

Key operational infrastructure to be constructed within the motorway operations complexes would include:

- A maintenance facility
- A motorway control centre
- Emergency smoke extraction facilities
- About three ventilation facilities
- Water treatment plant.

Construction activities for these key operational infrastructure components are detailed in the following sections.

Maintenance facility

An operational maintenance facility would be constructed within Kingsgrove motorway operations complex (MOC1) (refer to **Figure 5-40**).

Construction of the maintenance facility, including bulky equipment storage and workshop facilities would include:

- Erection of columns and roof for the bulky equipment store and maintenance facility
- Protection of columns with barriers
- Excavation, footing and base slab installation with retaining walls as required
- Construction of maintenance facility walls
- Erection of roof supported by walls and columns
- Enclosure of maintenance facility building with walls and lightweight cladding.

Ventilation and emergency smoke extraction facilities

Ventilation facilities would be constructed at the following locations:

- The Kingsgrove motorway operations complex (MOC1) , a continually operating ventilation facility
- The Bexley Road South motorway operations complex (MOC2), providing supply and emergency smoke extraction functionality
- The Arncliffe motorway operations complex (MOC3), providing continually operating ventilation and emergency smoke extraction functionality
- The St Peters motorway operations complex (MOC4), a continually operating ventilation facility.

The location of the ventilation facilities are shown in **Figure 5-38** to **Figure 5-41**. Construction of the ventilation and emergency smoke extraction facilities would include:

- Erection of precast or in situ poured concrete wall panels for shaft structure stability
- Installation of precast floor or in situ poured elements at the fan room and damper levels
- Installation of roof panels and stair structures for maintenance, access and monitoring of the facilities
- Fixture of façade support structures to shaft walls as per architectural and urban design
- Internal fit-out of plant areas, equipment installation and commissioning of smoke plant rooms.

The ventilation facilities at the Arncliffe and St Peters motorway operations complexes would be constructed with the use of cranes which are no higher than the prescribed limits, so as to not encroach into airspace required for operation of Sydney Airport.

Substations

A distribution substation would be constructed above-ground at the Arncliffe motorway operations complex (MOC3) and would be the main connection to the Ausgrid network. High voltage power from the distribution substation at Arncliffe would be reticulated through the main alignment tunnels to the above-ground substations which would be constructed at the Kingsgrove motorway operations complex (MOC1), Bexley Road South motorway operations complex (MOC2), St Peters motorway operations complex (MOC4) and the Burrows Road motorway operations complex (MOC5).

The electricity supply for the project is described in more detail in **Section 5.8.5** and **Chapter 24** (Resource use and waste minimisation).

The substations would be above-ground and would be constructed using prefabricated components where possible.

Operational water treatment plant

An operational water treatment plant would be constructed within the Arncliffe motorway operations complex (MOC3) (refer to **Figure 5-43**) and would consist of a plant facility and treatment wetlands.

The operational water treatment plant would be constructed using prefabricated components which would be assembled on site as follows:

- Transport components to site
- Mechanical assembly of operational water treatment plant components, including rising main and discharge pipework
- Complete electrical connections between the operational water treatment plant components and incoming power supply
- Commission the operational water treatment plant.

The construction of the treatment wetlands would include:

- Earthworks to form the wetlands
- Installation of a drainage network or median for the wetlands, to guide water
- Provision of inlet and outlets to the wetlands
- Provision of landscaping and plant species relevant to the wetlands area.

Motorway control centre

A motorway control centre would be constructed within the Burrows Road motorway operations complex (MOC5) (refer to **Figure 5-42**). The motorway control centre would be fitted out with communications, security and electrical equipment required for the monitoring and control of the main alignment tunnels, along with office spaces and amenities.

Construction of the motorway control centre would include:

- Excavation, footing and base slab installation
- Erection of concrete columns, floor slabs and concrete column to support the roof
- Enclosure of the building with walls and architecturally clad façades
- Internal fit-out of building with control rooms, computer rooms, offices, workshops and staff amenities.

6.5.8 Bridges

The project would involve the construction of 13 bridge structures:

- Three separate single span bridges to extend the Kindilan underpass extension within the western surface works
- A pedestrian and cycle bridge that connects Sydney Park with Alexandria, over Campbell Road and Alexandra Canal
- The Campbell Road and Gardeners Road extension bridges across the Alexandra Canal
- Seven bridges as part of the St Peters interchange.

Kindilan underpass extension

The existing Kindilan underpass would be extended to accommodate the westbound surface lanes and the new westbound bypass ramp (refer to **Figure 5-13**). The underpass would be extended by about 51 metres, to a total length of about 71 metres and would match the structural form of the existing underpass. The Kindilan underpass extension would be used for construction vehicles and pedestrians / cyclists.

The extension would include the construction of three separate single span bridge structures and modifications to the existing bridge to suit the modified motorway lane configurations (refer to **Section 5.4.1**). Each single span bridge would be around 18 metres long, around 3.6 metres high and would vary in width between seven and 21 metres.

The bridges would comprise piled foundations (bored piles) with wrap-around reinforced earth wall abutments and conventional precast planks. A five to 6.5 metre high transparent noise barrier would be attached to the back of barriers along the outermost flank of the northernmost and southernmost bridge structures respectively.

Construction of the Kindilan underpass extension would require the underpass to be closed to the public for about four weeks (assuming suitable weather conditions) to install the precast roof planks and pour the topping slab. Restricting access during this time would ensure the efficient construction of the extension of the underpass and would minimise potential safety risks to the public. Additional intermittent closures may also be required.

Campbell Road pedestrian and cycle bridge over the on-and off-ramps

A new pedestrian and cycle bridge would be constructed over Alexandra Canal, Burrows Road and the New M5 ramps and Campbell Road. This infrastructure would connect Sydney Park and Campbell Road to Bourke Street.

The bridge would be made up of two main sections:

- Extending from Bourke Road, across Alexandra Canal to then run parallel to Campbell Road to around Campbell Lane. This section would:
 - Be around 370 metres long and provide pedestrian and cycle access across the on- and off-ramps, as part of the St Peters interchange
 - Comprise nine spans, including two long spans over the on-and off-ramps and over the Alexandra Canal. The substructure would comprise bored piles, piers and abutments. The superstructure would include steel box girders and beams.
- Extending across Campbell Road to Sydney Park. This section of the bridge would:
 - Be around 60 metres long and four metres wide and would cross Campbell Road in a single span
 - Include architectural features, comprising a sweeping arc, anti-throw screens, integrated pedestrian lighting and landscaping. The substructure would consist of bored piles and abutments built from the pile level. The superstructure would consist of a steel arch, precast floor slabs and an in-situ deck.

Construction of the substructure would include construction of bored piles socketed into rock, with in situ piers and abutments. The steel box girders which would make up the superstructure would be installed using mobile cranes situated close to the final girder locations. Bridge beams would be prepared for installation off site and installed directly from the delivery vehicle.

Temporary towers would be used to support the central span over the on-and off-ramps and would be located as far back as practical from roadways to avoid impacts on traffic. In selected locations, girder erection may require partial or full closure of traffic lanes on Burrows Road at night to complete the works safely.

The superstructure over the Alexandra Canal would be installed in sections. A suspended work platform would be used to provide access to install and connect the separate bridge sections. Construction of the pedestrian and cycle bridges over the Alexandra Canal has been developed to eliminate the need for a temporary pier or other intrusive works within the Alexandra Canal. The piles would be bored piles and constructed on either side of the canal, followed by the girder and abutments. A central span would then be constructed to complete the structure and the bridge deck would then be constructed over the top of the girders.

The pedestrian and cycle bridge across Campbell Road is intended to be a landmark structure, constructed as part of the local road upgrades. The location of the bridge is shown in **Figures 5-32 to Figure 5-34**.

Campbell Road and Gardeners Road bridges across the Alexandra Canal

The Campbell Road bridge would extend Campbell road by around 128 metres across the Alexandra Canal, and would be constructed as part of the local road upgrades. The Gardeners Road bridge would extend Gardeners Road across Alexandra Canal and connect to St Peters interchange. The Gardeners Road bridge would span 68 metres over the Alexandra Canal and Burrows Road. The Campbell Road and Gardeners Road bridges would be clear spans over the Alexandra Canal, that is, no piers would be required within the watercourse.

The location of the Campbell Road and Gardeners Road bridges are shown in **Figures 5-34 and 5-36**.

