Transport for NSW

Chapter 7
Project description – construction

Contents

Tables

Figures

7. Project description – construction

This chapter describes the proposed approach to construction, including the indicative construction methodology, program and working hours, temporary construction compounds, workforce numbers and transport and access arrangements. A description of the proposed features of the project and how it would operate is provided in Chapter 6 (Project description – infrastructure and operation).

7.1 Overview

7.1.1 Construction overview

Construction would broadly involve the following key stages:

- site establishment (see section 7.2)
- main construction works, including constructing the light rail infrastructure, bridges and other proposed infrastructure (see section 7.3)
- finishing works, including testing, commissioning and site rehabilitation (see section 7.4).

Some preparatory investigations may also be undertaken separately from the above (see section 7.1.3.

This chapter provides an indicative construction methodology that would be refined and optimised by the successful construction contractor(s). A final construction methodology and program would be developed by the construction contractor(s) based on the conditions of approval and the mitigation and management measures provided in this EIS.

Detailed construction planning, including timing, delivery strategy and work sequencing considerations, would be confirmed once construction contractor(s) have been engaged. An indicative overview of the construction program is provided in section 7.1.2 and construction timing and working hours are described in section 7.5.

Construction resources, including land requirements, ancillary facilities and the workforce required to support construction, are described in section 7.6. The proposed arrangements for transport and access during construction are described in section 7.7.

Construction would also involve works to utilities within the project site, including relocating a portion of two of Sydney Water's trunk mains in Ermington. These proposed works are described in section 7.8.

Construction would involve works within the project site as described in section 2.2 and shown on Figure 2.2 to Figure 2.7. In some instances, due to the ongoing nature of design development, some construction activities may need to be undertaken outside the project site, including:

- utility adjustments and connections
- drainage works where connections are made to existing infrastructure
- property adjustment works, including adjustments within properties to property fencing, driveway realignments and the provision of new property access

- minor road network and public transport changes, such as traffic signal adjustments, signage and line marking; road, footpath or active transport tie-ins, and new or relocated car parking and bus stop infrastructure
- boat and barge movements, including loading and unloading facilities for bridge works
- tree planting in accordance with the tree offset strategy (see section 15.6).

7.1.2 Program

The construction program presented within this EIS provides indicative timing only. The final construction program may vary. Subject to planning approval and procurement, it is anticipated that construction would start in 2025 and the project would take about five to six years to complete. The indicative timing of the main work phases is shown on Figure 7.1 and the first passenger services are proposed to start from 2030/2031. The two bridges over the Parramatta River are expected to take about 30 to 36 months to construct. While the main construction activities would take at least five years, the project would likely be delivered in stages subject to decisions regarding the delivery strategy. Staging would be investigated in detailed project planning and confirmed via a Staging Report.

Where the works would be staged at discrete locations these work areas would not remain active for the full duration of construction.

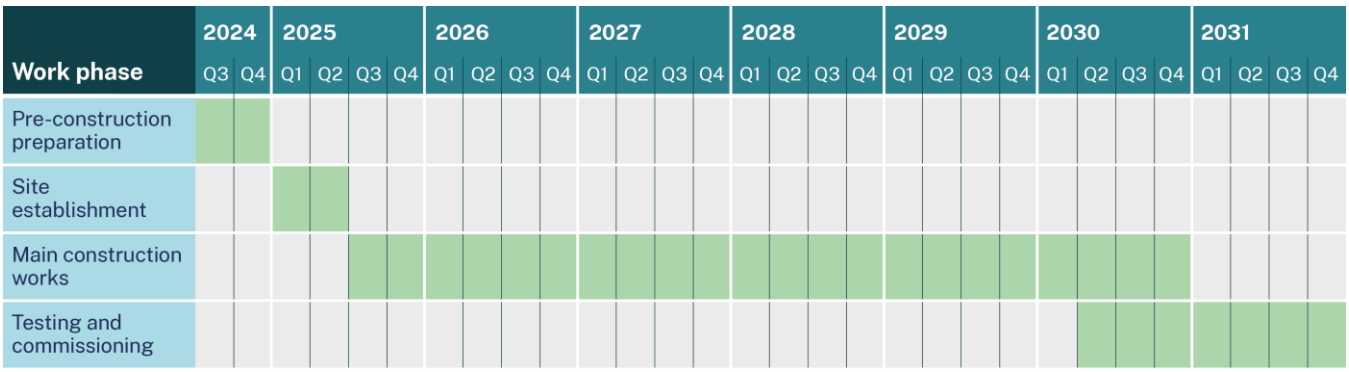


Figure 7.1 Indicative construction program

A key driver for the construction program is the works to Sydney Water's trunk mains, including the proposed relocation of two of the pipelines in Ermington (see section 7.8.1). Due to the importance of these pipelines, Sydney Water has indicated a number of requirements in relation to works to the pipelines. These include that works can only be undertaken in winter (when demand for water is lower) and works can only be undertaken on one pipeline at a time. Given these constraints, these works may be undertaken prior to the start of substantial construction of the light rail infrastructure.

