilities) within the study area. The study area covers a large number of individual suburbs that sit within the following densely populated urban LGAs:

- Bayside (amalgamation of former Bayside and Rockdale LGAs)
- Randwick
- Sydney
- Inner West (amalgamation of former Ashfield, Leichhardt and Marrickville LGAs)
- Canterbury Bankstown
- Georges River.

When considering the health of a local community there are a large number of factors to consider. The health of the community is influenced by a complex range of interacting factors including age, socio-economic status, social networks, behaviours, beliefs and lifestyle, life experiences, country of origin, genetic predisposition and access to health and social care.

Information relevant to the health of populations in NSW is available from NSW Health for populations grouped by local health districts. The project site is located in the South Eastern Sydney Local Health District and Sydney Local Health District. This assessment compared the mortality and hospitalisation indicator data between 2011 and 2016 for all causes, potentially avoidable, chronic obstructive airways disease, lung cancer, cardiovascular disease and asthma.

The rate of mortality indicators for the South Eastern Sydney and Sydney local health districts are significantly lower than that reported for NSW, except for chronic obstructive airways disease and lung cancer which was not significant for the Sydney Local Health District.

The rate of hospitalisations indicators presented in the South Eastern Sydney and Sydney local health districts is significantly lower than that reported for NSW, with the exception of cardiovascular disease hospitalisations in South Eastern Sydney, which is similar to the rate for NSW.

In relation to mental health, data from NSW Health indicates the following for adults:

- The rate of high or very high psychological distress reported in 2017 in the South Eastern Sydney local health district (11.2 percent) is a little lower than the state average (15.1 percent). The rate for the Sydney local health district (15.3 percent) is essentially the same as the state average.
- The rate of high or very high psychological distress in Sydney Local Health District has varied between 10.9 and 15.3 percent between 2003 and 2017. In the South Eastern Sydney Local Health District, the rate has generally declined from around 14.1 percent in 2003 to less than 10 percent in 2015 and 11.2 percent in 2017.

Where health data was available for the LGAs in the study area, these have been compared with available data for the South Eastern Sydney Local Health District, Sydney Local Health District, Sydney and NSW. A review of the available health statistics indicate that for the LGA population in study area, the mortality rates and hospitalisation rates are variable but generally similar to those reported in the larger local health districts of South Eastern Sydney, Sydney and the wider Sydney metropolitan area and slightly lower than the whole of NSW.

21.2.3 Utilities within the study area

A number of utilities are located within and adjacent to the project site and are listed in Table 21.1. The location of high pressure gas pipelines in the vicinity of the project are shown in Figure 21.1.

Table 21.1 Utilities within the study area

COMPANY NAME	UTILITY TYPE	DANGEROUS GOOD TRANSPORTER OR SAFETY/ ENVIRONMENTAL IMPACT POTENTIAL	LOCATION
APA	Ethane Gas Pipeline (Moomba to Sydney Pipeline)	Yes – dangerous good transporter (high pressure ethane gas)	Banksia Street to Southern Cross Drive
Qenos	Ethylene Gas Pipeline (Nitrogen charged)	Potentially – dangerous good transporter (high pressure ethylene gas), although pipeline not currently in use	Banksia Street to King Street
Jemena	Natural Gas (Multiple services: 100 mm DIA sub-main, 550 mm DIA primary main, 100 mm DIA, 32 mm DIA)	Yes – dangerous good transporter (high pressure natural gas)	Multiple locations – local service
AusGrid	Electricity (Multiple services: LV 415 V, auxiliary, HV 11 kV, 33 kV, 132 kV)	Yes – potential safety impact	Banksia Street to King Street
Sydney Water	Stormwater (Multiple services)	Yes – environmental impact	Banksia Street to King Street
Sydney Water	Sewer (Reinforced concrete box culverts)	Yes – environmental and health impact	Banksia Street to King Street
Sydney Water	Potable Water (Iron, steel pipe)	Yes – environmental impact	Banksia Street to King Street
Bayside Council	Stormwater (Multiple services)	Yes – environmental impact	Banksia Street to King Street
Roads and Maritime Services (RMS)	Intelligent Traffic Systems (ITS) – Electrical, telecommunications	Yes – potential safety impact	O'Riordan Street to Robey Street
Sydney Airport	Electricity (Multiple services)	Yes – potential safety impact	O'Riordan Street to King Street
Telstra	Telecommunications (Optical fibre and copper)	No	Banksia Street to King Street
Optus	Telecommunications (Optical fibre and copper)	No	Banksia Street to Bay Street