The construction of the bridges would be undertaken in five stages, including:

- Preparatory works to establish the site, including the identification, relocation and/ or protection of existing utilities, establishment of environmental controls and work zones and construction of hardstand areas for plant and equipment.
- Installation of temporary works, including crane lifting pads and structures that can be lifted into place for construction of the bridge.
- Construction of the superstructure, carried out from the banks of the Alexandra Canal, including the abutments, pier piles and temporary demolition catch deck platform.
- Construction of the substructure using large mobile cranes to erect the steel box girders, placement of precast soffit formwork and in-situ reinforced concrete deck.
- Asphaltting, installation of road furniture and line-marking.

St Peters interchange bridges

As detailed in **Section 5.6.2**, seven bridges would be constructed as part of the St Peters interchange. All bridges would comprise match cast, segmental box girders. The seven bridges range from around 90 metres and around 220 metres.

Construction of the bridges would include:

- Preparatory works to establish the site, including the identification, relocation and / or protection of existing utilities, establishment of environmental controls and works zones
- Construction of hardstand areas for plant and equipment
- Construction of the superstructure, including the piles (bored and concrete driven), piers and capitals

- Construction of the substructure using large mobile cranes to erect the box girders, placement of soffit formwork and in-situ reinforced concrete deck
- Asphaltting, installation of road furniture and line-marking.

6.5.9 Drainage and water management infrastructure

The project would require the construction of new drainage infrastructure and alterations to existing drainage infrastructure (refer to **Section 5.8.3** and **Chapter 16** (Soil and water quality)). It would also require the construction of water management infrastructure, including water treatment plants for the construction and operational phases of the project.

Drainage and water management infrastructure works would include:

- Construction of water treatment plants, including:
 - Five construction phase water treatment plants at the Kingsgrove North construction compound (C1), the Commercial Road construction compound (C3), the Bexley Road South construction compound (C5), the Arncliffe construction compound (C7) and the Canal Road construction compound (C8)
 - One operational phase water treatment plant (including components for the management and treatment of western tunnel water and eastern tunnel water) at the Arncliffe motorway operations complex (MOC3)
- Construction of new surface water drainage pits located along surface roads, at intersections and pedestrian crossings, upstream of bridge decks and around on-and off-ramps near where they meet surface roads
- Construction of new and upgraded surface water runoff basins, including:
 - Three new wet basins to capture and treat runoff, including one within the western surface works area, and two within the St Peters
 - One new dry basin near the eastern tunnel portals at the St Peters interchange to capture, store and treat surface water runoff
 - Upgrades to the existing detention basin in Camdenville Park near the Bedwin Road / Campbell Street / Unwins Bridge Road / May Street intersection to manage the increase in runoff as a result of the project
- Installation of new hydrodynamic oil and grit separators within the western surface works area, around the St Peters interchange and local road upgrades to capture and treat surface water runoff at locations where construction of a surface water basin is impractical
- Construction of new and upgraded culverts, including:
 - A new box culvert to connect existing stormwater pipes to a concrete channel at Kirrang Street, Beverly Hills (near the western end of the western surface works areas) underneath the existing shared pedestrian and cycle path. This new culvert would be around three metres wide and around 2.4 metres high. It would be constructed within an existing open swale and would connect into an existing culvert
 - Extension of the two existing culverts at Kooemba Road, Beverly Hills (near the western end of the western surface works areas), by around 30 metres to accommodate the widening of the motorway at this point. The culvert extensions would be constructed as twin pipes under the motorway using micro-tunnelling techniques. The tunnelled pipes would be around 1.5 metres and 1.8 metres in diameter, respectively
- Construction of upgrades to the existing drainage infrastructure that serves local surface roads (within the St Peters interchange and local road upgrade surface works areas), including connection to the existing piped drainage network and/ or provision of a new drainage discharge point at Alexandra Canal
- Construction of a new stormwater pumping station at St Peters interchange to capture and pump out stormwater runoff from the interchange prior to it entering the tunnels. The pumping station would be located south of the New M5 ramps near eastern tunnel portal at Canal Road
- Construction of a stormwater pumping station near the future possible M4-M5 Link tunnel portal.

6.5.10 Road pavement works

Road pavement works would be carried out along the project tunnels, surface roads and bridges following construction of the main structure of each of these projects. Existing road pavements within the western surface works area and local roads upgrades would be modified to integrate with the project.

Pavement works would involve the construction of:

- Base and select layers of materials in areas of bulk earthworks
- Pavement layers
- Pavement drainage, including kerb and gutter (where required)
- Concrete barriers, medians, rope fencing and guardrails (where required).

In areas where the project would tie in or modify existing roads, pavements would potentially be subject to widening, changes in configuration, milling and resurfacing, removal and cross-stitching.

Pavement surfaces have been selected to achieve the desired surface texture, skid resistance, water spray, aquaplaning and noise attenuation requirements for the project.

6.5.11 Finishing works

Finishing works would be completed towards the end of the construction program for the project. The key finishing works for the project would generally include:

- Line marking
- Installation of directional signage and roadside furniture, such as street lighting
- Erection of toll gantries at the western tunnel portals and at the St Peters interchange
- Landscaping works
- Site demobilisation and rehabilitation of temporary construction compound sites and other areas of construction disturbance.

6.6 Traffic management and access

Construction of the project would be subject to careful traffic management to ensure the functionality of surrounding roads is maintained, as well as the safety of members of the public, motorists and construction personnel.

Generally, temporary road pavements would be constructed as early as possible within the construction program to remove live traffic from construction work zones. However, a number of phases of traffic management and traffic switches would be required to facilitate construction of on and off-ramps at the western surface works, as well as the St Peters interchange and local road upgrades.

6.6.1 Changes to local roads

The project would require temporary and permanent road closures, and diversions to facilitate construction. **Table 6-22** details these closures. Roads which would permanently be closed as a result of the project are discussed in **Section 5.7**.

Table 6-22 Indicative temporary road closures and diversions during construction

Location	Extent of road closure	Estimated duration	Staging of any closure or modification	Road access reinstatement
Bedwin Road	Temporary	Two years	• Works would be carried out in stages to facilitate offline construction, where possible and to align with construction works along Campbell Street • Temporary diversions would be required during various stages of construction • Two lanes in each direction would generally be maintained, with temporary closures to one lane in each direction required for central pavement works, installation of barriers and associated construction activities • Temporary traffic signals would be maintained through traffic stages.	Once works are completed, road would be reopened in line with permanent design (refer to Figure 5-31).
Bourke Road / Bourke Street	Temporary	Two years	• Works would be carried out in stages to align with the construction works along Gardeners Road • Temporary diversions would be required during various stages of construction • Access to Bunnings, Mascot (at the corner of Gardeners Road and Bourke Road) and other businesses would be maintained • One lane of traffic in each direction would generally be maintained • Traffic signals would be maintained through construction stages. Pedestrian access would be maintained along at least one side Bourke Road.	Once works are completed, road would be reopened in line with permanent design (refer to Figure 5-35).
Brown Street	Temporary	Two years	• Access to Brown Street from Campbell Street would be partially closed • Brown Street would require full closure for short periods of time • Kerb side parking would be removed within the construction footprint • Alternate access to Brown Street would be available via the Princes Highway and/ or Unwins Bridge Road.	Once works are completed, the road would be reopened in line with permanent design (refer to Figure 5-31).
Burrows Road	Temporary	Two years	• Temporary diversions would be required during various stages of construction • One lane in each direction would be maintained with temporary relocation of the road to enable construction of the new road. • Kerb side parking would be removed within construction footprint • Temporary business access would be maintained throughout the works.	Once works are completed, the road would be reopened with new traffic arrangement in line with permanent design (refer to Figure 5-34).
Campbell Lane	Permanent	Permanent	Campbell Lane would be permanently closed as part of the project	Campbell Lane would be permanently closed
Canal Road	Temporary	Three years	• The kerbside lanes of Canal Road would be temporarily closed to facilitate construction, generally at night time • Access along Canal Road would be maintained.	Once works are completed, road would be reopened.