7.1.3 Preparatory investigations

Some preparatory work and investigations (such as survey, soil sampling, archaeological testing, and utilities investigations) may be undertaken for the purposes of ongoing design development and construction planning. These works are typically of low environment impact. Examples of low impact preparatory works include:

- survey work, monitoring work and investigations, including investigative boreholes on land and over water
- property condition surveys
- treatment of contaminated sites (subject to the recommendations of a contaminated sites investigation report)

- minor utility works
- property adjustment works, including installation or adjustment of property fencing
- at-property noise treatments to mitigate anticipated construction noise impacts before commencement of construction.

7.2 Site establishment

Site establishment works would generally include:

- installing site environment management controls, including site fencing, exclusion fencing for sensitive areas, sediment and erosion control, screening and noise attenuation
- removing redundant buildings and structures (as required)
- salvage Aboriginal objects if required in accordance with the salvage methodology (see Chapter 11 (Aboriginal heritage))
- establishing construction compounds (see section 7.6.2) and work areas, including providing access, erecting demountable buildings and fencing
- supplying power, water and other utilities to construction compounds and work areas
- vegetation removal, trimming and tree removal/relocation where required
- relocating, adjusting and protecting utilities and services (other than minor utility works)
- establishing temporary road, pedestrian and cyclist diversions
- preparing works areas for main construction works, including bridge works (levelling, grading and/or compacting)
- remediation of contaminated land (to the extent required for the proposed use) (see Chapter 18 (Soils and contamination)).

7.3 Main construction works

7.3.1 Light rail infrastructure

Track work

Constructing the light rail tracks would generally involve civil works, track installation works and overhead wiring installation, as described below. Figure 7.2 shows a simplified construction process for these elements.

Civil works

Civil works associated with track construction would typically involve:

- removing existing road pavement and subgrade in the vicinity of the proposed track location
- earthworks (see section 7.3.5), including subgrade works for the track slab foundation and compaction of fill material
- installing services conduits
- constructing drainage
- preparing the track bed
- placing steel reinforcement and concrete formwork, pouring concrete or installing pre-formed concrete slabs

- constructing retaining walls (see section 7.3.6)
- backfilling areas of excavation
- reinstatement of affected areas, including roads, paths and grassed areas
- public domain works (including landscaping) where required (see section 6.8).