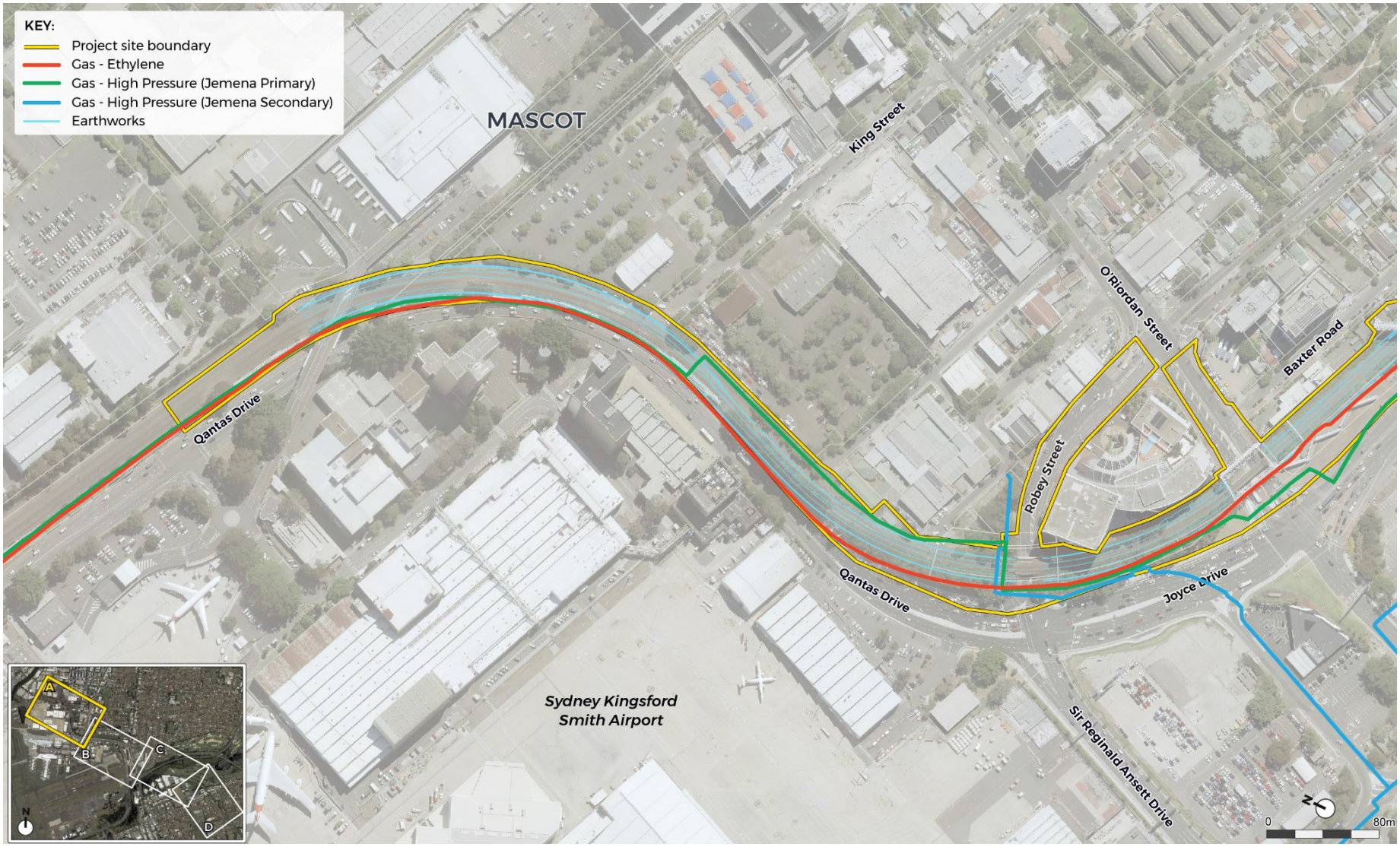


Figure 21.1a High pressure gas pipelines in the vicinity of the project

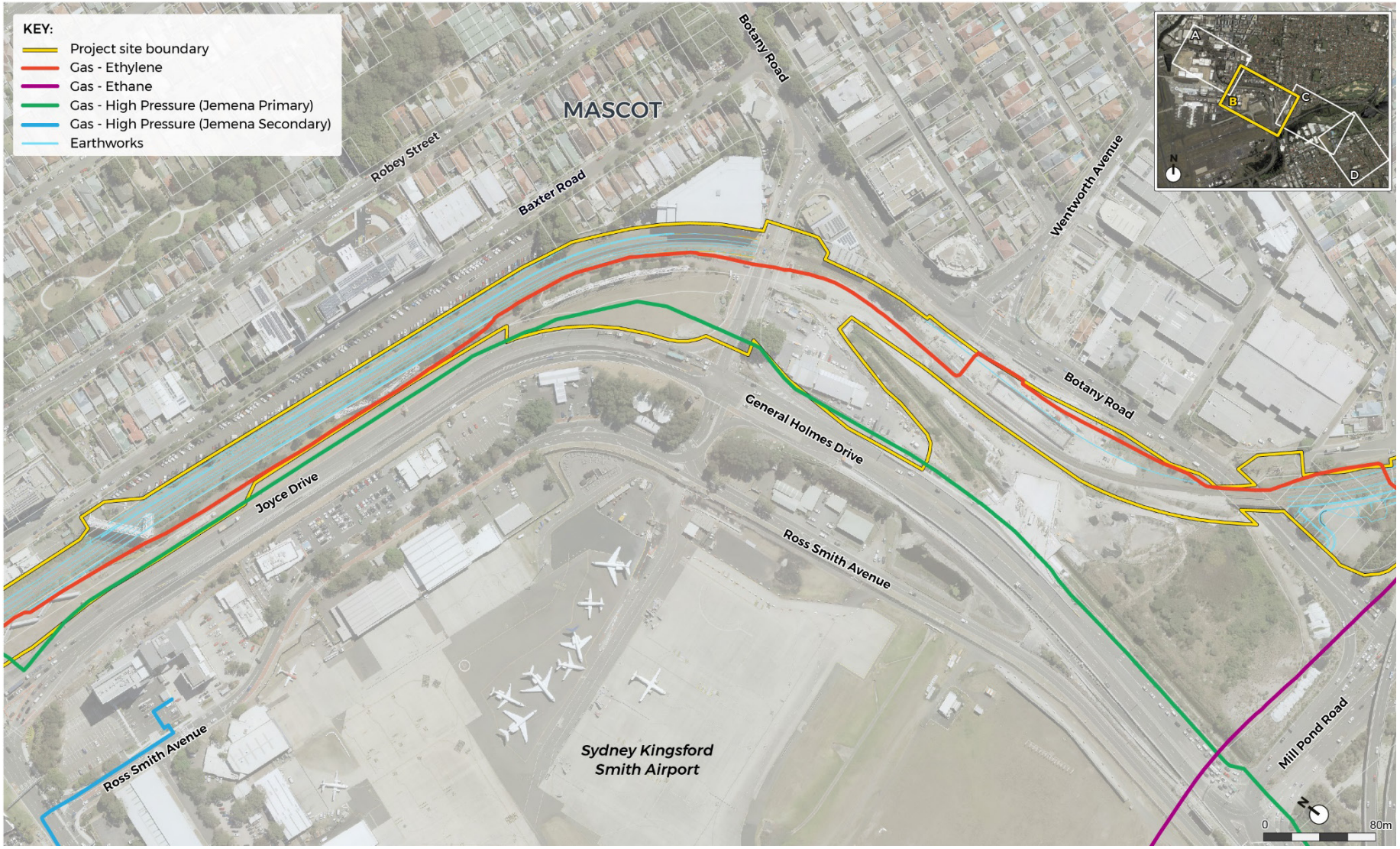


Figure 21.1b High pressure gas pipelines in the vicinity of the project

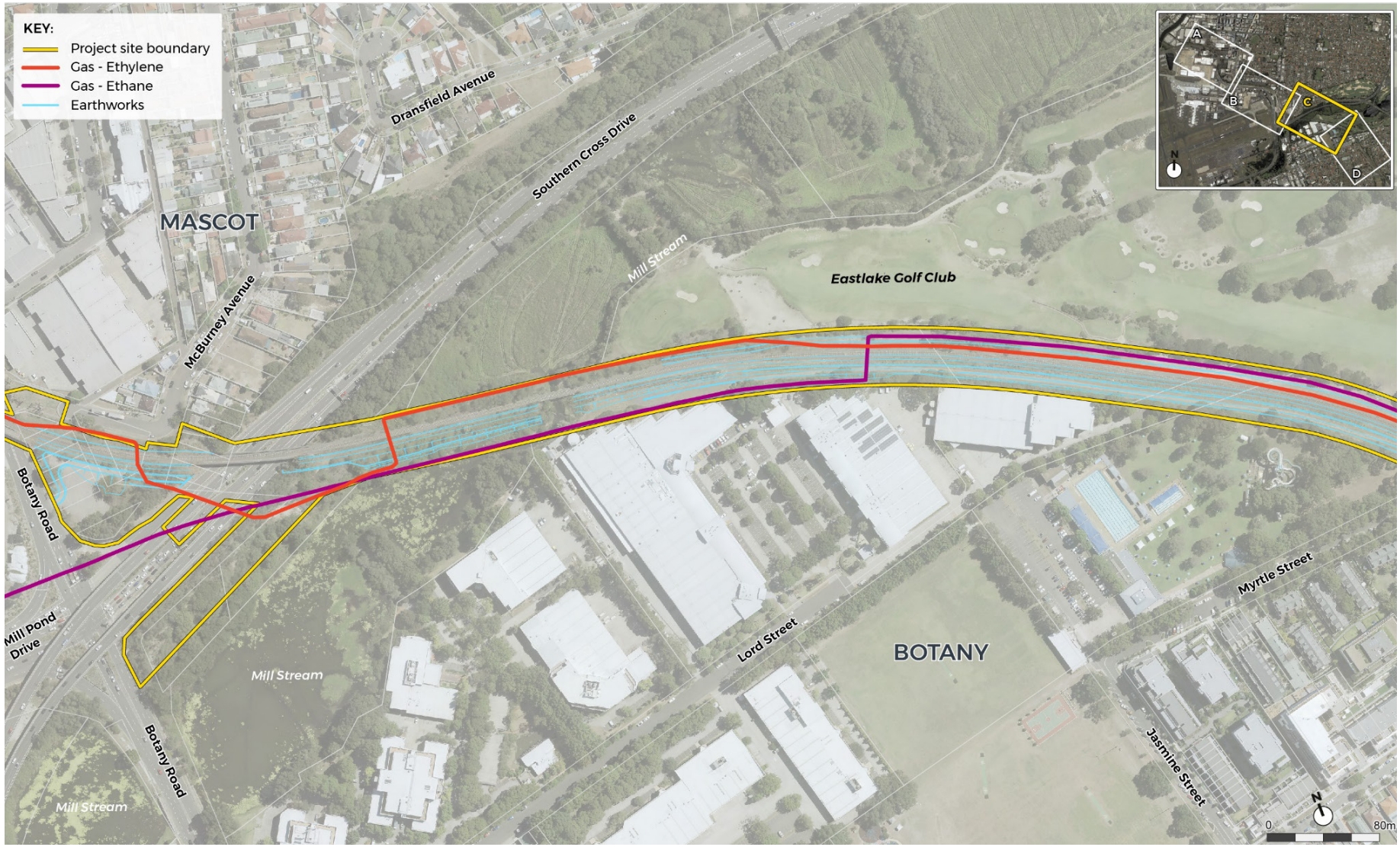


Figure 21.1c High pressure gas pipelines in the vicinity of the project

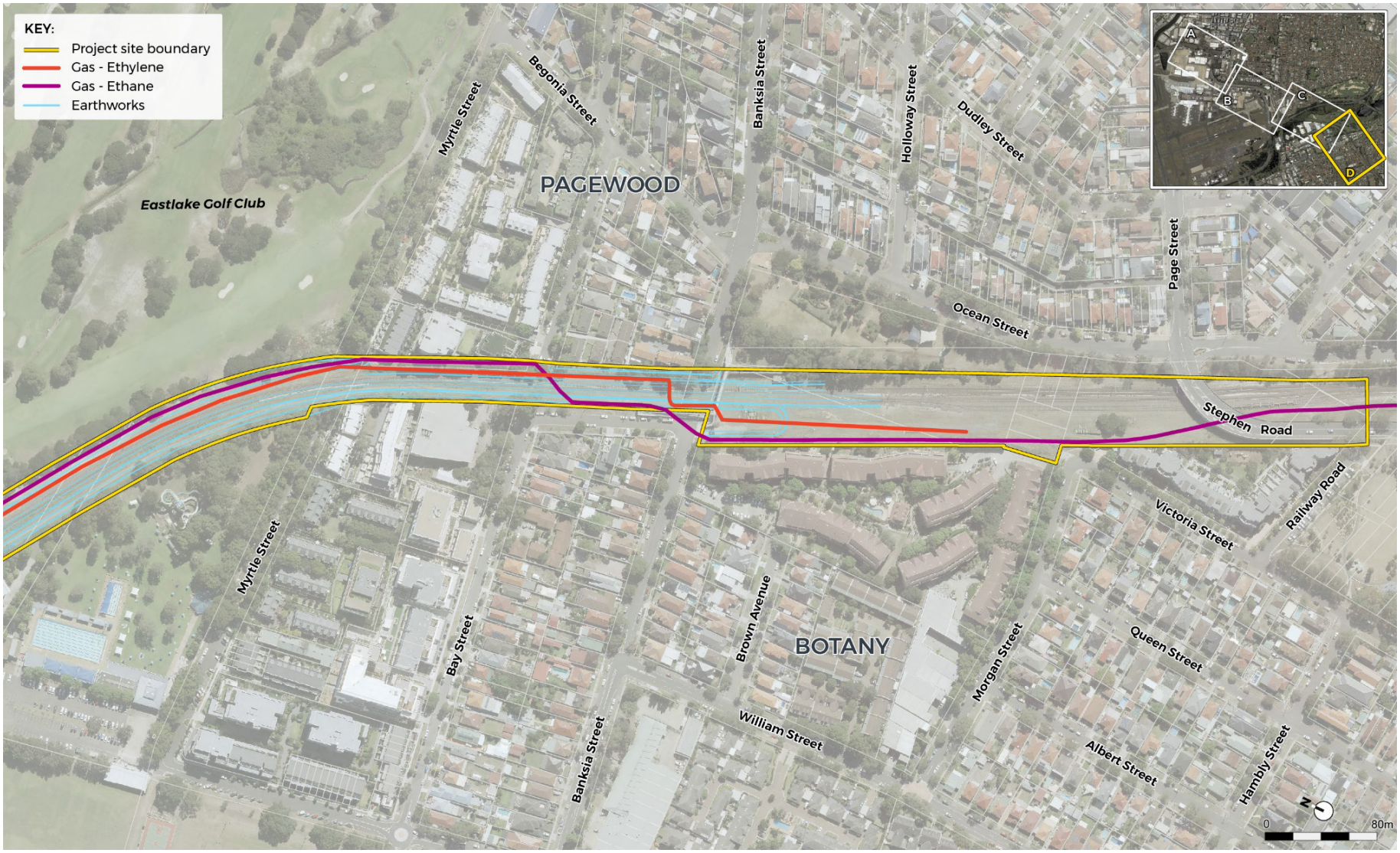


Figure 21.1d High pressure gas pipelines in the vicinity of the project

21.2.4 Sydney airport

Airport operations

Sydney Airport has three runways, comprising two parallel runways on an approximate north−south alignment (Runways 16R/34L and 16L/34R) and a cross runway on an east−west alignment (Runway 07/25) (see Figure 21.2). The airport operates in accordance with the *Sydney Airport Curfew Act 1995*, which restricts operations between 11 pm and 6 am the following day.

The obstacle limitation surface at Sydney Airport spans a radius of about 15 kilometres from the runway ends and is part of the prescribed airspace as defined in the *Airports (Protection of Airspace) Regulations 1996*. The obstacle limitation surface is a series of heights associated with each runway at an airport, that define the desirable limits to which objects may project into the airspace around the airport so that aircraft operations may be conducted safely. The obstacle limitation surface is primarily related to operations where pilots are flying in good visibility and using visual cues. Infrastructure and terrain within this area is required to be at a height below the obstacle limitation surface to avoid becoming a hazard to aircraft operations.

The lowest point of the obstacle limitation surface over the project site occurs in the approach and departure path for Runway 07/25. Runway 07/25 is the cross runway on an approximate east−west alignment through the centre of the airport (see Figure 21.2). The obstacle limitation surface model provided by Sydney Airport Corporation Limited shows that this lowest point is at 12.48 metres Australian height datum (mAHD), with the corresponding level of the project at 11.36 mAHD.

Airport safety

The Australian Transport Safety Bureau reports on aircraft incidents. The Bureau reported for 2017 (ATSB, 2018), that aircraft control, followed by terrain collisions, were the most common incident type for aircraft involved in commercial air transport operations for all airports. Wildlife strikes, including bird strike, were the most common type of incident involving both commercial air transport and general aviation operations. Runway events and aircraft control incidents were the most common types of incident reported for recreational aviation.

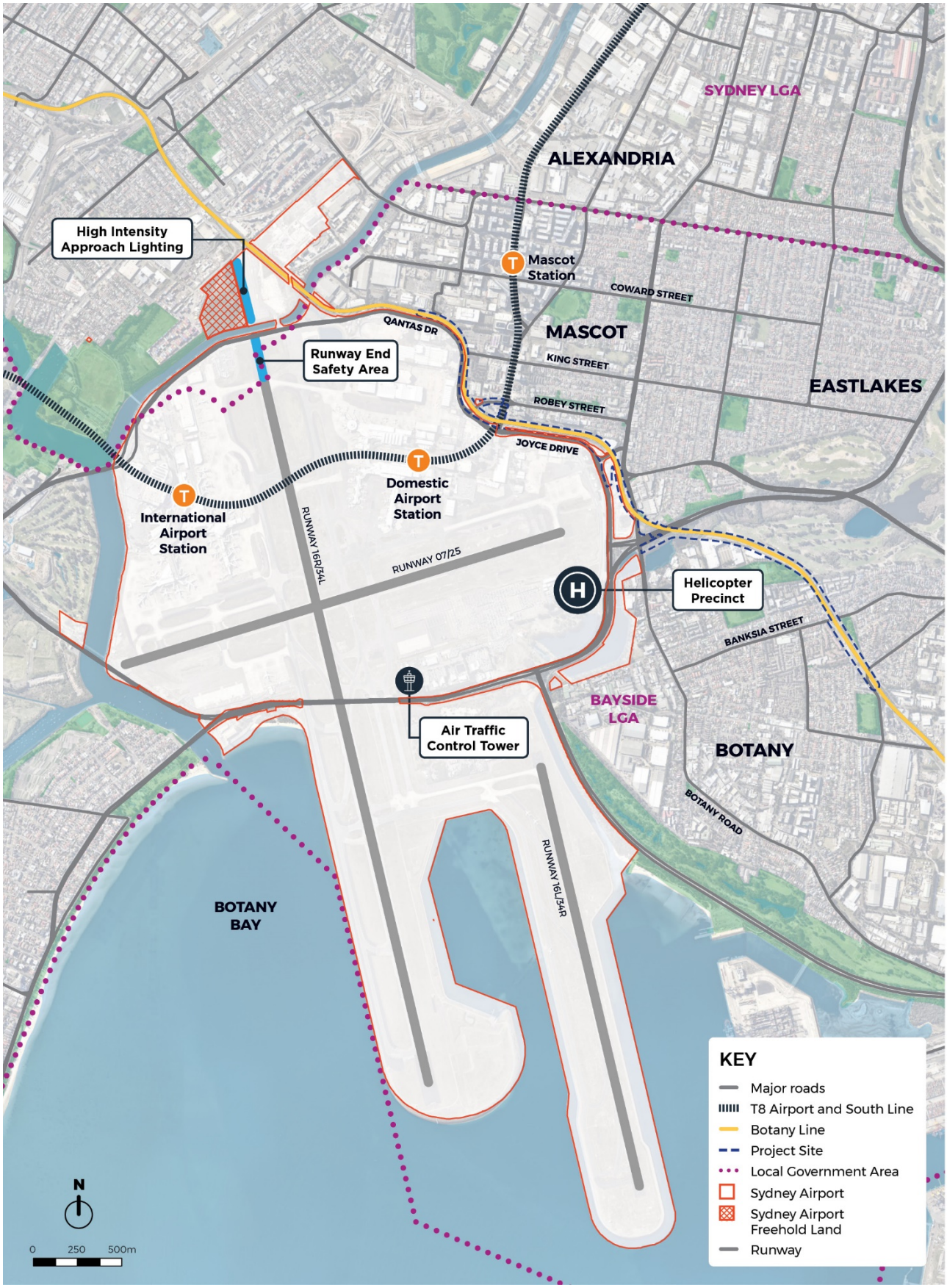


Figure 21.2 Location of key facilities at Sydney Airport

21.3 Assessment of construction impacts

21.3.1 Public safety

Construction of the project would require construction traffic to access the project site and the temporary closure and diversion of some transport routes. Section 7.6 details the potential construction traffic volumes and routes and the temporary road, pedestrian and cyclist route closures and detours during construction.

These changes could result in the following impacts and risks:

- confusion about available routes and access, resulting in traffic collisions between road users, pedestrians and cyclists crossing at unsafe locations or taking the wrong routes
- injury to pedestrians, cyclists or vehicles users passing construction areas from falling objects, collapse of structures such as walls or materials being dropped during loading/unloading
- injury to pedestrians, cyclists, vehicles users or property damage from collision with construction vehicles.