Location	Extent of road closure	Estimated duration	Staging of any closure or modification	Road access reinstatement
Campbell Road / Campbell Street	Temporary	Two years	• Works would be carried out in stages to facilitate offline construction, where possible and to align with construction works along Euston Road and Burrows Road • Temporary diversions would be required during various stages of construction • At least one lane in each direction would generally be maintained during construction. • Short term temporary road closures would be required to allow for the lifting and installation of infrastructure for the pedestrian and cycle bridge • Traffic signals would be maintained during construction at the intersection with the Princes Highway • Kerbside parking along Campbell Road/ Street would be removed within the construction footprint.	Once works are completed, the road would be reopened in line with permanent design (refer to Figure 5-31 to Figure 5-34).
Church Street	Temporary	Two years	• Access to Church Street from Campbell Street would be partially closed • Kerb side parking would be removed within construction footprint.	Once works are completed, the road would be reopened in line with permanent design (refer to Figure 5-31).
Euston Road	Temporary	Two years	• Temporary diversions would be required during various stages of construction • At least one lane in each direction would generally be maintained during construction. • Kerbside parking would be removed along one side of Euston Road • Construction would be undertaken in stages to facilitate offline construction, where possible and to align with construction works along Campbell Street and Sydney Park Road. • Access to businesses would be maintained.	Once works are completed, the road would be reopened in line with permanent design (refer to Figure 5-29 and Figure 5-30).
Florence Street	Temporary	Two years	• Access to Florence Street from Campbell Street would be partially closed • Florence Street would require full closure for short periods of time • Kerb side parking would be removed within the construction footprint • Alternate access to Florence Street would be available from the Princes Highway and / or Unwins Bridge Road.	Once works during the stage completed, the road would be reopened in line with permanent design (refer to Figure 5-31).

Location	Extent of road closure	Estimated duration	Staging of any closure or modification	Road access reinstatement
Gardeners Road	Temporary	Two years	• Works would be carried out in stages to facilitate offline construction, where possible and to align with construction works along Bourke Road / Street and Kent Road • Temporary diversions would be required during various stages of construction • Two lanes would generally be maintained in each direction, with temporary closures to one lane in each direction required for central pavement works, installation of barriers and associated construction activities • Traffic signals, including provision for pedestrian crossing would be maintained • Kerbside parking would be removed along Gardeners Road between Kent Road and the new Venice Street • Access to businesses along Gardeners Road would be maintained.	Once works are completed, the road would be reopened in line with permanent design (refer to Figure 5-36).
Harber Street	Permanent	Permanent	Harber Street would be permanently closed as part of the project	Street would be permanently closed
Holland Street	Permanent	Permanent	Holland Street would be permanently closed as part of the project	Street would be permanently closed
Huntley Street	Temporary	Two years	• Works would be carried out in stages to facilitate offline construction, where possible and to align with construction works along Euston Road and Sydney Park Road • Temporary diversions would be required during various stages of construction • At least one lane in each direction would generally be maintained during construction • Kerbside parking along sections of Huntley Street within the construction footprint would be removed	Once works are completed, the road would be reopened in line with permanent design (refer to Figure 5-30).
Princes Highway	Temporary	Two years	• Temporary diversions would be required during various stages of construction • Three lanes would generally be maintained in each direction, with temporary closures to two lanes in each direction required for central pavement works, installation of barriers and associated construction activities • Traffic signals at the intersection with Campbell Street would be maintained, including provision for pedestrian crossing • Access would be maintained with businesses and residents.	Once works are completed, the road would be reopened with new traffic arrangement in line with permanent design (refer to Figure 5-32).

Location	Extent of road closure	Estimated duration	Staging of any closure or modification	Road access reinstatement
St Peters Street	Temporary	Two years	- Access to St Peters Street from Campbell Street would be partially closed - Kerbside parking along sections of St Peters Street within the construction footprint would be removed.	Once works are completed, the road would be reopened with new traffic arrangement in line with permanent design (refer to Figure 5-31).
Sydney Park Road	Temporary	Two years	- Works would be carried out in stages to align with the staging of construction works along Euston Road - Two lanes would generally be maintained in each direction, with temporary closures to one lane in each direction required for central pavement works, installation of barriers and associated construction activities	Once works are completed, the road would be reopened with new traffic arrangement in line with permanent design (refer to Figure 5-30).
Unwins Bridge Road	Temporary	Two years	- Works would be varied out in stages to align with the construction works at the intersection of Campbell Street, Bedwin Road and May Street. - One lane in each direction would be maintained at all times. - Traffic signals would be maintained through construction at the intersection of Unwins Bridge Road with Campbell Street, May Street and Bedwin Road. - Kerbside parking along Unwins Bridge Road would be removed within the construction footprint. - Access to residents and businesses would be maintained.	Once the works are completed the road would be opened along the new alignment, in line with the permanent design (refer to Figure 5-31).
Woodley Street	Permanent	Permanent	Woodley Street would be permanently closed as part of the project	Street would be permanently closed

Parking provisions for light vehicles within construction compounds have been provided across the project. Parking would not be allowed off-site, which would be regularly reinforced through project inductions and toolbox talks. Construction personnel would be encouraged to use public transport where possible, and consider other modes of transport such as carpooling.

The indicative light vehicle parking provisions to be provided during construction of the project are summarised in **Table 6-23**. The number of car parking spaces allocated has been based on a worst case, peak operation.

Table 6-23 Indicative Construction compound light vehicle parking provisions

Construction compound	Indicative Number of parking spaces	Peak construction workforce
Kingsgrove north (C1)	175	200 ²
Commercial Road (C3)	18	20
Bexley Road East	100	89 ²
Arncliffe	180	300 ²
St Peters interchange ¹	290	320 ²
Campbell Road bridge	10	15
Gardeners Road bridge	10	10

¹ Note St Peters interchange includes the Canal Road (C8), Campbell Road (C9), Landfill Closure (C10), Burrows Road (C11) and Sydney Park (C14) construction compounds

² Note includes shift work

The western surface works and the local road upgrades would be constructed in three stages, including a number of traffic switches to maintain access along all roads. Traffic switching is discussed further in **Chapter 9** (Traffic and Transport).

6.6.2 Changes to pedestrian and cycle routes

Some existing pedestrian and cyclist facilities would be temporarily or permanently diverted or realigned to facilitate construction of the western surface works and local roads upgrades. Cyclist and pedestrian facilities would be modified for construction of the project, including but not limited to:

- Western surface works:
 - The existing shared path within Beverly Grove Park to the north of the M5 East Motorway would be permanently realigned so that it is to the north of the Kingsgrove North construction compound
 - The shared path within Beverly Grove Park to the south of the M5 East Motorway would be closed for the duration of construction due to space constraints. Pedestrians and cyclists would be diverted onto the northern path via Karingal Street and the Kindilan underpass. Pedestrian and cyclist access via the Kindilan underpass would generally be maintained during construction and would be physically separated from construction traffic to maintain safe access
 - The Kindilan underpass would be closed for around four weeks (subject to weather) during construction to accommodate its extension, and would require additional intermittent closures. In instances where the underpass is closed, pedestrians and cyclists would be diverted to Karingal Street and Coolangatta Road for access between the southern and northern paths
 - The M5 East Motorway has been permanently closed to cyclists between Belmore Road and Bexley Road as part of the King Georges Road interchange upgrade. At the completion of construction of the New M5, cyclists would be able to cycle along the M5 South West Motorway from King Georges Road westwards. From King Georges Road eastwards, cyclists have been diverted onto the shared paths within Beverly Grove Park and / or surrounding local roads.

- Local road upgrades:
 - The Bourke Road cycle path would be temporarily diverted around the construction works due to space constraints
 - Pedestrian and shared path facilities in areas subject to local roads upgrades would be relocated or temporary access paths would be constructed to maintain access throughout construction
 - Concrete barriers would be installed to separate pedestrians, cyclists and the general public from construction activities where a haul road is in close proximity to a pedestrian access.

A strategy for the maintenance of pedestrian and cyclist access throughout construction would be provided as part of the Construction Traffic Management Plan for the project which would be prepared during detailed design.

6.6.3 Changes to bus stops

To accommodate construction of the project, a number of bus stops would be removed and / or relocated as part of the local road upgrades at St Peters and Mascot. Where bus stops are relocated, pedestrian access, including disabled facilities would be maintained.

The bus stop on Canal Road (southbound) near the corner of the Princes Highway would be permanently relocated further south to allow construction and operation of the proposed Canal Road compound and St Peters motorway operations complex (MOC4).

The existing bus stop on Euston Road northbound, south of the intersection with Maddox Street, would be temporarily relocated throughout the upgrade of Euston Road and Maddox Street. The bus stop would be reinstated following the upgrade of Euston Road.

The following bus stops would be temporarily removed for the duration of construction and reinstated in a similar location at the completion of construction:

- Princes Highway (southbound) outside 136 Princes Highway, St Peters
- Bourke Road (northbound) outside 81A to 83 Bourke Road, Mascot
- Bourke Road (northbound) outside 520-530 Gardeners Road, Mascot
- Gardeners Road (eastbound) outside 538 to 540 Gardeners Road, Mascot.