Site management plans would be prepared prior to the commencement of the enabling works and a construction traffic and access management plan (CTAMP) to manage construction traffic for the main construction works. The aim of the management plans would be to ensure appropriate practices are adopted to maintain the safety of road users within and near the site. This would include providing safe movement of traffic for both the general public and construction workers through defined routes, diversions, signage, safe crossing points for pedestrians and cyclists and the allocation of traffic management staff, if needed. Deliveries and loading/unloading activities would be restricted to areas specified within the construction traffic management plan and separated from the general public and transport routes.

Standard mitigation measures relating to construction methodology, layout of compounds sites and hoardings would be detailed in the relevant management plan. Construction methodologies would include avoiding lifting of equipment above pedestrian routes and appropriate hoarding to contain construction activities within the project site.

The potential for the above activities to cause safety impacts is considered to be low, based on works being undertaken in accordance with NSW workplace safety laws. These laws require construction sites to have adequate site security, which includes fencing and hoarding to separate construction activities from the community. Where impacts are not mitigated through the use of hoarding (separating the person from the risk) active traffic management would be used to minimise the potential for impacts as construction vehicles and equipment access the project site.

A number of other construction activities could result in impacts on the safety of the local community if not properly managed. These include:

- items falling off vehicles during the transportation of equipment and materials to and from the project site
- potential for risks to pedestrian/public safety resulting from unauthorised access to construction work areas including the rail corridor.

Safety risks during construction and transportation of materials by road or rail would be managed through the relevant management plans. These would include the implementation of standard workplace health and safety requirements including the requirements of the *Australian Code for the Transport of Dangerous Goods by Road & Rail* (National Transport Commission, 2017). The risk of an incident is considered unlikely.

The potential for unauthorised access to result in safety risks is considered unlikely, based on NSW workplace safety laws. This requires construction sites to have adequate site security, which includes appropriate fencing and access restrictions. The construction contractor would need to ensure that construction sites are secure at all times, construction plant and equipment could not be activated by unauthorised persons and take all possible actions to prevent entry by unauthorised persons. Security fencing along the rail corridor would be maintained during the construction phase.

21.3.2 Transportation and handling of dangerous goods

Hazardous materials are defined by Applying SEPP 33 (DoP 2011a) for substances falling within the classification of the *Australian Code for the Transport of Dangerous Goods by Road & Rail* (National Transport Commission, 2017). Dangerous goods are substances that, because of their physical, chemical (physicochemical) or acute toxicity properties, present a risk to people, property or the environment. *Technical Report 14 – Hazard and Risk Assessment* details the assessment of transportation and handling of dangerous goods and a summary is provided below.

Materials required for construction are outlined in section 7.5.3. This may include a number of dangerous goods used during construction of the project. Dangerous goods used and stored on the project construction compound would be those typically expected for a civil/rail construction site and include:

- spray paint, marker paint
- acetylene gas for metal/rail cutting and welding
- liquid propane gas (LPG)
- fuels (diesel, petrol, two-stroke)
- epoxy and resin based concrete repair and adhesives
- mechanical fluids for plant and equipment (oils, lubricants, grease, degreaser, coolants, etc)
- oxygen gas for metal/rail cutting and welding
- cleaning products
- safe-working rail detonators (for worksite protection)
- rail weld kits (thermit igniters)
- cement, grout, ready-mix concrete
- concrete curing compounds and formwork de-bonding
- sealants and joint fillers.

The transportation of dangerous goods for construction would be in quantities below the Applying SEPP 33 (DoP 2011a) transport screening thresholds. Given the frequency of traffic movement of dangerous goods would be low, the potential for an incident is considered unlikely. Mitigation measures for the transportation and handling of dangerous goods are provided in section 21.6.2.

According to Applying SEPP 33 (DoP 2011a), if any of the screening thresholds are exceeded then the proposed development would be considered a ‘potentially hazardous industry’ and a preliminary hazard analysis is required. The results of the dangerous goods and transport screening indicate that the project would not result in any of the thresholds being exceeded. As a result, the project is not considered to be ‘potentially hazardous’ and a preliminary hazard analysis is not required.

An assessment of the air quality, noise and vibration of the project has been completed as part of the EIS. These assessments determined that the project would meet the relevant amenity criteria throughout the life of the project with the implementation of appropriate management measures.

On this basis, the project is not considered to be ‘potentially offensive’.

21.3.3 Utilities

Initial consultation with key utility stakeholders regarding route alignment, access tracks and preliminary design has already occurred with the aim to limit impact to utility services. This process will continue throughout the remaining project phases. *Technical Report 14 – Hazard and Risk Assessment* details the assessment of utilities and a summary is provided below.

Some works to utilities are considered to be temporary, during construction only, whereas some would be permanent. As part of the project, existing agreements and deeds with utilities providers will be utilised where relevant to manage the interface between utilities and ensure the design, construction and ongoing maintenance of the utilities can be undertaken effectively and efficiently.

Utility service relocation or protection works would be undertaken during the enabling works. A description of the methodology for utilities works is provided in Chapter 7 of the EIS. Table 21.2 provides the findings of the utility hazard identification process. Mitigation measures to minimise the risks are provided in section 21.6.2.

Table 21.2 Utility hazard identification

EVENT	CAUSE(S)	POTENTIAL RESULT(S)	CONSEQUENCE	LIKELIHOOD	RISK PRIOR TO MITIGATION
Telecommunication Utility Strike	Impact during construction	1. Telecommunication service disruption, including customer complaints	1. Minor	1. Unlikely	1. Low
Water Utility Strike – water and sewer	Impact during construction	1. Flooding, including environmental damage/ sink holes	1. Minor	1. Unlikely	1. Low
		2. Health/personal injury	2. Minor	2. Possible	2. Medium
		3. Service disruption, including customer complaints	3. Minor	3. Unlikely	3. Low
Power Utility Strike – gas	Impact during construction	1. Flammable gas release, no ignition but area evacuation.	1. Moderate	1. Unlikely	1. Medium
		2. Flammable gas release, immediate ignition and multiple fatalities	2. Extreme	2. Rare	2. Medium
		3. Flammable gas release, delayed ignition and multiple fatalities	3. Extreme	3. Rare	3. Medium
		4. Property damage	4. Major	4. Rare	4. Medium
		5. Gas service disruption, including customer complaints	5. Minor	5. Unlikely	5. Low
Power Utility Strike – Dangerous goods pipelines	Impact during construction	1. Flammable liquid release, no ignition but area evacuation	1. Moderate	1. Unlikely	1. Medium
		2. Flammable liquid release, immediate ignition and multiple fatalities	2. Extreme	2. Rare	2. Medium
		3. Property damage	3. Major	3. Rare	3. Medium
		4. Soil contamination	4. Moderate	4. Possible	4. Medium
		5. Fuel service disruption, including customer complaints	5. Minor	5. Unlikely	5. Low

EVENT	CAUSE(S)	POTENTIAL RESULT(S)	CONSEQUENCE	LIKELIHOOD	RISK PRIOR TO MITIGATION
Power Utility Strike – electricity (below ground)	Impact during construction	1. Electrocution and single fatality 2. Electricity service disruption, including customer complaints	1. Extreme 2. Minor	1. Rare 2. Unlikely	1. Medium 2. Low
Power Utility Strike – electricity (above ground	Impact during construction	1. Electrocution and single fatality 2. Electricity service disruption, including customer complaints	1. Extreme 2. Minor	1. Rare 2. Unlikely	1. Medium 2. Low

Utility infrastructure that transports high pressure dangerous goods, such as fuels or natural gas, have the largest risk, as a release of these materials, if ignited, could result in a fire or explosion that impacts areas well beyond the study area.

21.3.4 Human health impacts

A health impact assessment is detailed in *Technical Report 13 – Health Impact Assessment* and a summary is provided below.

Air quality impacts

Construction activities associated with vehicle movements, groundworks, vegetation removal, bridge demolition and construction works may cause emissions of dust to be dispersed into the atmosphere. The air quality impact assessment (see Chapter 10) identified dust as the principle risk during construction and outlines the guidelines and criteria which relate to dust emissions. For the assessment of potential health impacts during construction, use of these guidelines and criteria is appropriate and sufficiently protective of health. Where there are impacts predicted during construction that result in exceedance of these guidelines, there is the potential for health impacts.

It is predicted that air quality impacts from dust during construction will meet the criteria within seven metres of the site boundary. There is a low potential for dust generated during construction to exceed these guidelines within the community, particularly where mitigation measures are implemented. Therefore, the potential for health impacts are considered to be low.

The implementation of management measures relating to air quality during construction as outlined in section 10.6 are appropriate for minimising dust impacts to protect health. While health impacts are expected to be low with the implementation of proposed mitigation measures, there may still be some nuisance dust that is noticeable by the community on occasions.

Noise and vibration

The enabling works, main construction works and associated vehicle movements would result in increases in noise and vibration, with the potential to affect surrounding sensitive receivers.

Unlike chemical pollution, noise energy does not accumulate either in the body or in the environment, but it can have both short-term and long-term adverse effects on people. These health effects include (WHO 1999, 2011, 2018):

- sleep disturbance (sleep fragmentation that can affect psychomotor performance, memory consolidation, creativity, risk-taking behaviour and risk of accidents)
- cardiovascular health
- annoyance
- hearing impairment and tinnitus
- cognitive impairment (effects on reading and oral comprehension, short and long-term memory deficits, attention deficit).

Often, annoyance is a major consideration because it reflects the community's dislike of noise and their concerns about the full range of potential negative effects, and it affects the greatest number of people in the population (I-INCE 2011; WHO 2011, 2018).

A number of exceedances of construction noise criteria have been identified for residential and non-residential receptors during the day, evening and night-time periods, for a range of activities. This includes exceedances of the noise criteria by more than 20 dBA. Some receivers are located within the minimum vibration working distance criteria for human comfort. Occupants of these buildings may be able to perceive vibration impacts at times when vibration intensive equipment is in use. These impacts are likely to only occur for relatively short durations. Details of the construction noise and vibration assessment are provided in section 9.3 and mitigation measures for noise impacts provided in section 9.6.

Where the proposed management measures are implemented, the potential for construction noise and vibration to adversely impact community health is minimised. Where mitigation measures are implemented, some noise impacts may occur where works occur close to sensitive receivers. These impacts are expected to be of short duration, but annoyance and potentially sleep disturbance may occur on occasions.

Other potential impacts on health and wellbeing of the community

Changes in the urban environment associated with the project have the potential to result in a range of impacts on health and wellbeing of the community. The potential for changes to result in impacts on health and wellbeing is complex. Changes that may occur have the potential to result in both positive and negative impacts on community health and may include:

- contamination
- increase in traffic
- access and amenity of public facilities such as green space
- visual impact
- economic changes.

Chapter 12 discusses potential contamination risks during construction works. Where the mitigation measures outlined in section 12.4 are implemented, there are no issues of concern in relation to community health.

The project would require the temporary closure of major roads (Robey Street and O'Riordan Street) and some lane closures (including to Southern Cross Drive) to facilitate construction works. These activities would result in delays in the local road network including to bus services and potentially contribute to reduced cohesion and community severance where access to local amenities and social networks is disrupted.

Increased levels of congestion and longer travel times have the potential to increase levels of stress and anxiety in local commuters as well as those that commute to the area for work or travel. Network changes and construction traffic would also affect pedestrian and cycle routes in those areas. Management plans would be developed to manage impacts and minimise delays. While it is unlikely that there would be no delays to traffic in the local area, where the impacts are managed and mitigated as proposed, the potential impacts on community health are expected to be minimal.

Construction of the project may impact the use of green space through temporary impacts relating to noise or visual amenity and the use of McBurney Avenue Reserve as a material storage area during construction. Impacts are anticipated to be minor and no positive or negative impacts expected on community health in relation to project impacts on green space.

Construction of the project will result in some visual changes, with some vegetation being removed and some areas having views of construction compounds and activities. For some individuals, changes in visual amenity can increase levels of stress and anxiety. These impacts, however, are typically of short duration as most people adapt to changes in the visual landscape, particularly within an already urbanised area. As a result, most changes in visual impacts are not expected to have a significant impact on the health of the community.

The economic aspects of the project are where there is the potential to benefit community health. During construction, the peak employment workforce is estimated to be about 270 to 405 people, with indirect benefits on local businesses also identified. These economic benefits are a factor influencing community health with lowered levels of stress and anxiety related to congestion (an improved access to travel and transport) and employment opportunities.

21.3.5 Sydney Airport operations

Construction works have the ability to impact airport operations due to either height of construction plant, construction lighting, or dust production affecting visibility. All these factors can present hazards to arriving and departing aircraft. A full description of the construction assessment relating to Sydney Airport is provided in *Technical Report 15 – Airport Operations Assessment*.

Construction plant

During construction works, it is anticipated that there will be some intrusions into the obstacle limitation surface. This would include activities such as piling, embankment/retaining wall works and cranes required for bridge construction, as well as any other construction activity where plant and equipment is required to be placed within the obstacle limitation surface zone of Sydney Airport (see section 21.2.4).

The track work and backfilling of the retaining walls would require plant (hi-rail dump trucks, excavators, cranes) that would encroach on the obstacle limitation surface. Dump trucks would also be required to operate at full lift while excavators can be operated with height restrictors. The 'Processing Applications under the *Airports (Protection of Airspace) Regulations 1996* Guideline for Operations of Federal Airports' requires any such operations to be approved by the airport operator.