Temporary changes to bus infrastructure during construction would be made in consultation with Transport for NSW and bus operators.

An assessment of the impacts of the project on public and active transport facilities and infrastructure during construction and operation of the project is provided in **Section 9.3** of **Chapter 9** (Traffic and transport).

6.6.4 Construction compound access

Proposed construction traffic routes to and from each construction compound are described in **Section 9.3.1** of **Chapter 9** (Traffic and transport). Construction traffic movements would include heavy and light vehicles associated with spoil and waste removal, material deliveries and the arrival and departure of construction workers.

Access and egress arrangements for each construction compound and the roads proposed to be used as part of construction compound vehicle routes are summarised in **Table 6-24**.

Table 6-24 Construction compound access and egress points

Construction compound	Access and egress points	Roads used as part of construction compound vehicle routes.
Kingsgrove North (C1)	Garema Circuit (left in, left out) M5 East (left in, left out).	• Garema Circuit • Wirega Avenue
Kingsgrove South (C2)	Garema Circuit through the Kingsgrove North construction compound (left in, left out). M5 East (left in, left out).	• Moorefields Road • King Georges Road • Kingsgrove Road • M5 East Motorway
Commercial Road (C3)	Commercial Road (right in, left out).	• Commercial Road • Kingsgrove Road
Bexley Road North (C4)	Bexley Road (left in, left out).	• Bexley Road • Canterbury Road • King Georges Road • M5 East Motorway
Bexley Road South (C5)	Bexley Road (left in, left out).	• M5 East Motorway • King Georges Road • Stoney Creek Road • Forest Road • Bexley Road
Bexley Road East (C6)	Wolli Avenue (left in, right out).	• Wolli Avenue • Frost Street • Douglas Street • Homer Street
Arncliffe (C7)	Marsh Street at signalised intersection (left and right in, left out).	• Marsh Street • West Botany Street • M5 East Motorway • Wickham Street • Princes Highway
Canal Road (C8)	Canal Road at a new signalised intersection (left in, left out).	• Canal Road • Princes Highway
Campbell Road (C9)	Campbell Road (left and right in, left and right out).	• Campbell Road • Burrows Road
Landfill closure (C10)	Campbell Road (left in, left out), through the Canal Road construction compound.	• Canal Road • Princes Highway
Burrows Road (C11)	Burrows Road (left and right in, left and right out).	• Campbell Road • Burrows Road • Canal Road • Princes Highway
Campbell Road bridge (C12)	Burrows Road (right in, left out).	• Burrows Road • Campbell Road • Princes Highway
Gardeners Road Bridge (C13)	Burrows Road (left and right in, left and right out)	• Campbell Road • Burrows Road • Canal Road • Princes Highway
Sydney Park (C14)	Campbell Road (left and right in, left and right out)	• Campbell Road • Burrows Road • Canal Road • Princes Highway

6.7 Construction workforce and works hours

6.7.1 Construction workforce

The estimated peak construction workforce at each construction compound is detailed in **Table 6-25**. The peak construction workforce at each construction compound does not necessarily occur at the same time, so these numbers cannot be added together to provide a whole of project peak workforce number.

The construction workforce comprises trades and construction personnel, subcontract construction personnel and engineering, functional and administrative staff.

Table 6-25 Peak construction workforce estimates

Construction compound	Approximate peak construction workforce	Approximate day shift peak construction workforce	Approximate afternoon shift peak construction workforce	Approximate night shift peak construction workforce
Kingsgrove North (C1)	177	100	52	25
Kingsgrove south (C2)	90	45	45	0
Commercial Road (C3)	86	86	86	86
Bexley Road North (C4)	42	20	14	22
Bexley Road South (C5)	42	20	14	22
Bexley Road East (C6)	34	28	0	6
Arncliffe (C7)	190	111	56	79
Canal Road (C8)	193	112	57	79
Campbell Road (C9)	215	200	15	15
Landfill Closure (C10)	30	30	30	2
Burrows Road (C11)	40	35	10	10
Campbell Road bridge (C12)	35	25	10	10
Gardeners Road bridge (C13)	45	35	10	10
Sydney Park (C14)	25	15	10	10

6.7.2 Construction work hours

Construction activities required for the project would be managed in six broad categories:

- Tunnelling and tunnelling support activities, including spoil handling and haulage, deliveries and underground construction and fit-out works. These activities would be carried out up to 24 hours per day and seven days per week
- Out of hours construction activities that cannot be conducted during standard construction hours for safety or operational reasons. These activities would include some M5 East Motorway integration works and local road upgrade works
- Most other construction activities, which would be carried out within standard construction hours
- Blasting and rock breaking, which would be conducted with reduced construction hours and subject to provision of respite periods
- Minor or ancillary activities that would not generate a noise impact above acceptable levels, or are otherwise authorised by an Environment Protection Licence under the *Protection of the Environment Operations Act 1997* (POEO Act)
- Activities that are required to be conducted under direction from a relevant authority (such as Police) or are required to prevent an imminent loss of life or environmental damage.

In accordance with the *Interim Construction Noise Guidelines* (DECC, 2009), the majority of surface construction would be carried out between the following standard construction hours:

- 7:00am to 6:00pm Monday to Friday
- 8:00am to 1:00pm Saturdays

There would generally be no aboveground construction works on Sundays or public holidays, with the exception of those activities required to be undertaken outside of standard construction hours.

A summary of construction hours for these categories of construction activities is provided in **Table 6-26**, with further details provided in the following sections.

Table 6-26 Construction hours

Activity	Construction hours	Comments or exception
Tunnelling, tunnelling support and underground construction activities		
Tunnelling excavation	24 hours per day, seven days a week.	• The main alignment tunnels, tunnel stubs, ventilation extraction tunnels and all underground excavations would be carried out continuously. • Activities that support tunnelling works would occur 24 hours per day, seven days a week
Spoil handling and haulage	Up to 24 hours per day, seven days per week.	• Spoil haulage would be limited and managed during peak hours and special events • Vehicle movements would be limited and managed during evening and night-time in residential areas or close to identified sensitive receivers • Vehicle movements outside of standard construction hours would occur at the following construction compounds: – Kingsgrove North construction compound (C1) and, via left-in, left-out access from the M5 East Motorway or via Garema Circuit, Wirega Avenue, Moorefields Road, Kingsgrove Road and King Georges Road¹, Kingsgrove South construction compound (C2) – Commercial Road construction compound (C3), via access from Commercial Road, Kingsgrove Road and the M5 East Motorway – Bexley Road North construction compound (C4), via Bexley Road, Canterbury Road and King Georges Road and the M5 East Motorway – Bexley Road South construction compound (C5), via Bexley Road, Kingsgrove Road, Stoney Creek Road, Forest Road and the M5 East Motorway – Bexley Road East construction compound (C6), via Wolli Avenue, Frost Street, Douglas Street, Stoney Creek Road, Bexley Road, Forest Road and the M5 East Motorway² – Arncliffe construction compound (C7), via Marsh Street Princes Highway, Wickham Street, West Botany Street and the M5 East Motorway – Canal Road construction compound (C8), via Canal Road and the Princes Highway. • Spoil would be moved during the day, outside of peak periods where practical, feasible and reasonable management strategies would be investigated to minimise the volumes of heavy vehicle movements at night

Activity	Construction hours	Comments or exception
Underground construction and tunnel fit-out	Up to 24 hours per day, seven days per week.	Deliveries for underground construction would be subject to the same management measures as spoil haulage.
Out of hours activities for safety and operational reasons		
Out of hours activities for safety and operational reasons	At any time, subject to individual requirements.	- Construction activities would only be conducted outside standard construction hours for safety or operational reasons, including design and quality considerations and to avoid traffic interruptions - Specific management measures would be developed for each relevant activity or group of activities to manage potential impacts on sensitive receivers - The construction activities will include - Surface works at the Kingsgrove, Arncliffe & St Peters Interchange sites - Local road upgrade works - Bridge construction - Delivery of precast units & other materials - Services searches - Road maintenance works - Traffic control and switches - Line-marking - Service relocations & adjustments.
Surface construction activities (not specified elsewhere)		
Most surface construction activities	Daytime construction hours: 7 am to 6 pm on weekdays 8 am to 1 pm on Saturdays - No works on Sundays or public holidays.	- Surface works supporting underground construction - Construction traffic movements for tunnel support - Excavation and spoil removal from construction shafts and declines at the surface - Western surface works - Local road upgrades - Bridge construction - Surface works at the Kingsgrove, Arncliffe and the St Peters interchange.
Blasting and rock breaking		
Blasting	Between 9:00am and 5:00pm, Mondays to Fridays and 9:00 am to 1:00pm on Saturdays	Blasting would occur up to six days per week (Monday to Saturday). Blasts would be limited to one single detonation in any one day per receiver group, unless otherwise agreed by the NSW EPA through consultation on the Construction Noise and Vibration Management Plan.

Activity	Construction hours	Comments or exception
Rock breaking (with potential for impulsive or tonal noise impact at a sensitive receiver)	Between 8:00am and 6:00pm Monday to Friday and 8:00am to 1:00pm Saturdays, with respite periods.	Respite periods would be scheduled to minimise the frequency and duration of extended rock breaking activities with potential for impulsive or tonal noise emissions.
Minor or ancillary activities		
Minor activities	At any time	Minor activities would include activities that do not lead to an exceedance of the applicable noise management level at an affected receiver.
Activities authorised by an environment protection licence	As specified in the environment protection licence.	Construction activities would be managed as required by the Environment Protection Licence.
Emergency or directed activities		
Emergency or directed activities	At any time	- Activities would be carried out as directed by a relevant authority - Activities would be carried out if required to prevent an imminent loss of life or environmental damage.

1: Heavy vehicle movements from C1 outside of standard construction hours would occur via access and egress directly to and from the M5 East Motorway. There would be times when direct access to the M5 East Motorway would be blocked due to construction works within the site and access would then be required via Garema Circuit

2: Only light vehicles would travel via Wolli Avenue, Frost Street, Douglas Street, Stoney Creek Road, Bexley Road and Forest Road

A summary of the proposed construction work hours at each construction compound is provided in **Table 6-27**.

Table 6-27 Construction work hours at construction compounds

Construction compound	Type of construction activity	Construction work hours
Kingsgrove North (C1)	Tunnelling	24 hours a day, seven days a week
	Civil construction*	7:00am to 6:00pm Monday to Friday 8:00am to 1:00pm Saturdays
Kingsgrove south (C2)	Civil construction*	7:00am to 6:00pm Monday to Friday 8:00am to 1:00pm Saturdays
Commercial Road (C3)	Tunnelling	24 hours a day, seven days a week
Bexley Road North (C4)	Tunnelling	24 hours a day, seven days a week
Bexley Road South (C5)	Tunnelling	24 hours a day, seven days a week
Bexley Road East (C6)	Tunnelling	24 hours a day, seven days a week
Arncliffe (C7)	Tunnelling	24 hours a day, seven days a week
Canal Road (C8)	Tunnelling	24 hours a day, seven days a week
	Civil construction*	7:00am to 6:00pm Monday to Friday 8:00am to 1:00pm Saturdays
Campbell Road (C9)	Civil construction*	7:00am to 6:00pm Monday to Friday 8:00am to 1:00pm Saturdays
Landfill Closure (C10)	Civil construction*	7:00am to 6:00pm Monday to Friday 8:00am to 1:00pm Saturdays
Burrows Road (C11)	Civil construction*	7:00am to 6:00pm Monday to Friday 8:00am to 1:00pm Saturdays

Construction compound	Type of construction activity	Construction work hours
Campbell Road bridge (C12)	Civil construction*	7:00am to 6:00pm Monday to Friday 8:00am to 1:00pm Saturdays
Gardeners Road bridge (C13)	Civil construction*	7:00am to 6:00pm Monday to Friday 8:00am to 1:00pm Saturdays
Sydney Park (C14)	Civil construction*	7:00am to 6:00pm Monday to Friday 8:00am to 1:00pm Saturdays

*Some works outside of standard construction hours may be required

Works outside of standard construction hours

While the majority of the surface construction work would be constructed during standard construction hours, some construction activities would need to be undertaken at night for reasons including:

- Public and construction worker safety
- Design and quality considerations
- To minimise the length of construction and the duration of any associated amenity impacts on the local community
- To avoid significant traffic interruptions along the M5 East Motorway and the surrounding arterial and local road network.

Night works would generally commence after the evening traffic peak period when traffic volumes have reduced.

Works undertaken outside of standard hours are expected to be subject to relevant conditions of an environment protection licence issued under the POEO Act. Environment protection licence conditions would potentially include measures relating to community notifications and procedures for recording and addressing complaints. Additional information regarding licences and approvals that may be required for construction of the project is provided in **Chapter 2**.

Some out-of-hours surface works would be required to minimise impacts on the efficiency of the road network, and to minimise safety impacts to the construction workforce and members of the public. Subject to permits and approvals from the Traffic Management Centre and/ or Roads and Maritime (where relevant), surface works to be undertaken outside of standard construction hours would generally include:

- Traffic switching of the M5 East carriageways, providing access tie-ins between the completed permanent works associated with the project and the M5 East Motorway, including asphaltting, line marking and the installation of barriers
- Traffic switching along local roads to newly constructed pavement, including asphaltting, line marking and the installation of traffic barriers and signals
- Demolition of infrastructure along the M5 East Motorway to accommodate construction of the project including concrete barriers, noise barriers and vegetation
- Installation of signage and tolling infrastructure in close proximity to traffic
- Relocation of services at locations close to traffic, and service cutovers
- Delivery of oversize items to construction ancillary facilities
- Crane lifts which require lane closures, or where the works are restricted by the operation of Sydney Airport and / or road travel restrictions.

Tunnelling works (including fitout work but excluding blasting) would be undertaken 24 hours a day, seven days a week to minimise the overall length of construction and the duration of any associated amenity impacts on the local community.

All activities that support tunnelling would also be required to be undertaken 24 hours a day, seven days a week. Handling of spoil at the surface would be required as stockpiling large amounts of spoil within the main alignment tunnels would not be feasible. Spoil is therefore required to be transported from the main alignment tunnels to stockpiles on the surface (within acoustic sheds and non-acoustic sheds), prior to haulage from the site.

Stockpiling spoil on the surface with no spoil haulage outside of standard construction hours would result in additional heavy vehicle movements during standard construction hours, which would have an adverse impact on the road network, particularly during the AM and PM peak periods. Spoil haulage outside of standard construction hours would be from:

- Kingsgrove North (C1) construction compound
- Commercial Road (C3) construction compound
- Bexley Road North (C4) construction compound
- Bexley Road South (C5) construction compound
- Arncliffe (C7) construction compound
- Canal Road (C8) construction compound.

Concrete and shotcrete deliveries for shotcrete to these construction compounds would also be required 24 hours a day, seven days a week, as the excavated tunnel would be progressively supported behind the roadheader by applying shotcrete to the excavated tunnel walls. The alternative would be a concrete batch plant at each construction compound that provides tunnelling support, which would have adverse noise impacts at sensitive receivers.

Spoil haulage from these construction compounds would be limited to the regional and State road network. Construction traffic and noise impacts from spoil haulage outside standard construction hours are assessed in **Chapter 9** (Traffic and transport) and **Chapter 12** (Noise and vibration).

Some additional activities at construction compounds across the project would be required to support out-of-hours works. Where possible, these activities would be kept to a minimum with only those required to support the works to be used.

Night time and weekend work would also be required for some construction activities associated with construction of the bridges over Alexandra Canal, works associated with the upgrades to local roads and for the western surface works, including:

- Road tie-in works, temporary diversions and traffic switches – Completing these construction works at night when traffic flows are low would minimise disruptions to traffic and minimise any potential safety conflict between construction personnel and traffic.
- Pavement works and linemarking – These works would require lane closures and, in some cases, total closure of roads in order to safely carry out the works. This means that pavement works cannot be undertaken during periods of high traffic volumes and would need to occur during evening and night-time periods. Carrying out these works at night would minimise disruptions to traffic flows along the M5 Motorway corridor and local roads, as the works would involve multiple traffic switched within a short period of time before traffic is allowed to use the completed sections of pavement.

Other works that are proposed to be undertaken outside of standard daytime construction hours without any further approval (assuming this is consistent with the instrument of approval) would include any of the following circumstances:

- Works which are expected to comply with the relevant Noise Management Level at the nearest sensitive receiver
- The delivery of materials as required by the Police, Roads and Maritime Services and/ or other authorities for safety reasons
- Where it is required to avoid the loss of lives, property and / or to prevent environmental harm in an emergency
- Where agreement is reached with affected receivers.