Construction plant associated with the project site, including cranes and piling rigs, would remain below the obstacle limitation surface wherever possible. Where the work area requires cranes to operate within the obstacle limitation surface, a Crane Enquiry Form (Application for Approval of Crane Operation), in line with Sections s.182, 183, the Airports Act, and *Airports (Protection of Airspace) Regulations 1996* – Reg 7 must be completed and submitted to Sydney Airport Corporation Limited.

A number of temporary crane zones would be established where large cranes are required to work. These comprise the Robey Street, O'Riordan Street bridge, Southern Cross Drive and Mill Stream work locations and also at the General Holmes Drive work area. These areas would only be in use during short periods when cranes are required. Some activities that intrude the obstacle limitation surface would be required to be undertaken during the curfew hours of Sydney Airport (between 11 pm and 6 am). Where work is required to be undertaken outside of this time, consultation will be carried out with Sydney Airport Corporation Limited to seek relevant approval exemptions and crane permits (as required).

The construction methodology (described in Chapter 7) identifies where there are operations likely to cause short term intrusion into the airspace. These will be considered further during detailed design in consultation with Sydney Airport Corporation Limited and the relevant approval process followed.

Construction lighting

The Civil Aviation Safety Authority has the power through regulation 94 of the *Civil Aviation Regulations 1988* to require lights, which may cause confusion, distraction or glare to pilots in the air, to be extinguished or modified. The area around Sydney Airport is zoned into maximum lighting intensities protection areas where glare may cause distraction of pilots and the allowed lighting intensity is restricted.

The project site is located within several lighting zones. Flood lighting in the site compounds, which are to operate 24 hours a day, will need to be compliant with the lighting zones and shielded as necessary.

Construction dust, noise and vibration

There is potential for air quality emissions to occur during the construction of the project. The principle activities which may result in emissions include:

- dust and particulate matter emissions from earth working activities
- combustion and pollutant emissions from construction vehicle and plant exhaust.

During construction there is a risk of excessive dust production. Section 10.3 discusses the potential impacts from dust and section 10.6 identifies mitigation measures to minimise impacts from dust. To maintain visibility in the airspace surrounding the airport, dust levels would be kept at a minimal level.

The main potential sources of vibration from the construction works are vibratory rollers and rockbreakers. Impacts are discussed in detail in section 9.3. Construction noise and vibration would not have any impact on aviation operations.

Wildlife strikes

Wildlife strikes, including bird strikes, are a hazard to air transport and general aviation operations. Construction activities may lead to accumulation of waste that attracts birds. Relevant management plans would address and avoid this risk through waste management strategies. Temporary site drainage would be required to avoid ponding water that could attract birds.

Overall, the risk of attracting wildlife during the construction phase of the project is considered negligible.

21.4 Assessment of operational impacts

21.4.1 Public safety

Following completion of construction of the project, road, pedestrian and cycle facilities would be reinstated in a similar or same location, as described in section 6.1. Therefore, there would be no additional impacts on the safety of road users, pedestrians and cyclists from operation of the project.

The new rail bridges over Robey Street bridge, O'Riordan Street bridge, Southern Cross Drive bridge and Mill Stream bridge would extend the existing road, cycle and pedestrian routes which go under the rail bridges. The lighting design for the connections under the bridges would achieve adequate illumination during the night time.

The new structures such as bridges, embankments and retaining walls would be designed with appropriate tolerances to windshear, scour and potential collapse and would meet appropriate standards. Therefore, any safety issues related to collapse of structures is considered to be low.

21.4.2 Dangerous goods

The transportation to the project site of dangerous goods needed for maintenance activities would be infrequent and would be in quantities below the Applying SEPP 33 (DoP 2011a) transport screening thresholds. Given the traffic movement of these dangerous goods would be low, the potential risk during transportation is not considered to be significant. There would be no storage of dangerous goods in the project site during the operation and maintenance of the project. Therefore, there are no operational or maintenance impacts to be considered.

Management of the rolling stock and goods transported would continue to be managed by the rail operators, as is currently done.

21.4.3 Utilities

The key risk and hazard aspects to the project are related to the utility services. Utility protection from maintenance activities during operation would be considered in the Pipeline Safety Management Study (SMS). This will occur during the detailed design phase of the project, once design has reached a level that enables completion of a compliant AS 2885.6 process.

21.4.4 Human health impacts

A health impact assessment is detailed in *Technical Report 13 – Health Impact Assessment* and a summary is provided below.

Air quality

The principle source of air emissions during operation of the project would be from the diesel exhaust of locomotives. The data used to evaluate health impacts relates to key pollutants derived from locomotives, which are benzene, CO, SO_2, NO_2, $PM_{2.5}$ PM_{10}. Where air quality modelling has predicted increases in pollutant concentrations (relevant to emissions from diesel locomotives), these were low and were not considered to be of significance or of concern in relation to community health. Details are provided in *Technical Report 13 – Health Impact Assessment* and are summarised below:

- Maximum concentration of hydrocarbons from the project are only 1.6 percent of the NSW EPA criteria (for benzene). On this basis, there are no community health impacts of concern for hydrocarbon emissions and no further detailed assessment of potential health impacts has been undertaken.
- All the concentrations of carbon monoxide identified are well below the relevant health based standards/guidelines. The contribution from the project is very small. Therefore, there are no health impacts of concern in relation to the project.
- All predicted concentrations of SO_2 are well below the adopted health based criteria. There are no health issues of concern in relation to all (acute and chronic) exposures to SO_2 in the local community.
- The calculated risks for community exposures to nitrogen dioxide indicate that all risks are considered to be within an acceptable threshold. On this basis there are no health risk issues of concern in relation to changes in nitrogen dioxide in the community.
- Concentrations of $PM_{2.5}$ and PM_{10} are essentially unchanged within the local community with the operation of the project. On this basis, there are no health risk issues of concern in relation to $PM_{2.5}$ and PM_{10} in the community.

Noise

Rail noise is caused by the combination of rolling noise (noise from wheels on the rails, including squealing of wheels) and idling/propulsion noise (from locomotives). The main health effects that can arise from this noise impact include annoyance, sleep disturbance, cardiovascular disease, stroke and memory/ concentration (cognitive) effects.

Without mitigation there are a number of residential and other properties where noise levels exceed the adopted operational noise criteria that are designed to be protective of health. Section 9.4 details the operation noise assessment. In summary, predicted noise levels would exceed noise criteria thresholds (daytime and night-time) at a number of locations:

- around King Street
- near Baxter Road
- near Botany Road and McBurney Avenue
- along Myrtle Street.

The predicted increases in noise levels during the day and night-time periods from rail noise are below a level where health impacts from annoyance and sleep disturbance are considered to be unacceptable. Therefore, noise increases predicted in these areas are unlikely to be associated with unacceptable increases in health impacts.

The total noise levels in these areas, which includes the maximum noise levels, exceed the following thresholds suggested by the WHO (2018):

- thresholds for adverse health effects related to environmental noise
- thresholds for minimising rail noise impacts.

Minimising noise impacts from rail noise will therefore minimise health impacts within the community.

The use of at-property noise management treatments (such as higher performance windows, doors and seals), which are suggested as a final mitigation measure, can have a number of subsequent impacts on residential amenity. Negative impacts which may arise from at-property treatment include:

- the measure only mitigates the impact within a building. This does not reduce the impact to outside areas (such as balconies or gardens) potentially leading to a reduction in the use and enjoyment of outdoor areas due to increased noise. This may result in increased levels of stress at individual properties
- at-property treatment relies on correct usage. Where incorrectly used, such as opening windows, there remains the potential for adverse health effects, particularly annoyance and sleep disturbance, to occur.

Therefore treatment at or near the source (such as track lubrication treatments) should be the preferred option.

Other potential impacts on health and wellbeing of the community

The project would unlock additional rail network capacity, with improved travel times through the Botany Line resulting in a potential increase in the number of freight rail services supporting the movement of goods. The increased rail capacity has the potential to reduce the number of trucks in the region. The reduction of heavy vehicle traffic on the road network would not only free up capacity for general traffic, it also has the potential to provide road safety advantages. These impacts have the potential to improve health and wellbeing within the community through the provision of employment, easier access to employment, reduced levels of stress and anxiety.

The project would have no impact on the road network or public transport network upon completion. Therefore, there would be no health impacts.

Once operational the project would not affect existing community access or cohesion in the local area and would therefore not contribute to community severance.

The operation of the project will result in some visual changes to the project site. This includes a second rail line and increased rail movements. Once construction is complete, the project would reinstate, where feasible, to provide visual screening. This may result in some visual changes in some areas. These visual changes are not significant and would not be expected to significantly impact on community wellbeing.

21.4.5 Sydney airport operations

Operation of the Botany Rail Duplication project could create further hazards to airport and aircraft operations. A full description of the assessment relating to Sydney Airport is provided in *Technical Report 15 – Airport Operations Assessment*.

Potential hazards could include:

- light glare from train headlights distracting or confusing pilots
- train heights, and other rail infrastructure heights, infringing the obstacle limitation surface
- maintenance activities infringing the obstacle limitation surface
- bridge structures creating changes in wind turbulence within the airspace
- drainage and landscaping creating attractive habitats for wildlife, increasing risk of wildlife strikes or avoidance manoeuvres.

The following *National Airports Safeguarding Framework Guidelines* (DIRDC, no date) apply to the operational impacts of the Botany Rail Duplication project:

- Guideline B – Managing the risk of building generated windshear and turbulence at airports.
- Guideline C – Managing the risk of wildlife strikes in the vicinity of airports.
- Guideline E – Managing the risk of distractions to pilots from lighting in the vicinity of airports.
- Guideline F – Managing the risk of intrusions into the protected operational airspace of airports.

The potential operational impacts are discussed below.

Light glare

Light glare from train headlights has the potential to distract or confuse pilots as they are arriving or leaving Sydney Airport. The operational project site is located within a light management zone for the airport. Train headlights are currently used on the existing Botany Line and managed within the requirements of the maximum lighting intensities for each lighting zone.

As the trains that will operate on the new line are the same as the current, it is unlikely that there will be a significant change to the direction or type of current light spill. Furthermore, as the trains will not be running parallel to the runway centreline, the risk of pilot confusion is reduced.

Rail and train heights and control tower line of sight

The finished height of the rail line would be below the obstacle limitation surface.

Freight trains currently traveling along the existing Botany Line alignment are classified as transient obstacles that protrude through the obstacle limitation surface for the existing approach to Runway 25 and the existing take-off area for Runway 07. These transient obstacles are currently declared in the Sydney Airport *En Route Supplement Australia* (ERSA) as infringing the obstacle limitation surface by a maximum of 15 feet (4.57 metres) above ground level. The new rail line is adjacent to, and at a similar level as the existing, and therefore trains operating on it will also form transient obstacles.

The project would result in an increase in the frequency of trains on the Botany Line. Consultation with Sydney Airport Corporation Limited, CASA and Airservices Australia will continue with any additional requirements relating to transient obstacles. The information contained in the ERSA may require an update by Airservices Australia and this would be reviewed during detailed design of the project.

The project will not impact on the line of sight of the air traffic control tower to any part of Sydney Airport aircraft movement areas as all works are outside of this area.

Windshear

Turbulence is caused by a disruption to the smooth flow of air. Turbulence in the lower atmosphere is generally created by air flow around an obstacle such as buildings. In accordance with NASF Guideline B, where any developments are proposed in proximity to runways, they should be assessed for potential to create windshear and turbulence that could affect the safety of aircraft.

As there are no significant structures associated with the project, and no significant changes to topography, the windshear or turbulence is not expected to change from the current situation.

Wildlife strikes

Drainage and landscaping within the project site has the ability to attract wildlife that may not have been present in the area previously.

The majority of the project is located within the existing rail corridor and therefore landscaping will be limited to revegetation of cleared areas. The project also requires removal of vegetation rather than creation of new areas of landscaping. Overall, the risk of attracting wildlife during the operational phase of the project is considered negligible.

21.5 Cumulative impacts

21.5.1 Overview

The methodology of the cumulative impact assessment and details of other projects considered are detailed in Chapter 24. A summary of the predicted cumulative impacts which relate to hazards, health and safety are described below.

21.5.2 Cumulative construction impacts

Dangerous goods cumulative impacts could occur if large quantities of dangerous goods are located in close proximity. Due to the small quantity of dangerous goods expected to be associated with other proposals (see section 23.1 for a list), it is not anticipated that there are any cumulative impacts from the use or transportation of dangerous goods in combination with other projects.

Due to the co-location of some project areas, a cumulative impact associated the Sydney Gateway road project exists. This cumulative impact is associated with the disturbance of utility services. Co-ordination of utility relocations would be considered as some utilities have relocation requirements for both projects.

The Sydney Gateway road project includes the following potential impacts on airport operations, in relation to Runway 16R/34L (see Figure 21.2):

- intrusion into prescribed airspace during construction phase
- potential lighting glare during construction, and from vehicle headlights during operation.