Where work is required outside of standard construction hours, measures would be implemented to minimise noise and other types of disturbance to residents and sensitive receivers.

An assessment of potential noise impacts associated with construction of the project as well as management measures, including for works outside of standard construction hours is included in **Chapter 12** (Noise and vibration) of this EIS.

The construction noise assessment for the project (AECOM, 2015) was undertaken in accordance with the *Interim Construction Noise Guidelines* (DECC, 2009) and feasible and reasonable noise management measures have been identified as part of this assessment.

Noise management measures would be further refined during the detailed design phase of the project in consultation with the NSW Environment Protection Authority. Further, the environment protection licence for the project would provide for appropriate management of construction noise impacts.

6.8 Plant and equipment

The plant and equipment listed in **Table 6-28** is planned to be used during the construction of the project. Final plant and equipment would be confirmed during detailed design, taking into account any requirements of the environmental planning approval for the project.

Table 6-28 Indicative construction plant and equipment

Plant / equipment	Construction compound													
	Kingsgrove North (C1)	Kingsgrove South (C2)	Commercial Road (C3)	Bexley Road North (C4)	Bexley Road South (C5)	Bexley Road East (C6)	Arncliffe (C7)	Canal Road (C8)	Campbell Road (C9)	Landfill closure (C10)	Burrows Road (C11)	Campbell Road bridge (C12)	Gardeners Road (C13)	Sydney Park (C14)
Surface works														
30 tonne excavator with rock hammer	✓	✓	✓	✓	✓			✓		✓	✓	✓	✓	✓
35 tonne excavator with bucket	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
45 tonne excavator with rock hammer	✓		✓					✓	✓	✓			✓	
100 tonne crane – wheeled		✓			✓		✓	✓						
Asphalt truck and sprayer	✓	✓	✓					✓	✓	✓	✓	✓	✓	✓
Bobcat									✓		✓	✓	✓	✓
Bulldozer (D7)	✓	✓	✓					✓						
Chainsaw	✓	✓	✓	✓	✓	✓	✓	✓						
Compressor	✓	✓	✓		✓	✓	✓	✓		✓				
Concrete agitator	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓
Concrete grinding machine		✓			✓		✓	✓						
Concrete pump	✓	✓	✓	✓	✓		✓	✓	✓	✓			✓	✓
Concrete saw	✓	✓	✓					✓	✓	✓	✓	✓	✓	✓
Concrete vibrator		✓			✓		✓	✓						
Daymaker lighting tower	✓	✓	✓					✓	✓	✓	✓	✓	✓	✓
Drilling machine – diesel	✓	✓	✓	✓	✓		✓	✓						
Excavator									✓		✓		✓	✓
Franna crane (20 tonne)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓
Grader (25 tonne)								✓	✓	✓	✓	✓	✓	✓
Hiab truck									✓		✓	✓	✓	✓
Light vehicle	✓	✓	✓	✓	✓	✓	✓	✓		✓				
Mobile crane (up to 500 tonnes)									✓		✓		✓	✓
Paver	✓	✓	✓					✓	✓	✓	✓	✓	✓	✓
Piling Rig (bored)	✓	✓	✓	✓	✓									

Plant / equipment	Construction compound													
	Kingsgrove North (C1)	Kingsgrove South (C2)	Commercial Road (C3)	Bexley Road North (C4)	Bexley Road South (C5)	Bexley Road East (C6)	Arncliffe (C7)	Canal Road (C8)	Campbell Road (C9)	Landfill closure (C10)	Burrows Road (C11)	Campbell Road bridge (C12)	Gardeners Road (C13)	Sydney Park (C14)
Piling rig (driven concrete piles)									✓	✓	✓		✓	✓
Pneumatic hammer	✓	✓	✓	✓	✓		✓	✓			✓	✓	✓	✓
Road profiler (17 tonne)	✓	✓	✓					✓	✓	✓	✓	✓	✓	✓
Roller (12 tonne)	✓	✓	✓					✓	✓	✓	✓	✓	✓	✓
Saw cutting reo		✓			✓		✓	✓						
Saw cutting formwork		✓			✓		✓	✓						
Scissor Lift		✓	✓					✓		✓				
Shotcrete Rig – diesel	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓
Truck – deliveries	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Truck – large (20 tonnes)														
Truck – line marking	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	
Truck – road	✓	✓	✓					✓	✓	✓	✓	✓	✓	✓
Truck – small (less than 20 tonnes)	✓	✓	✓	✓	✓	✓	✓	✓		✓				
Truck and dog	✓	✓	✓	✓	✓		✓	✓			✓	✓	✓	✓
Truck and dog (spoil haulage)	✓	✓	✓					✓	✓	✓	✓	✓	✓	✓
Tub grinder / mulcher	✓	✓	✓	✓	✓	✓	✓	✓						
Wacker Packer														
Water cart (15 kilo litre)	✓	✓	✓		✓		✓	✓	✓	✓			✓	
Water treatment plant		✓			✓		✓	✓						
Water treatment plant pumps	✓	✓	✓			✓	✓	✓		✓				
Workshop hand tools	✓	✓	✓		✓	✓	✓	✓		✓				
Underground works														
1 kilo volt electric road header	✓	✓	✓	✓	✓		✓	✓						
1 kilo volt ventilation fan	✓	✓	✓	✓	✓		✓	✓						
30 tonne excavator with rock hammer	✓	✓	✓				✓	✓						
35 tonne excavator with bucket	✓	✓	✓	✓	✓	✓	✓	✓						
38 tonne Moxie	✓	✓	✓	✓	✓		✓	✓						

Plant / equipment	Construction compound													
	Kingsgrove North (C1)	Kingsgrove South (C2)	Commercial Road (C3)	Bexley Road North (C4)	Bexley Road South (C5)	Bexley Road East (C6)	Arncliffe (C7)	Canal Road (C8)	Campbell Road (C9)	Landfill closure (C10)	Burrows Road (C11)	Campbell Road bridge (C12)	Gardeners Road (C13)	Sydney Park (C14)
Compressor	✓	✓	✓	✓	✓		✓	✓						
Concrete pump	✓	✓	✓	✓	✓		✓	✓						
Concrete truck	✓	✓	✓	✓	✓		✓	✓						
Dust scrubber	✓	✓	✓	✓	✓		✓	✓						
Franna crane	✓	✓	✓	✓	✓	✓	✓	✓						
Front-end loader	✓	✓	✓	✓	✓		✓	✓						
Pneumatic vibrator	✓	✓	✓	✓	✓		✓	✓						
Power generator	✓	✓	✓				✓	✓						
Shotcrete rig – Diesel														
Truck – small (less than 20 tonnes)	✓	✓	✓	✓	✓	✓	✓	✓						
Truck and dog	✓	✓	✓				✓	✓						
Truck and dog – spoil haulage	✓	✓	✓	✓	✓		✓	✓						

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6.9 Construction noise attenuation

Temporary noise attenuation at construction compounds would include:

- Noise barriers along the boundaries of construction compounds at locations that face sensitive receivers
- Acoustic sheds around tunnel shafts and associated stockpile sites at the following locations where out of hours works would be undertaken near sensitive receivers, including:
 - Kingsgrove North (C1) construction compound
 - Bexley Road North (C4) construction compound
 - Bexley Road South (C5) construction compound
- Non-acoustic sheds around tunnel shafts and associated stockpile sites at the following locations:
 - Commercial Road (C3) construction compound
 - Arncliffe (C7) construction compound.

Temporary noise barriers would be installed along the boundaries of construction compounds that face sensitive receivers. Acoustic sheds would be constructed around tunnel shafts and associated stockpile sites where out of hours spoil removal would occur near residential receivers.

A summary of temporary construction noise attenuation structures to be implemented as part of the project is provided in **Table 6-29** below. Further detail regarding construction noise mitigation and management is provided in **Chapter 12** (Noise and vibration).

Table 6-29 Temporary construction noise attenuation structures

Construction compound	Temporary noise attenuation
Kingsgrove North (C1)	• Two and a half metre high noise barrier along northern and eastern boundaries of the facility • Acoustic shed surrounding shaft and associated spoil stockpile no more than 20 metres high • Based on the outcomes of the Technical working paper: Noise and vibration (Appendix J), the height of the noise wall may be considered. This would be confirmed during detailed design.
Commercial Road (C3)	• Non-acoustic shed surrounding tunnel shaft and associated spoil stockpile.
Bexley Road North (C4)	• Four and a half metre high noise barrier along entire boundary of facility • Acoustic shed surrounding tunnel shaft and associated spoil stockpile no more than 20 metres high.
Bexley Road South (C5)	• Four and a half metre high noise barrier along almost all boundaries of the facility • Acoustic shed surrounding tunnel shaft and associated spoil stockpile no more than 20 metres high.
Bexley Road East (C6)	• Four and a half metre high noise barrier along northern and eastern boundaries of the facility.
Arncliffe (C7)	• Three metre high noise barrier along the northern and western boundaries of the facility • Non-acoustic sheds surrounding tunnel shaft and associated spoil stockpile.
Canal Road (C8)	• Two and a half metre high noise barrier along the Canal Road and Princes Highway boundaries of the facility.
Campbell Road (C9)	• Two and a half metre high noise barrier along Campbell Road adjacent to the hardstand and laydown area • Two and a half metre high noise barrier along part of the western boundary of the facility.

Potential construction noise impacts at sensitive receivers have been assessed as part of the Technical working paper: Noise and vibration for the project (**Appendix J**). The construction noise assessment tables which summarise the construction noise impacts predicted from each construction compound are provided in **Chapter 12** (Noise and vibration).

6.10 Construction waste management

The project would generate three main categories of construction waste:

- Spoil from tunnelling works and other bulk earthworks, which represents the major construction waste stream
- Contaminated materials generating during landfill closure works
- Other construction wastes.

6.10.1 Spoil generation and management

About 3.2 million cubic metres of surplus spoil would be generated from the project, primarily from tunnel excavations. The anticipated volume of spoil which would be generated at each construction compound is summarised in **Table 6-30**.

Table 6-30 Anticipated spoil generation

Construction compound	Spoil volume- surface works (cubic metres)	Spoil volume- tunnelling (cubic metres)	Spoil volume- total (cubic metres)
Kingsgrove North (C1)	237,130	100,540	337,670
Kingsgrove South (C2)	117,830	0	117,830
Commercial Road (C3)	0	43,088	43,088
Bexley Road North (C4),	0	450,937	450,937
Bexley Road South (C5)	0	300,624	300,624
Bexley Road East (C6)	0	0	0
Arncliffe (C7)	50,000	975,635	1,025,635
Canal Road (C8)	90,000	787,660	877,660
Campbell Road (C9)	90,000	0	90,000
Landfill Closure (C10)	0	0	0
Burrows Road (C11)	6,000	0	6,000
Campbell Road bridge (C12)	6,000	0	6,000
Gardeners Road bridge (C13)	0	0	0
Sydney Park (C14)	1,000	0	1,000
Total spoil	597,960	2,658,484	3,256,444

Most of this material would consist of crushed sandstone and shale material, classified as virgin excavated natural material (VENM), which can be reused where possible, or taken to sites approved to receive the material.

Potential reuse within the project footprint would include:

- The use of tunnel spoil for the refill of temporary access shafts and declines
- The use of tunnel and civil surface works spoil for landfill closure, landscaping and site rehabilitation
- The use of Hawkesbury Sandstone from tunnel excavation works to be reused for local road upgrades, namely the replacement of existing unsuitable pavement subgrade material.
- Fill and landscaping purposes.

The construction traffic and transport assessment (**Section 9.3.1**) has taken into account heavy vehicle movements associated with spoil disposal, as the peak construction period. **Table 9-38** of **Chapter 9** provides a summary of heavy vehicle movements at each construction compound, including spoil related haulage.

Excess spoil that cannot be reused within the project would require offsite disposal. Five potential spoil management sites have been identified for receiving excess spoil from the project, as summarised in **Table 6-31**. Negotiations for the final destination(s) for excess spoil from construction of the project would be made during detailed design, and may include one or more of the sites listed in **Table 6-31**, or other alternatives is identified. The management of spoilt facilities does not form part of the project. Sites identified as potential spoil disposal locations that do not currently have the necessary environmental planning approval to accept the materials would be subject to separate assessment and approval in accordance with the requirements of the *Environmental Planning and Assessment Act 1979* (EP&A Act 1979) and disposal of spoil from the project to particular locations would be undertaken in accordance with those other approvals.

A Spoil Management Strategy would be prepared and implemented for the project before construction begins. The Strategy would take into account construction staging and specific conditions of approval that may be applied to the project. More information regarding the Spoil Management Strategy is provided in **Section 24.1.2** of **Chapter 24** (Resource use and waste minimisation).

Table 6-31 Potential spoil management sites

Spoil management site	Location	Distance from the project* (kilometres)	Capacity for site to accept spoil (m ³)
CSR PGH Brick Pit	75 Townson Road, Schofields.	55	550,000
DHA Schofields	49 Manorhouse Boulevard, Quakers Hill	60	500,000
Austral Plant 2 or 3 clay shale pit	738-780 Wallgrove Road, Horsley Park	40	3,000,000
Riverstone West Sakara Development	Land west of Riverstone	60	3,500,000
Kurnell Landfill Company	330 Captain Cook Drive, Kurnell	15	7,000,000

*Distance from the project has been taken from Bardwell Valley Golf Course, about halfway along the tunnelling works to be undertaken as part of the project.

Other disposal / re-use sites may be used depending on need at the time spoil is generated. Further details regarding spoil generation and management are provided in **Chapter 9** (Traffic and transport) and **Chapter 24** (Resource use and waste minimisation).

6.10.2 Landfill closure wastes and management

Leachate

Leachate generated within the Alexandria Landfill would be pumped out of the main leachate extraction riser and into a leachate treatment plant. The treated leachate would be pumped to a sewer discharge point in Albert Street under a trade waste agreement with Sydney Water.

The existing leachate collection system would be maintained in the short term during construction until the new leachate collection and treatment system is constructed and operational. Additional detail regarding the new leachate collection and treatment system is provided in **Section 5.9.3** and **Chapter 17** (Contamination).

Contaminated wastes

The Alexandria Landfill site stopped accepting waste in December 2014. A clean-up of the site has been underway since July 2015; however, the landfill was licensed to accept asbestos, and there is the potential for the site to contain hazardous and special wastes, including friable and non-friable asbestos.

Any works within the landfill site as part of the landfill closure and / or construction of the project may disturb asbestos containing materials. The excavation or movement of any material known or potentially containing asbestos would be undertaken in accordance with procedures detailed in an Asbestos Management Plan and Asbestos Removal Control Plan to ensure the safety of construction workers and the surrounding community during construction.

Other wastes identified within the Alexandria Landfill site as hazardous or potentially hazardous waste in accordance with the Waste Classification Guidelines (NSW EPA, 2014) would be stored, treated and transported in accordance with the *Protection of the Environment Operations (Waste) Regulation 2005*.

Additional detail regarding the management and minimisation of waste is provided in **Chapter 24** (Resource use and waste minimisation).

6.10.3 Other wastes and management

Other wastes that would be generated throughout construction would include wastewater and other construction waste.

Wastewater

During construction, tunnelling works would result in significant volumes of wastewater requiring treatment and disposal. Wastewater would be generated during construction from:

- Groundwater ingress into the main alignment tunnels
- Process water, namely cooling water for roadheaders
- Dust suppression and washdown
- Sewage / greywater from construction compounds
- Treated leachate from the Alexandria Landfill facility.

Water volumes generated during construction of the project would vary based on the construction activities that are taking place in the main alignment tunnels, the amount of groundwater infiltrating into the main alignment tunnels and the length of the tunnel that has been excavated.

Estimated wastewater generation at construction compounds over the duration of the construction period from tunnelling and their discharge points into local waterways are provided in **Table 6-32**. Refer to **Chapter 16** (Soil and water) for more detail.

Table 6-32 Indicative wastewater volumes at construction compounds

Construction compound	Wastewater volume (megalitres)	Discharge point
Kingsgrove North (C1)	86	Wolli Creek
Commercial Road (C3)	86	Wolli Creek
Bexley Road South (C5)	340	Wolli Creek
Arncliffe (C7)	676	Cooks River
Canal Road (C8)	370	Alexandria Canal
Landfill Closure (C10)	108	Alexandria Canal
Total	1666	-

Where feasible, construction wastewater would be captured and reused on-site during construction for activities such as dust suppressions, roadheader operations, irrigation, aquifer replenishment and non-potable applications. Where reuse is not feasible, wastewater would be discharged into the local stormwater system in accordance with the requirements of an environmental protection licence. Additional information is provided in **Chapter 24** (Resource use and waste minimisation). Six construction water treatment plants would be used during construction of the project. Details of water treatment methods and discharge water quality are provided in **Chapter 16** (Soils and water quality).