Similar to the Botany Rail Duplication, these issues are not expected to result in impacts on aviation safety, as it is expected that relevant legislation and other guidelines would be followed. Consultation would be carried out with Sydney Airport Corporation Limited to seek relevant approval exemptions and crane permits (as required).

Impacts on health that are of particular importance relate to construction fatigue. Fatigue can be caused when communities are impacted concurrently and consecutively by multiple projects impacting the same area. When considering construction fatigue, the main concerns include dust generation, noise and vibration, traffic and transport (including congestion, pedestrian access and cycle access) and visual amenity. Where these impacts occur for extended periods of time, there is the potential that increased levels of stress and anxiety may also continue for extended periods of time.

21.5.3 Cumulative operational impacts

It is not anticipated the project in combination with other projects would provide any cumulative impacts with the project in relation to hazards and risk, provided all proposed mitigation measures are implemented.

Other approved infrastructure projects in the local area are aimed at improving infrastructure, connections and access within the urban environment. Therefore on a broader scale, Botany Rail Duplication and the other longer-term projects, may assist in reducing stress and physiological and mental health impacts associated with living and working within the urban environment.

21.6 Management of impacts

21.6.1 Approach

As described in the EIS Chapter 6 (Project features and operation) and Chapter 7 (Construction), design development and construction planning has focussed on avoiding or minimising the potential for environmental impacts during all key phases of the process. Measures taken to avoid or minimise impacts which relate to airport operations include:

- design in conjunction with the Sydney Airport protected airspace data
- construction method statements to be developed in conjunction with legislation, policies and guidelines, in particular the National Airports Safeguarding Framework.

In order to manage the risk to high pressure pipeline, a series of AS 2885.6 safety management study workshops with impacted pipeline owners would be conducted, to demonstrate threats to each pipeline can be appropriately managed during construction and operation. The safety management study workshops will be conducted once design has reached a level that enables completion of a compliant AS 2885.6 process.

A full description of the approach to environmental management and mitigation is provided in Chapter 24.

21.6.2 List of mitigation measures

The mitigation measures that would be implemented to address potential hazards, health and safety impacts are listed in Table 21.3. This table also outlines which mitigation measures (during the construction stage) would be implemented during the enabling works and main construction works.

Table 21.3 Mitigation measures

STAGE	IMPACT	MEASURE	ENABLING WORKS	MAIN CONSTRUCTION
Design	High pressure flammable material released from pipeline	Independently facilitated AS 2885.6 SMS workshops will be completed with each high pressure pipeline owner and the construction contractor. The SMS workshops will be conducted once design has reached a level that enables completion of a compliant AS 2885.6 process. This level is considered to be detailed design for construction and will be completed before construction relating to the relevant utilities commence.	N/A – Design phase	N/A – Design phase
	Disruption of utility services	The location of key utility infrastructure which relate to the project site and proposed construction works will be identified and documented in the relevant design drawings and reports, prior to construction works commencing.	N/A – Design phase	N/A – Design phase
	Disruption of utility services	Details of proposed works for key utilities, such as relocate or protect will be confirmed prior to construction works commencing.	N/A – Design phase	N/A – Design phase
	Wind shear and turbulence due to new constructions in the vicinity of the airport	Based on the current design, detailed windshear assessment is not warranted. Consultation with Sydney Airport Corporation Limited is required to confirm any need for detailed assessment in accordance with *National Airports Safeguarding Framework Guideline B* during detailed design.	N/A – Design phase	N/A – Design phase
	Light glare distracting and confusing Sydney Airport aircraft pilots	Lighting associated with operation and maintenance of the rail line, including train headlights, will comply with the CASA Manual of Standards 139 section 9.21 and National Airports Safeguarding Framework Guideline E.	N/A – Design phase	N/A – Design phase
	Rail and train heights infringing the Sydney Airport obstacle limitation surface	The rail alignment has been designed in conjunction with the protected airspace associated with Sydney Airport to minimise the intrusions into the airspace. Consultation with Sydney Airport Corporation Limited will be undertaken during detailed design on the final rail alignments and heights. Consultation with Airservices Australia will be undertaken during detailed design for assessment of any required updates to the ERSA.	N/A – Design phase	N/A – Design phase

STAGE	IMPACT	MEASURE	ENABLING WORKS	MAIN CONSTRUCTION
	Wildlife strikes to Sydney Airport aircraft due to increased wildlife activity in the vicinity of the airport	Drainage and revegetation has been designed so as not to create high risk environments for attracting additional wildlife. Any changes to the drainage or revegetation design made during detailed design will ensure that no high risk environments for attracting additional wildlife are created.	N/A – Design phase	N/A – Design phase
	Cumulative impacts on utility services (Sydney Gateway road project)	Coordination of utility relocations will be considered before enabling works commence.	N/A – Design phase	N/A – Design phase
Construction	Risks to infrastructure from utility works during enabling works	The site EMPs will include a section specific to utility management and utility protection.	✓	
	Risks to public safety from general construction activities	Construction-related risks related to public safety from general construction activities (listed in section 21.3.1) will be incorporated into the relevant management plans with measures to minimise and manage risks.	✓	✓
	Chemical and explosive management	The management of all chemicals and detonators used during construction will comply with the relevant Australian Standard.	✓	✓
	Dangerous goods use and storage quantities exceeded	The relevant management plan will include a review of the required dangerous goods quantities to be used and stored during construction to validate Applying SEPP 33 (DoP 2011a) screening assessment. If the Applying SEPP 33 (DoP 2011a) thresholds levels are not exceeded, no further work is needed. If the Applying SEPP 33 (DoP 2011a) thresholds are exceeded, a preliminary hazard analysis will be completed and provided to DPIE for reference.	✓	✓
	Construction plant infringing Sydney Airport obstacle limitation surface	Management plans will be developed and implemented for the project to ensure that the necessary approvals are sought, particularly for the use of cranes. Use of cranes will comply with *National Airports Safeguarding Framework Guideline F* (DIRDC, no date) Where necessary, use of cranes that would infringe the obstacle limitation surface will be limited to curfew hours and permits obtained from Sydney Airport.	✓	✓

STAGE	IMPACT	MEASURE	ENABLING WORKS	MAIN CONSTRUCTION
	Construction lighting producing light spill in the direction of incoming Sydney Airport aircraft	Management plans will be developed and implemented for the project to ensure the lights proposed for use comply with CASA Manual of Standards 139 section 9.21, and *National Airports Safeguarding Framework Guideline E* (DIRDC, no date).	✓	✓
	Dust production causing visibility issues in the Sydney Airport airspace surrounding the airport	Management plans will be developed and implemented for the project to ensure the construction methods used do not produce excessive amounts of dust, as detailed in section 10.6).	✓	✓
	Risk of wildlife strikes to Sydney Airport aircraft due to attraction of wildlife to areas near airport operations	Management plans will include measures to minimise waste attracting wildlife, particularly birdlife. These will include, but not be limited to: • food waste being stored in covered bins • waste being regularly removed from site	✓	✓
Operation	Disruption of utility services or rail services	Communication with utility service providers during maintenance (both rail and utility) will be undertaken in accordance with the ARTC Safety Management System.	N/A – Operation	N/A – Operation
	Personal injury (within the community) relating to maintenance activities around utilities	Utility maintenance works will be undertaken in accordance with safety protocols prescribed in ARTC's Safety Management System, ARTC's Safety Management System includes requirements for safe work method statements, which will be prepared as required for utility maintenance works.	N/A – Operation	N/A – Operation

21.6.3 Consideration of the interaction between measures

Mitigation measures to control impacts on health and safety of the community and Sydney Airport may replicate mitigation measures proposed for the control of impacts associated with noise, air quality, water quality, contamination, traffic and access, social impacts and waste management.

All mitigation measures for the project would be consolidated and described in the relevant management plan. The plan would identify measures that are common between different aspects. Common impacts and common mitigation measures would be consolidated to ensure consistency and ease of implementation.

21.6.4 Managing residual impacts

A residual risk analysis was undertaken following the impact assessment summarised in this chapter. The results of the residual risk analysis are provided in Appendix B. Residual risks with an assessed level of medium or above are summarised below:

- impact to utilities including pipelines.

Utility service relocation or protection will be carried out during the enabling works for the project. Prior to construction of enabling works, a site environmental management plan will be completed by the construction company. The purpose of this management plan is to describe how the construction company will manage and verify the safety compliance and risk aspects of the project works for the construction and completion phases of the utility works, including reviewing and updating the construction hazard assessment (provided in *Technical Report 14 – Hazard and Risk Assessment*), as required.

The construction hazard assessment will be updated to provide a detailed methodology of the site construction and installation for hazardous situations. The detailed methodology will indicate the potential hazards and the control measures required to mitigate risks to as low as reasonably practicable during the construction stage.

The construction hazard assessment will update and confirm the risk register, which will be treated as a live document to be regularly reviewed during the construction phase. Any information considered to be relevant to the operational phase will be carried forward in the risk register.

22. CLIMATE CHANGE RISK

This chapter provides the climate change risk assessment for the project. A full copy of the assessment report is provided as *Technical Report 16 – Climate Change Assessment*.

22.1 Assessment approach

A summary of the approach to the climate change risk assessment is provided in this section, including the legislation, guidelines and policies driving the approach and the methodology used to undertake the assessment.

22.1.1 Legislative and policy context to the assessment

Relevant legislation, policies, guidelines and standards include:

- *National Climate Resilience and Adaptation Strategy* (Department of the Environment, 2015), which is a Commonwealth guideline that recommends a risk management approach to guide climate resilience building and adaptation. This approach was used to inform the methodology of the climate change risk assessment (see section 22.1.20).
- *The NSW Climate Change Policy Framework* (NSW Government, 2016), which guides NSW climate change policy and programs, outlines that the NSW Government will provide targeted information to assist in climate risk management. This framework led to the NSW Government's NSW and ACT Regional Climate Modelling project (NARCliM), which provides the climate change projections that were adopted for the climate change risk assessment (see Table 22.1).
- *Sea Level Rise Policy Statement* (NSW Government, 2009), which provides the sea level rise benchmarks that were adopted for the climate change risk assessment (5334:2013 Climate change adaptation for settlements and infrastructure, a risk based approach, which follows AS/NZS ISO 31000:2009 (AS/NZS 2009) Risk management – principles and guidelines, was used as the basis for the methodology for the climate change risk assessment (see section 22.1.2).
- *Floodplain Risk Management Guideline: Practical Considerations of Climate Change* (DECC, 2007), which provides guidance for undertaking flood modelling sensitivity analysis. The flood modelling undertaken for *Technical Report 6 – Flooding Impact Assessment* was in line with this guideline and has been used to inform the climate change risk assessment (see section 22.2).

Further discussion regarding the relevant policies and guidelines with respect to climate change are provided in section 3 of *Technical Report 16 – Climate Change Assessment*.

22.1.2 Methodology

Key tasks

The assessment involved undertaking a climate change risk assessment in line with the approach outlined in AS 5334 *'Climate change adaptation for settlements and infrastructure – A risk based approach'.* The assessment involved:

- establishing the climate change context of the project by undertaking a review of the NARCliM and CSIRO climate change projections for climate change variables that are considered relevant to this project and historical baseline data
- undertaking a project-specific risk assessment, which included:
  - risk identification through:
    - reviewing the project design in consultation with a multidisciplinary team of designers and environmental specialists
    - reviewing previous climate change risk assessments undertaken for similar asset types
    - consideration of potential impacts that different climate change variables may have on the project components
  - risk analysis through consideration of the likelihood and consequence of the risks identified
  - risk evaluation through combining the likelihood and consequence into an overall risk rating using a risk level matrix
- proposing risk treatment/adaptations for the extreme, high and medium risks identified.

To assist with risk identification, flood modelling was undertaken by Lyall & Associates to assess the potential impacts of increases in rainfall intensity and sea level rise due to climate change on the project (see *Technical Report 6 – Flooding Impact Assessment*). The scenarios modelled were:

- **Scenario 1** – based on an assumed 10 percent increase in currently adopted design rainfall intensities, together with a rise in sea level of 0.4 metres.
- **Scenario 2** – based on an assumed 30 percent increase in currently adopted design rainfall intensities, together with a rise in sea level of 0.9 metres.

A review of risks assessments undertaken for similar asset types was also undertaken to inform this assessment.

More information on the flood modelling that was undertaken to inform this climate change risk assessment is provided in *Technical Report 6 – Flooding Impact Assessment* and section 4.3 of *Technical Report 16 – Climate Change Assessment.*

A detailed description of the overall climate change risk assessment methodology is provided in section 3 of *Technical Report 16 – Climate Change Assessment*.

Study area

The study area for the climate change risk assessment is defined by the resolution of the climate change projections adopted, which are used to determine how the climate at the project site is likely to change in the future.

Where possible, the climate change projections from the *Metropolitan Sydney Climate Change Snapshot* (OEH, 2014) have been used in the climate change risk assessment. The *Metropolitan Sydney Climate Change Snapshot* summarises NARCliM projections for the Metropolitan Sydney Region for two timescales; the years 2030 and 2070. These two timescales have been used to assess the 'near future' and 'far future' climate change impacts on the project.

However, for climate change variables not covered by NARCliM, the CSIRO projections for the wider East Coast Cluster Region (which includes Sydney) were adopted (Dowdy, A et al. 2015).

22.1.3 Risks identified

The preliminary environmental risk assessment undertaken for the project (provided in Appendix B) included a potential climate change risk associated with impacts on infrastructure due to increased heat, rainfall and flooding. Prior to the identification and assessment of mitigation measures, this risk was assessed to be a medium level risk. Further information on the risk assessment, including the approach, methodology and the results, is provided in Appendix B. This potential risk and its associated impacts were considered as part of the climate change risk assessment. The assessment also considered matters identified by the SEARs (as described in Chapter 3. The residual risk levels, following further risk assessment (as per *Technical Report 16 – Climate Change Assessment*) based on the implementation of the mitigation measures proposed in this EIS, are discussed in section 22.4.4.

22.1.4 How potential impacts have been avoided or minimised

As described in Chapters 6 and 7, design development and construction planning has included a focus on avoiding or minimising the potential for environmental impacts during all key phases of the process.
As discussed in section 22.4, potential climate change risks would be minimised through implementation of design treatments and adaptation measures.

22.1.5 Existing and future environment

Existing climate

Historic data from the closest Bureau of Meteorology weather station to the project site, the Sydney Airport weather station, which is located within a four kilometre distance of the project site, shows that for the project site:

- most of the annual rainfall occurs in the first six months of the year, with June being the wettest month
- the highest recorded daily rainfall was 216.2 mm, which occurred on 3 Feb 1990
- the mean maximum temperatures during summer range from 25.9°C to 26.6°C
- the mean maximum temperatures during winter range from 17.1°C to 18.4°C
- the highest temperature recorded was 46.4°C, which occurred on 18 January 2013.

Further information on the local climate is provided in section 4.1.2 of *Technical Report 16 – Climate Change Assessment*.

Climate change projections

Climate change has the potential to alter the frequency, intensity and distribution of extreme weather related natural hazards, including more intense and frequent heat waves, droughts, floods and storm surges.

Table 22.1 summarises the adopted climate change projections for the project site in the near future (2030) and far future (2070).

Table 22.1 Climate change projections adopted

	2030	2070	SOURCE
Projected temperature changes			
Maximum Temperature	Maximum temperatures are projected to increase in the near future by 0.7°C (0.3–1.0°C)	Maximum temperatures are projected to increase in the far future by 1.9°C (1.6–2.5°C)	NARCliM
Minimum Temperatures	Minimum temperatures are projected to increase in the near future by 0.6°C (0.4–0.8°C)	Minimum temperatures are projected to increase in the far future by 2.0°C (1.4–2.5°C)	NARCliM
Hot days	The number of hot days will increase in the near future	The number of hot days will increase in the far future	NARCliM
	Average change +4 hot days per annum above 35°C	Average change +11 hot days per annum above 35°C	NARCliM
Cold nights	The number of cold nights will decrease in the near future	The number of cold nights will decrease in the far future	NARCliM
	Average change of 5 fewer cold nights per annum below 2°C	Average change of 12 fewer cold nights per annum below 2°C	NARCliM
Projected rainfall changes			
Mean Rainfall	Rainfall is projected to decrease in spring and increase in autumn	Rainfall is projected to decrease in spring and winter. Rainfall is projected to increase in summer and autumn	NARCliM
Rainfall Intensity	The intensity of rainfall events is projected to increase in the far future*		CSIRO
Projected sea level rise changes			
Sea level is projected to increase 0.08 to 0.18 m above 1986–2005 levels in the near future*		Sea level is projected to increase 0.4–0.55 m above 1986–2005 levels in the far future*	CSIRO
Projected forest fire danger index (FFDI) changes			
Average fire weather is projected to increase in spring in the near future		Severe fire weather days are projected to increase in summer and spring in the near future	NARCliM
Projected wind speed changes			
Minimal change in mean surface wind speed with an increase in the frequency of high intensity east coast lows that result in damaging winds in the near future.		Minimal change in mean surface wind speed with an increase in the frequency of high intensity east coast lows that result in damaging winds in the far future.	NARCliM CSIRO
Lightning			
The frequency of lightning strikes is predicted to increase in the near and far future.			DECCW

* See section 4.3 in *Technical Report 16 – Climate Change Assessment* for an explanation of the rainfall intensity and sea level rise scenarios considered in this assessment

Source: NARCliM projections from Metropolitan Sydney Climate Change Snapshot, OEH, 2013b

Source: CSIRO projections from East Coast Cluster Report, (Dowdy, A et al. 2015)

22.2 Assessment results

The potential climate change risks during construction are considered to be minimal, as the climate would not change noticeably within the short-term. Therefore, the focus of the climate change risk assessment was to identify and assess potential climate change risks relevant to the operation of the project.

Table 22.2 summarises the key climate change risks that may result in impacts during operation of the project (see section 5.2 in *Technical Report 16 – Climate Change Assessment* for further detail). A revised risk rating has also been provided to illustrate the likely residual climate change risk if the proposed treatment/adaptation measures are implemented (see section 22.4).

Table 22.2 Potential climate change risks identified during operation of the project

CLIMATE VARIABLE/ HAZARD	DESCRIPTION OF POTENTIAL IMPACT ON PROJECT	RISK RATING WITHOUT ADAPTATION MEASURES	RISK RATING WITH ADAPTATION MEASURES
Increase in rainfall intensity combined with sea level rise	Localised flooding resulting in inundation of the rail tracks on sections of the Botany Line.	Low – Direct risk on operations	Low – Direct risk on operations
	Localised flooding causing scour of the track formation and ballast, requiring replacement and increasing the need for maintenance.	Medium – Direct risk on operations and maintenance	Medium – Direct risk on operations and maintenance
	Flooding of the corridor access road near Southern Cross Drive and between Botany Road and Southern Cross Drive, resulting in access restrictions for maintenance vehicles during significant rainfall events.	Low – Direct risk on operations and maintenance	Low – Direct risk on operations and maintenance
	Reduced performance of surface drainage systems caused by increased rainfall intensity and localised flooding.	Medium – Direct risk on operations and maintenance	Low – Direct risk on operations and maintenance
	Damage to the communication and signalling equipment due to flooding, requiring replacement of equipment and causing disruptions to services.	High – Direct risk on operations and maintenance	Medium – Direct risk on operations and maintenance
Extreme high temperatures (and increased mean maximum temperature)	Track buckling and potential derailment of trains.	Medium – Direct risk on operations and maintenance	Medium – Direct risk on operations and maintenance
	Increased frequency of reduced track speeds and rail track inspections due to increased risk of track buckling.	Medium – Direct risk on operations	Medium – Direct risk on operations
	More frequent malfunctioning of communication and signalling systems resulting in delays on the rail network.	Medium – Direct risk on operations and maintenance	Low – Direct risk on operations and maintenance
	High demand on the wider electricity grid leading to blackouts of the overall network and back-up supply, disruption to signalling systems and delays on the rail network.	Medium – Indirect risk on operations and maintenance	Low – Indirect risk on operations and maintenance
	Increased frequency of thunderstorms and associated lightning strikes resulting in damage and potential failure of signalling systems.	Medium – Indirect risk on operations and maintenance	Low – Indirect risk on operations and maintenance

CLIMATE VARIABLE/ HAZARD	DESCRIPTION OF POTENTIAL IMPACT ON PROJECT	RISK RATING WITHOUT ADAPTATION MEASURES	RISK RATING WITH ADAPTATION MEASURES
	Maintenance staff unable to performance maintenance tasks due to extreme temperature events.	Medium – Direct risk on operations and maintenance	Low – Direct risk on operations and maintenance
	Extreme heat resulting in heat stress and adverse health effects for maintenance staff.	Medium – Direct risk on operations and maintenance	Medium – Direct risk on operations and maintenance
More frequent extreme wind events	Increased likelihood of damage to signalling infrastructure, lighting and large billboards that span across the corridor resulting in debris on the rail line causing delays.	Low – Direct risk on operations and maintenance	Low – Direct risk on operations and maintenance
	Damage to vegetation adjacent to the alignment which can become a hazard on the trail tracks.	Medium – Direct risk on operations and maintenance	Low – Direct risk on operations and maintenance
Increased frequency of bushfires	Increased frequency of bushfires in bushland areas causing smoke, low visibility for drivers and adverse health impacts for operational and maintenance staff.	Low – Indirect risk on operations and maintenance	Low – Indirect risk on operations and maintenance
	Increased frequency of bushfires leading to damage of the electricity grid resulting in blackouts of the overall network and back-up supply, disruption to signalling systems and delays on the rail network.	Low – Indirect risk on operations and maintenance	Low – Indirect risk on operations and maintenance

As identified in Table 22.2, no extreme risks were identified in the climate risk assessment. One high risk was identified in relation to the failure of communications and signalling systems caused by flooding, as a result of an increase in rainfall intensity combined with sea level rise.

22.3 Cumulative impacts

Cumulative climate change impacts are typically related to cumulative flooding impacts, which may be worsened under future climate change conditions. *Technical Report 6 – Flooding Impact Assessment* determined that the project is likely to result in localised and minor flooding impacts under current climate conditions, which would result in negligible to minor cumulative flooding impacts. As the flooding impacts from the project would only be slightly increased under future climate conditions (see section 13.4.4), the cumulative flooding impacts associated with climate change (during operation of the project in the future) are expected to be minor.

Other climate change related impacts on the project, such as those associated with extreme high temperatures, more frequent extreme wind events or increased frequency of bushfires (see section 22.2), would not interact with aspects beyond the project site, and are therefore unlikely to result in cumulative impacts.

22.4 Management of impacts

22.4.1 Approach

The project has been designed and would be constructed and operated to be resilient to the future impacts of climate change. Adaptation strategies would be further developed and incorporated into the detailed design of the project to futureproof the assets. A list of potential adaptation measures to minimise climate change related risks during operation of the project has been provided in section 5.2 of *Technical Report 16 – Climate Change Assessment* and Table 22.3.

22.4.2 List of mitigation measures

The mitigation measures that would be implemented to address potential climate change impacts are listed in Table 22.3 (see section 5.2 in *Technical Report 16 – Climate Change Assessment* for more detail). No mitigation measures are proposed for the construction phase of the project, as the effects of climate change would not be noticeable in the short-term (see section 22.2).

Table 22.3 Mitigation measures

STAGE	IMPACT	MEASURE
Design	Climate change resulting in a range of potential impacts on the asset that can be mitigated through design	Measures to mitigate any extreme, high and medium climate change risks will be further refined and included in the detailed design to ensure there are no residual extreme or high climate risks, and minimise medium risks where practicable. The following potential measures will be considered: • designing drainage systems to consider the increase in rainfall intensity due to climate change • locating new rail systems infrastructure above predicted climate change flood levels, where practicable • placing cable routes outside climate change flood inundation zones where feasible • adjusting the neutral point when specifications are prepared for the stressing of steel rail to account for likely temperature variations and increases in average maximum temperatures • selecting equipment that is resilient to the projected temperature changes over its design life • designing ventilation systems for signalling equipment rooms/location cases to account for increased temperatures due to climate change • connecting to existing system at the site where UPS changeovers are provided to bridge power supply when changing from electricity network to critical infrastructure back-up supply to reduce risk of power failure • limiting outside exposure of cables where possible, ensure the installation of surge protection and provide a redundant power source to reduce likelihood and impacts of lightning strikes to exposed cables • reducing the number of signalling cabinets to reduce the amount of exposed cabling.

STAGE	IMPACT	MEASURE
Operation	Risk of extreme weather event affecting infrastructure and operations	ARTC's Asset Management System includes provision for regular inspections and maintenance. In accordance with ARTC's Asset Management System. Inspections of drainage infrastructure will be undertaken, to ensure operating at design capacity.
	Risk of extreme weather event affecting infrastructure and operations	Equipment rooms will be designed in accordance with the relevant standards and to consider future extreme heat events due to climate change. Response to such events will be in accordance with ARTC's safety management system and standard operating procedures.
	Risk of extreme weather event affecting infrastructure and operations	Where infrastructure is to be replaced during maintenance, it will be undertaken in accordance with the relevant standards and will consider the most up to date climate change projections. Response to such events will be in accordance with ARTC's standard operating procedures.
	Risk of extreme weather event affecting infrastructure and operations	Weather forecasting will be taken into consideration when planning maintenance works in accordance with ARTC's Standard Management Measures (under the Environmental Management System).

22.4.3 Consideration of the interaction between measures

In addition to the measures for climate change described above, there are interactions between the mitigation measures for hydrology and flooding (Chapter 13), which may also reduce the potential climate change risk during operation of the project.

All mitigation measures for the project are consolidated in Chapter 24 to ensure consistency in implementation.

22.4.4 Managing residual impacts

A residual risk analysis was undertaken following the impact assessment summarised in this chapter, which further defined and assessed the potential climate change risks and implementation of the mitigation measures as recommended in section 22.4.2. The results of the residual risk analysis are outlined in section 5.2 of *Technical Report 16 – Climate Change Assessment*.