Other construction wastes

Other construction wastes generated by the project would include

- Demolition waste
- Green waste
- General construction waste (timber formworks, scrap metal, steel, concrete, packaging, crates, cartons, plastics, wrapping materials)
- Site office waste (paper, putrecibles, cardboard, plastics, glass and printer cartridges),
- Demobilisation waste (removal of construction buildings).

Existing metropolitan waste management facilities would have the capacity to receive waste streams generated by the project. The waste hierarchy principles of avoidance, recovery and disposal would be applied to the project in accordance with a Construction Waste Reuse Recycling and Energy sub-plan (CWRREMP) developed for the project. Wastes would be managed and disposed of in accordance with the relevant State legislation and government policies including the POEO Act, *Waste Avoidance and Resource Recovery Act 2001*, *Waste Avoidance and Resource Recovery Strategy 2007* (DECC, 2007c) and the *(Waste Reduction and Purchasing Policy)* (RTA, 2009).

6.11 Construction resource use

6.11.1 Construction materials

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

- General fill and select fill for earthworks. This would be sourced from within the project tunnel spoil in instances where the material is of suitable quality
- Pavement materials including road base and sub-base
- Materials for lining drainage channels
- Aggregate for concrete, asphalt and bitumen
- Cement and concrete
- Steel for reinforcement
- Wood for use in formwork and other temporary structures
- Water
- Pre-cast concrete including pipes, culvert segments and roadside barriers
- Mechanical and electrical equipment for tunnel fit-out.

Indicative quantities of the major sources of materials required for construction of the project are detailed in **Table 6-33**. Material quantities would be reduced where possible through efficient design, construction and procurement processes.

Where practicable, construction materials would be sourced locally (ie from within the Sydney region). Given the location of the project within a suburban area, the extraction and procurement of select materials such as concrete, steel, asphalt, polypropylene and copper is likely to be required from quarries, manufacturers and suppliers outside of the Sydney region. **Chapter 24** (Resource use and waste minimisation) provides further discussion and assessment regarding resource consumption and waste minimisation associated with construction of the project.

Table 6-33 Indicative resource requirements

Material	Estimated quantity required
Concrete – plain shotcrete (cast <i>in-situ</i>)	2000 cubic metres
Concrete – reinforced shotcrete (cast <i>in-situ</i>)	130,000 cubic metres
Concrete – no-fines (cast <i>in-situ</i>)	80,000 cubic metres
Concrete – piles (cast <i>in-situ</i>)	12,000 cubic metres
Concrete – New Jersey kerbs slipformed	13,000 cubic metres
Concrete – retaining walls (precast)	1000 cubic metres
Concrete – base pavement	80,000 cubic metres
Concrete – drainage pipes 450 diameter (precast)	40,000 cubic metres
Concrete – other	200,000 cubic metres
Pre-fabricated noise walls	13,446 square metres
Steel – steel fibre reinforcement for shotcrete	4300 tonnes
Steel – rock bolts	5100 tonnes
Steel – rebar	40,000 tonnes
Asphalt	135,000 tonnes
Aggregate	350,000 tonnes
Copper wire cable	200 tonnes
Plastic – PVC conduit	402 tonnes
Plastic – polypropylene	180 tonnes
Plexiglass	128 cubic metres
Polyethylene	900 cubic metres
Power	130,000 megawatt hours
Fuel (Diesel and Petroleum)	30,500 kilolitres
Water	2462 megalitres

6.11.2 Construction power

All construction compounds would require power supply during construction. High voltage power would be required at compounds which would be used to support tunnel construction. The power supply requirements for these compounds are summarised in **Table 6-34**.

The 10 megavolt ampere supply between the Campbell Road construction compound (C9) and the St Peters substation has been sized to accommodate future works as part of the future possible M4-M5 Link project. This would remove the need for additional construction works and associated resource use, and disruption during future construction of the future possible M4-M5 Link. Other construction compound sites would be connected to the existing power supply infrastructure at each site and/ or provided with diesel powered generators.

The construction power supply routes summarised in **Table 6-34** below are for information purposes only and do not form part of the project. Power supply infrastructure would be subject to separate assessment and approval in accordance with the requirements of the EP&A Act 1979.

Table 6-34 Construction power supply requirements

Construction compound	Supply source substation	Distance to worksite (kilometres)	Connected load (megavolt ampere)
Kingsgrove North (C1)	Punchbowl Zone substation	4	3
Commercial Road (C3)	Punchbowl Zone substation	4	3
Bexley Road North (C4)	Canterbury Zone substation	2	6
Bexley Road South (C5)	Canterbury Zone substation	2	6
Bexley Road East (C6)	Canterbury Zone substation	2	6
Arncliffe (C7)	Canterbury Zone substation	4	2 x 36(33kV)
Canal Road (C8)	Green Square Substation	2	6
Campbell Road (C9)	St Peters substation	2	10

Note: Supply routes are indicative only and subject to change during detailed design and consultation with relevant power authorities.

6.11.3 Construction water

Construction of the project would require the use of potable and non-potable water. Water would be required for construction activities such as:

- The use of site amenities, including ablutions blocks and site offices.
- Dust suppression and cooling water for road headers.
- Surface works, including compaction of pavement materials and dust suppression.

Non-potable water would be used for construction activities where practical; however, higher quality water for some construction activities may be sourced from local drinking water supplies. Alternative water sources to potable water for concrete and shotcrete would be investigated during detailed design.

The total volume of water required for construction of the project would be around 2500 megalitres, and most of this would be required for excavation activities as part of the tunnelling works. Tunnelling would also generate wastewater which would require treatment and disposal. Further details are provided in **Chapter 24** (Resource use and waste minimisation).

Estimated volumes of water required for construction are provided in **Table 6-35**.

Table 6-35 Indicative construction water supply

Construction compound	Total potable water supply Sydney water mains	Total non-potable water supply		
		Collected rainwater	Treated groundwater	Total
Daily construction water usage (kilolitres per day)				
Kingsgrove North (C1)	643	2	121	766
Kingsgrove South (C2) and Commercial Road (C3)	641	4	121	766
Bexley Road North (C4)	177	2	164	343
Bexley Road South (C5)	176	3	164	343
Bexley Road East (C6)	1	1	0	2
Arncliffe (C7)	948	5	120	1073
Canal Road (C8)	638	3	90	738
Campbell Road (C9)	529	1	0	530
Landfill Closure (C10)	4	0	0	4
Burrows Road (C11)	45	0.150	0	45.150
Campbell Road Bridge (C12)	45	0.05	0	45.05
Gardeners Road Bridge (C13)	45	0	0	45
Sydney Park (C14)	2	0	0	2
Total daily usage	3894	21.2	780	4695.2
Annual construction water usage (kilolitres per year)				
Kingsgrove North (C1)	185,736	540	32,054	218,330
Kingsgrove South (C2) and Commercial Road (C3)	185,196	1080	32,054	218,330
Bexley Road North (C4)	101,055	585	11,550	113,190
Bexley Road South (C5)	100,650	990	11,550	113,190
Bexley Road East (C6)	148	383	0	531
Arncliffe (C7)	312,780	1620	39,600	354,000
Canal Road (C8)	210,450	855	27,000	238,305
Campbell Road (C9)	140,225	225	0	140,450
Landfill Closure (C10)	925	135	0	1060
Burrows Road (C11)	11,880	45	0	11,925
Campbell Road Bridge (C12)	11,912	14	0	11,926
Gardeners Road Bridge (C13)	11,925	0	0	11,925
Sydney Park (C14)	530	0	0	530
Total annual usage	1,273,412	6472	153,808	1,433,692
Total construction period (megalitres)				
Kingsgrove North (C1)	440	2	58	500
Kingsgrove South (C2) and Commercial Road (C3)	25	0	55	80
Bexley Road North (C4)	150	2	33	185
Bexley Road South (C5)	150	4	31	185
Bexley Road East (C6)	1	1	0	2
Arncliffe (C7)	480	5	100	585
Canal Road (C8)	340	3	67	410
Campbell Road (C9)	419	1	0	420
Landfill Closure (C10)	2	0	0	2
Burrows Road (C11)	30	Less than 1	0	31
Campbell Road Bridge (C12)	30	Less than 1	0	31
Gardeners Road Bridge (C13)	30	0	0	30
Sydney Park (C14)	Less than 1	0	0	1
Total construction usage	2,098	20	344	2462