In summary, at the end of detailed design there should be no residual extreme or high climate change risks. Residual risks with an assessed level of medium (following implementation of adaptation measures) include:

- increased rainfall intensity combined with sea level rise potentially resulting in:
  - localised flooding causing scour of the track formation and ballast
  - failure of communications and signalling systems caused by flooding
- increases in average annual temperatures and the number of extreme heat days potentially resulting in:
  - track buckling increasing operational and maintenance costs, causing delays and potential derailments
  - heat stress and adverse health effects for maintenance staff
- increases in the frequency of extreme wind events resulting in:
  - damage to vegetation adjacent to the alignment which can become a hazard on the rail tracks.

23. CUMULATIVE AND RESIDUAL IMPACTS

This chapter provides an assessment of the potential cumulative impacts. It describes other projects in the study area and identifies where there is the potential for cumulative impacts to occur. It also provides an assessment of the potential for residual impacts following implementation of the mitigation measures provided in chapters 8 to 22.

23.1 Assessment approach

When a project is assessed in isolation, the environmental impacts and benefits may not be considered large. However, when combined with other projects, the resultant cumulative effects may result in a greater extent, magnitude or duration of impact. Identifying the potential for cumulative impacts assists in guiding the development of appropriate mitigation measures.

The selection of proposed developments assessed as part of this cumulative impact assessment was based on a number of criteria including:

- the proximity of the project to the Botany Rail Duplication project
- the likelihood of the project being constructed during a similar time as the Botany Rail Duplication project
- the size of the project and the potential to result in substantial changes to identified key issues (such as traffic, air quality noise and vibration etc) or substantial changes to the existing land use of the area
- the likelihood of the project being constructed given its pre-approval status and support from relevant government planning strategies and local environmental plans.

Other projects with the potential for cumulative impacts with the Botany Rail Duplication project were identified during internal workshop discussions, consultation with technical specialists and a review of publicly available information and environmental impact assessments from the following databases:

- NSW Major Projects website (NSW Government, 2019)
- Bayside Council – Development Application search tool (Bayside Council, 2019)
- Australian Government – Department of Environment and Energy, EPBC Public notices list (Australian Government, 2019).

The cumulative assessment has been predominantly qualitative, due to information available at the time of the assessment, with the exception of the following:

- *Technical Report 1 – Traffic and Transport Impact Assessment*, which considered, construction of the Sydney Gateway – Road project, proposed construction staging (and opening of WestConnex) and the completion of key road network upgrades at Airport North and Airport East, in the 2022 future baseline assessment.
- *Technical Report 2 – Noise and Vibration Impact Assessment*, which considered the likelihood of overlapping construction works, and an increase in theoretical worst-case noise levels of around three decibels in modelling. The assessment is based on the assumption, when two construction activities occur at the same time, the resulting increase in noise is three decibels greater than a single noise source.

Projects considered to have the potential for cumulative impact with the Botany Rail Duplication project are listed in Table 23.1 and shown in Figure 24.1.

Table 23.1 Projects with the potential for cumulative impacts

PROJECT/ PROPONENT	DETAILS (INCLUDING PROPONENT)	STATUS (AUGUST 2019)	CONSTRUCTION TIMEFRAME (INDICATIVE)	NEAREST PROJECT LOCATION
Sydney Gateway – Road *Roads and Maritime*	Proposal to build new direct high capacity road connections linking the Sydney motorway network at St Peters interchange with Terminal 1 and Airport Drive in the south and Qantas Drive and Terminals 2/3 in the east.	Proposed	3.5 years from approval	Qantas Drive (immediately adjacent to the project site)
Qantas Training Facility *Qantas*	Proposal to construct a new training centre, internal road network and car parking facilities in Mascot.	Proposed	2019–2021	King Street, Mascot (immediately adjacent to the Project site)
Airport East *Roads and Maritime*	Upgrading of roads to the east of Sydney airport including the removal of the General Holmes Drive rail crossing and the replacement with a road underpass.	Under construction	2015–2020	General Holmes Drive (immediately to the east of the project site)
Airport North *Roads and Maritime*	Upgrading of roads to the north of Sydney airport including the reconfiguration of O'Riordan and Robey Streets.	Under construction	2015–2019	O'Riordan and Robey Streets (immediately adjacent to the project site)
Sydney Airport T2/T3 Ground Access Solutions and Hotel *Sydney Airport*	Proposed staged construction of Ground Access Solutions in the T2/T3 precinct in the north west of the airport. The proposal includes vehicle access modifications, construction of car parking and pedestrian access, a multi-level Ground Transportation Interchange and a 340-room hotel.	Approved – Under Construction	Staged construction 2015–2020, commensurate with demand and planned for completion with WestConnex Enabling works.	Sydney Airport (50 metres to the south of the project site)
WestConnex – New M5 *Roads and Maritime*	Construction of the new M5 consisting of twin underground motorway tunnels, nine kilometres long, from Kingsgrove to a new St Peters Interchange at the site of the old Alexandria landfill facility.	Under construction	2016–2020	St Peters (one kilometre northeast of the project site)
WestConnex M4-M5 *Roads and Maritime*	Construction of a new multi-lane road link (motorway tunnels) between the M4 East Motorway at Haberfield and the New M5 Motorway at St Peters.	Under construction	2016–2023	St Peters (1.5 kilometres northeast of the project site)

PROJECT/ PROPONENT	DETAILS (INCLUDING PROPONENT)	STATUS (AUGUST 2019)	CONSTRUCTION TIMEFRAME (INDICATIVE)	NEAREST PROJECT LOCATION
F6 Expansion – Stage 1 *Roads and Maritime*	Proposed multi lane road (via tunnels) between the New M5 Motorway at Arncliffe and President Avenue Kogarah.	Proposed	2020–2024	Marsh Street, Wolli Creek (2.4 kilometres from the project site)
Sydney Metro – City and Southwest *Transport for NSW*	Proposed new 30 km metro line extending from the end of Sydney Metro Northwest at Chatswood, under Sydney Harbor, through the CBD and south west to Bankstown. From Sydenham to Bankstown project construction will be carried out at surface within the existing heavy rail corridor, while from Chatswood to Sydenham construction will be largely underground.	Under construction	2017–2024	Sydenham Railway Station (2.3 kilometres to the northwest of the project site)
Mascot Intersection *Roads and Maritime*	Intersection upgrades in the suburb of Mascot to help manage congestion and safety, and help address growing freight and travel demand.	Proposed	2019–Unknown	Mascot (multiple locations 850 metres to the north of the project site)
King Apartments *Vanovac Tuon Architects*	Proposed 12 story mixed use building including public car park, hotel and commercial offices located at 324 King Street Mascot.	Approved	Unknown, not identified in DA planning documents.	King Street Mascot (146 metres to the north and east of the project site)

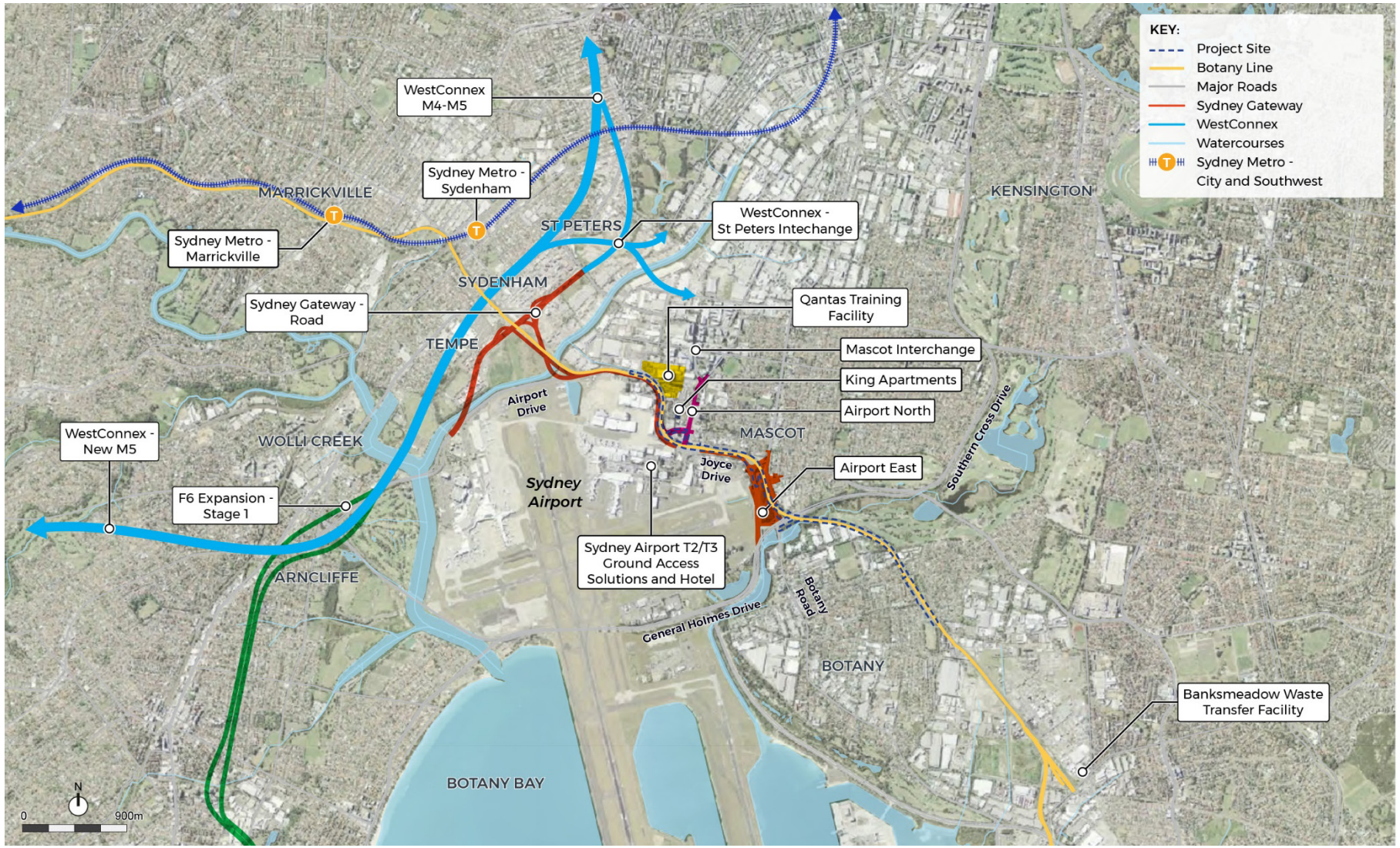


Figure 23.1 Projects with the potential for cumulative impacts with the Botany Rail Duplication project

23.2 Cumulative impacts

This section provides an overview of the cumulative impacts that may occur during the construction and operation of the Botany Rail Duplication project and other major developments.

Of the projects listed in Table 23.1 and shown in Figure 23.1, the Sydney Gateway road and the Qantas Training Facility are the only other major projects considered to result in cumulative impacts due to the potential overlap of construction periods, location of projects and magnitude of potential impacts.

23.2.1 Sydney Gateway road project

Project details

Transport for NSW proposes to build the Sydney Gateway road project to provide a new direct high capacity road connection, linking Sydney Airport and the Sydney Motorway network at St Peters in the north, Terminal 1 and Airport Drive in the south and Qantas drive in the east.

Key features of the Sydney Gateway road project include:

- Terminal 1 connection – a new grade separated section of road connecting Terminal 1 and the Sydney motorway network via St Peters interchange, including a new bridge over Alexandra canal.
- Qantas Drive upgrade and extension – widening and upgrading Qantas Drive and providing a new grade-separated section of road connecting the Sydney motorway network and Terminals 2/3 via a new high-level bridge over Alexandra Canal.
- St Peters interchange connection – a new grade-separated section of road connecting Qantas Drive and the Terminal 1 connection with St Peters interchange.
- Terminal links – two new grade separated sections of road linking Terminal 1 and Terminals 2/3, including a new bridge over Alexandra Canal.
- Terminals 2/3 access – a new grade-separated road connection to Terminals 2/3 from the upgraded Qantas Drive.
- Active transport facilities – realigning the existing shared path and providing connections to other shared paths around Alexandra Canal, Tempe and Mascot.
- Ancillary works – including new sections of road to provide access to airport land, new drainage infrastructure, signage and lighting, protecting/relocating utilities and relocating/adjusting advertising billboards (if required).

Location with respect to the Botany Rail Duplication project

The eastern portion of the Sydney Gateway road project is located immediately adjacent to the northern portion of the Botany Rail Duplication project (shown in Figure 23.1). The existing Botany Line is located parallel to Qantas Drive, where proposed upgrades including widening to accommodate a proposed grade separated road accessing Terminals 2/3.

Timing

It is expected construction of the Sydney Gateway road project and Port Botany Rail Duplication project will overlap. Table 23.2 outlines the indicative construction programs for Sydney Gateway road and Botany Rail Duplication projects. The construction timing would be carefully planned to consider the Sydney Gateway road project with particular emphasis on construction activities around the Robey Street and O'Riordan Street bridges. ARTC would complete ongoing consultation with Transport for NSW regarding the proposed construction program of the projects.

Table 23.2 Indicative construction programs for Sydney Gateway road and Botany Rail Duplication projects

PROJECT	2020				2021				2022				2023				2024			
Botany Rail Duplication																				
Sydney Gateway road project																				

Cumulative impacts

Potential cumulative impacts (assessed as greater than minor in relevant technical reports) that may arise as a result of both projects are summarised in Table 23.3. Key issues where no cumulative impacts are expected have been excluded. A discussion of cumulative impacts (including justification of no cumulative impacts where relevant) is provided in the relevant technical report and chapters.

Table 23.3 Summary of cumulative impact potential of the Sydney Gateway road and Botany Rail Duplication projects

ENVIRONMENTAL IMPACT	POTENTIAL CUMULATIVE IMPACTS WITHOUT MITIGATION
Construction Air Quality	There is potential for a temporary reduction in air quality during construction as a result of emissions and dust from construction vehicle movements in and around the project sites.
Operational Air Quality	There is potential for changes to air quality due to the operation of the two projects, however impacts from the Botany Rail Duplication are likely to be localised and available information pertaining to operational air quality from the Sydney Gateway road project was limited at the time of the assessment.
Construction Noise and Vibration	The construction scenarios for the Sydney Gateway road project are likely to be similar to the construction scenarios assessed in this report. Where construction works for both projects are being undertaken concurrently, nearby receivers in the surrounding area of Mascot (refer to sensitive receivers NCA01, NCA02 and NCA03 in Figure 9.10) may experience a theoretical increase in noise levels of around three decibels when compared with the construction of the Botany Rail Duplication only. However, the most likely outcome of the concurrent construction of the two projects is expected to be an increase in the duration of noise impacts (ie more periods with an impact from either project) experienced by receivers in NCA01, NCA02 and NCA03, rather than an increase in worst-case noise levels.
Operational Noise and Vibration	During operation, receivers near the Joyce Drive and O'Riordan Street intersection would potentially be affected by operational noise from both the Botany Rail Duplication and Sydney Gateway road project associated with a greater number of trains and cars using the area. However, operational noise from different types of transportation (ie road and rail) have different characteristics and result in different annoyance responses from affected communities. A quantitative cumulative assessment of the combined operational noise impacts from the two projects is not possible as the criteria for road and rail noise impacts are different.

ENVIRONMENTAL IMPACT	POTENTIAL CUMULATIVE IMPACTS WITHOUT MITIGATION
Construction Traffic and Transport	Construction of the two projects is likely to increase the overall level of traffic using the existing road network, increasing the potential impact and duration of the traffic delays and other impacts experienced by drivers, pedestrians and cyclists. Construction of the projects would result in traffic detours at the following intersections on up to 10 occasions over three years: • Qantas Drive/Robey Street/Seventh Street where the Level of Service would deteriorate from D to F with an increase in delay of 142 seconds. • General Holmes Drive/Wentworth Avenue where the Level of Service would deteriorate from B to F with an increase in delay of 59 seconds. • Botany Road/Wentworth Avenue where the Level of Service would deteriorate from C to F with an increase in delay of 146 seconds (due to performance changes due to the Robey or O'Riordan Street closure during a weekend works period).
Biodiversity	Construction of the projects would result in the removal of mainly planted vegetation and associated habitat, and would result in the loss of limited natural biodiversity values within restricted and highly modified environments.
Hydrology	Construction of the projects may result in an increased potential for cumulative groundwater quality impacts from increased rainfall infiltration.
Water quality	The projects have an overlapping drainage network, with around 500 metres of the drainage network proposed to be used by both projects, flowing to Alexandra Canal. Given the Botany Rail Duplication project is expected to have a negligible change in flow and water quality conditions, and is not proposed to impact sediments of Alexandra Canal or Mill Stream, the cumulative impact of the project and the Gateway road project would be only marginally worse than the impacts of the Gateway road project alone.
Non-Aboriginal Heritage	The cumulative impacts of the two projects is considered to be moderate to minor. While the two projects will have both direct and indirect impacts on individual heritage items, the cumulative impacts on non-aboriginal heritage relates to a general regional loss of heritage values within an area that has been subject to a high level of modification. The Sydney Gateway road project would result in the following heritage impacts: • construction of four bridges over the SHR-listed Alexandra Canal (considered a major impact to the heritage significance of the item) • demolition of eleven existing structures, their associated landscapes and mature fig trees within the Sydney (Kingsford Smith) Airport Group's heritage curtilage • construction of new road corridors and road connections in the suburbs of Tempe, St Peters and Mascot • construction of three bridges and overpasses over the existing Botany Line • visual impacts on the Mascot (Sheas Creek) Underbridge • potential impacts on State and locally significant archaeology The Botany Rail Duplication project would result in the following heritage impacts: • demolition of two section 170 listed heritage bridges on the Botany Line (considered a major impact to the heritage significance of the item) • remediation of one section 170 listed heritage bridge on the Botany Line • vegetation clearing within Sydney (Kingsford Smith) Airport Group's heritage curtilage • potential vibration impacts (minor) to the locally listed Beckenham Memorial Church • potential impacts on State and locally significant archaeology.

ENVIRONMENTAL IMPACT	POTENTIAL CUMULATIVE IMPACTS WITHOUT MITIGATION
Landscape Character	The cumulative impacts of the projects would increase the influence of the construction activity on the landscape character, particularly in Mascot, near the bridge replacements and retaining wall work at Robey and O'Riordan Streets. The cumulative impacts of the operation of the projects would result in the intensification of the urban character, particularly in the Mascot area. The Sydney Gateway road project would also limit the amount of available space to reinstate vegetation cleared as a result of the Botany Rail Duplication Project between Qantas Drive and the rail corridor.
Visual	The construction of the projects concurrently would increase the scale and extent of the visible construction activity. The removal and limitations on the replacement of vegetation between Qantas Drive and the Botany Line would impact views of road users including the arrival experience to Sydney, adjacent commercial areas and hotels. The operation of the projects would combine to alter views to the vehicular entry to Sydney from the airport. In the areas where both the project and Sydney Gateway road project would be seen, there would be an increased adverse visual impact. It should be noted that the influence of this visual impact as a result of the Botany Rail Duplication is considered minimal due to the presence of the existing rail line and scale of the duplication.
Socio Economic	The concurrent construction of the two projects has the potential to result in the following impacts: • increased demand for construction workforce due to resourcing across projects • further demand for services and increased expenditure at local and regional businesses • increased noise and vibration on residential properties and accommodation facilities near O'Riordan Street, Baxter Road and Joyce Drive • increased occurrence of delays affecting road users on the local road network including: o Qantas Drive, Robey Street and Seventh Street o General Holmes drive and Wentworth Avenue o Botany Road and Wentworth Avenue.
Hazard and Risk	The projects would have a cumulative impact associated with the disturbance of utility services.
Flooding	The future Sydney Gateway road project would involve the upgrade of the section of Qantas Drive to the south of the rail corridor within the Alexandra Canal catchment that, in combination with the project, has the potential for cumulative impacts on flood behaviour. While subject to future design development and environmental approvals, the Sydney Gateway Road project is likely to include surface earthworks and widening of the existing section of Qantas Drive between O'Riordan Street and Lancastrian Road, which may impact on flow behaviour in the drainage systems that run across Qantas Drive and through Sydney Airport between O'Riordan Street and Lancastrian Road. Given the minor nature of impacts on flow behaviour in the drainage systems that run through Sydney Airport that are attributable to the project, it is expected that the cumulative impacts of it in combination with the Sydney Gateway Road project would also be minor in nature.

23.2.2 Qantas training facility

Project details

Qantas is proposing to construct a new flight training centre on land directly adjacent to the northwestern end of the Botany Rail Duplication project in Mascot. The requirement for the new centre is a direct result of the proposed Sydney Gateway Road project, which requires the relocation of the existing flight training centre from within Sydney Airport. The proposal includes the following activities:

- remediation of the site
- removal of vegetation
- construction of new driveways and multi deck car park
- construction of the new flight training facility
- landscaping and general site improvements.

Location with respect to the Botany Rail Duplication

The proposed Qantas training facility is located at 297 King Street Mascot and shares a border (immediately to the west) of around 320 metres with the Botany Rail Duplication project.

Timing

It is expected construction of the Qantas Training Facility should be nearing completion prior to the commencement of construction of the Botany Rail Duplication project. However, some construction activities may overlap. Table 23.4 outlines the indicative construction programs for both projects.

Table 23.4 Indicative construction programs for Qantas Training facility and Botany Rail Duplication projects

PROJECT	2019				2020				2021				2022				2023				2024			
Botany Rail Duplication																								
Qantas Training Facility																								

Cumulative Impacts

Potential cumulative impacts (assessed as greater than minor in relevant technical reports) that may arise as a result of both projects are summarised in Table 23.5. Key issues where no cumulative impacts are expected have been excluded. A discussion of cumulative impacts (including justification of no cumulative impacts where relevant) is provided in the relevant technical reports and chapters.

Table 23.5 Cumulative impacts of the Qantas Training Facility and Port Botany Rail Duplication

ENVIRONMENTAL IMPACT	POTENTIAL CUMULATIVE IMPACTS WITHOUT MITIGATION
Noise and Vibration	The projects share a number of commercial sensitive receivers, including accommodation providers, the Travelodge and King Apartments (an approved residential development). Construction works at the site of the proposed Qantas Flight Training Centre would be much closer to these receivers than Botany Rail Duplication project, meaning that if concurrent works were to occur on both projects, the noise levels from construction of the Qantas Flight Training Centre would likely be dominant over the noise levels from the Botany Rail Duplication project.

23.2.3 WestConnex (M4-M5)

Project details

The WestConnex M4-M5 link (currently under construction) is part of the WestConnex program of work. The M4-M5 link would provide connections to a future western harbour tunnel and Beaches Link, the Sydney Gateway (via the St Peters interchange) and the F6 extension (via the new M5). The project includes the construction of two motorway tunnels and associated connections between the M4 motorway and the New M5 Motorway (St Peters interchange).

Location with respect to the Botany Rail Duplication project

The nearest component of the WestConnex M4-M5 project to the Botany Rail Duplication is the St Peters interchange, located around one kilometre to the north of the northwestern extent of the project. The projects are separated by commercial land use in the suburb of Mascot and the Alexandra Canal.

Timing

At the time of preparation of this EIS, the WestConnex M4-M5 project was at around 50% completion, with an expected completion date or early 2023. It is expected construction of the WestConnex M4-M5 and Botany Rail Duplication projects would overlap. Table 23.6 outlines the indicative construction programs for both projects.

Table 23.6 Indicative construction programs for the WestConnex M4-M5 and Botany Rail Duplication projects

PROJECT	2018				2019				2020				2021				2022				2023				2024			
Botany Rail Duplication																												
WestConnex M4-M5																												

Cumulative impacts

Potential cumulative impacts (assessed as greater than minor in relevant technical reports) that may arise as a result of both projects are summarised in Table 23.7. Key issues where no cumulative impacts are expected have been excluded. A discussion of cumulative impacts (including justification of no cumulative impacts where relevant) is provided in the relevant technical reports and chapters.

Table 23.7 Cumulative impacts of the WestConnex M4-M5 and Botany Rail Duplication projects

ENVIRONMENTAL IMPACT	POTENTIAL CUMULATIVE IMPACTS WITHOUT MITIGATION
Traffic and Transport	The proposed opening of WestConnex Stage 3a (the M4–M5 Link) would have notable network impacts with the construction of portions of the Sydney Gateway – Road project. The opening of WestConnex (M4-M5) also coincides with the Botany Rail Duplication bridge construction works at Robey Street, O'Riordan Street and Southern Cross Drive. Construction (and subsequent operation) of the Botany Rail Duplication, WestConnex (M4-M5) and Sydney Gateway – Road projects would have the potential to result in modifications to general traffic in the local area.

23.2.4 Other projects

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

- increased construction traffic travelling through the project site and on the surrounding road network
- increased construction noise and vibration, including road traffic noise
- reduced visual amenity
- increased dust emissions.

23.3 Management of impacts

Mitigation measures that would be implemented to address potential cumulative impacts listed in section 24.2 are addressed in Chapters 8 to 22.

23.3.1 Managing residual impacts

Despite the measures identified in Chapters 8 to 22, a number of residual impacts associated with the Botany Rail Duplication and surrounding projects remain. A discussion of residual impacts of the Botany Rail Duplication and their management is included in relevant chapters.

The main residual cumulative impact is the potential for ‘construction fatigue’, a term used to describe the combined effect of multiple construction projects occurring simultaneously, or in quick succession in a geographical area.

While there are long-term benefits associated with the projects identified in Table 23.1, such as increases in local and regional connectivity, reduced congestion and improvements to the amenity of local commercial areas. General construction activities in the local area, regardless of the overlap of construction activities is likely to result in fatigue within the affected community, with particular emphasis on residents, workers and business in Mascot, Botany and around Sydney Airport. Construction fatigue may result in annoyance from construction related activities such as dust, noise and vibration, or changes to road or pedestrian access.

Due to the location of the Botany Rail Duplication and other major projects near Sydney Airport, construction fatigue also has the potential to include regional road users, travellers, workers and businesses that use, or operate out of, or around Sydney Airport.

To mitigate residual cumulative impacts from the Botany Rail Duplication and surrounding projects (with particular emphasis on Sydney Gateway – road project), further consideration during detailed design of the communities’ tolerance of construction impacts (including noise and vibration) would be considered. The approach to construction would be managed through the implementation of relevant site management plans, and in consultation with Transport for NSW and Sydney Airport.