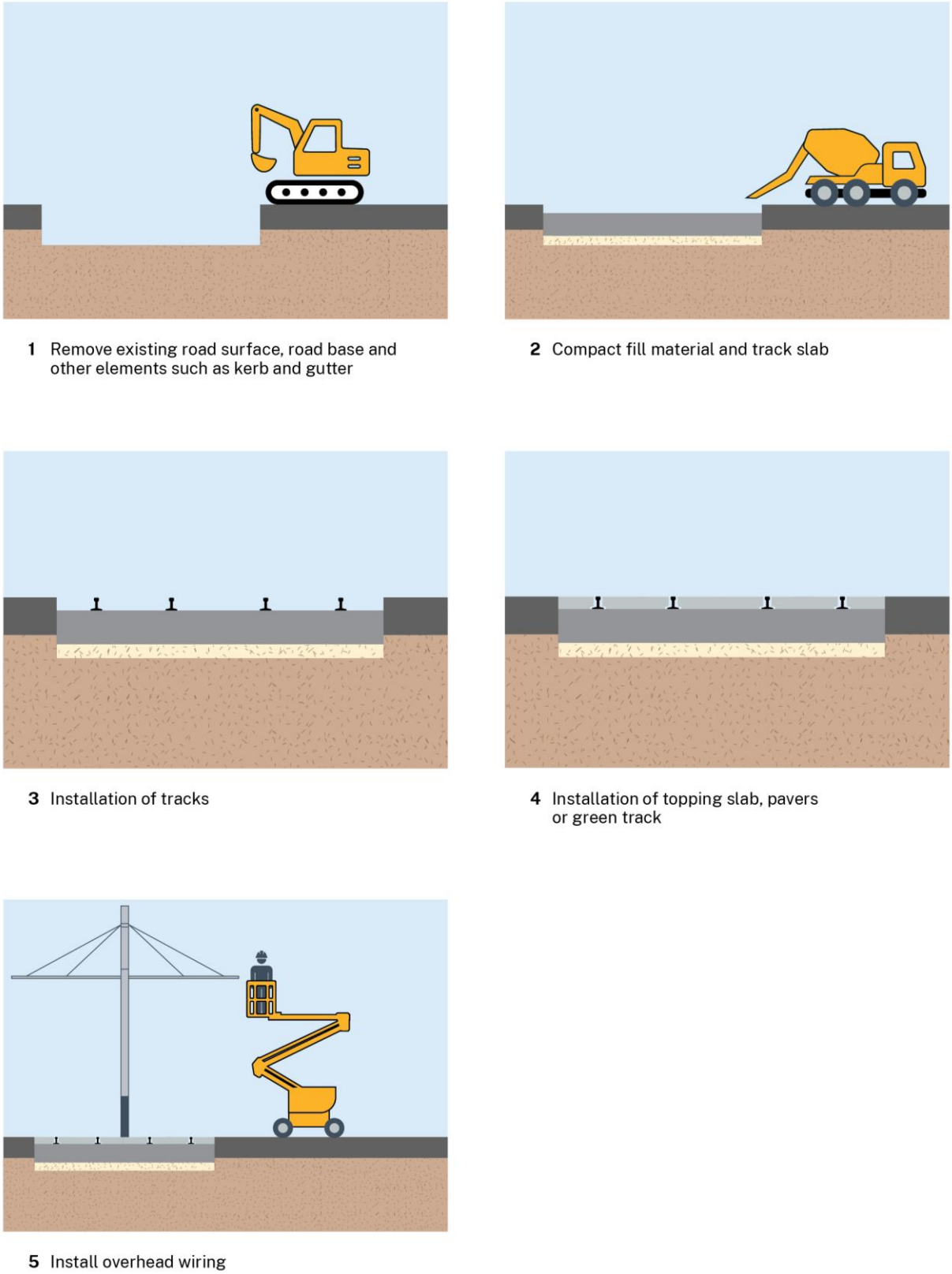


Figure 7.2 Typical construction process for track work

Track installation

Track installation would typically involve:

- installing the tracks in concrete, including track laying, welding and grinding
- rail systems installation, including conduits installed during civil works
- surface finishing, depending on the track form proposed at each location (see section 6.2.1)
- reinstating affected areas
- installing road and on-track linemarkings.

Generally, the tracks would be installed in linear sections, with multiple sections constructed at any one time. During detailed construction planning, the contractor(s) would confirm whether the light rail tracks are installed together, or whether each track is installed separately based on the design of the project and surrounding constraints, such as property adjustments and access and road usage.

Figure 7.3 shows an example of track installation for Parramatta Light Rail Stage 1.

Figure 7.3 Image showing track installation works for Parramatta Light Rail Stage 1

Overheard wiring, poles and street lighting

Where overhead wiring and pole and street lighting is required, installation would typically involve:

- removing existing pavement and excavating footings
- placing prefabricated reinforcement cage, base plate and other sub-structure elements
- concrete pouring
- off-site fabrication of poles and delivery to the work site

- erection of poles
- stringing overhead wires (where proposed), utility connection, installing droppers and wiring terminations.

Stops

Light rail stops may be constructed concurrently with the track infrastructure or constructed separately, with works at each stop commencing after the adjacent section of track infrastructure has been constructed.

Stop construction is likely to consist of installation of prefabricated materials and on-site concrete pours. Construction activities would typically involve:

- removing existing road pavement (where not undertaken as part of the track infrastructure works)
- excavation
- installing services, including communications and power supply into the stop structure
- construction of footings
- installing prefabricated columns, stop canopy, integrated service cabinets, signage, seating, windbreaks, balustrades at back of platforms (as required), and paving tactile indicators (see section 6.3.2)
- finishing works.

7.3.2 Bridges

Bridge construction

As described in section 6.5, the project involves the construction of five new bridges (two over the Parramatta River, one over Silverwater Road, one in Ken Newman Park and a new bridge adjacent to the existing Hill Road bridge).

Construction of the bridges, would typically include:

- excavation works at approaches and supports
- constructing abutments on the approaches to the bridge
- constructing bridge piles (if applicable) and pile caps (if applicable)
- constructing bridge piers (if applicable)
- constructing bridge superstructure, which may include:
  - lifting and installing concrete girders and/or precast concrete bridge segments using cranes
  - off-site assembly of structural elements and lifting into place
  - in-situ concrete pouring of bridge superstructure elements
- concrete pouring the bridge deck
- installing light rail infrastructure on the bridge deck
- other bridge fit-out works, including installing handrails, overhead wiring and other safety and operational infrastructure.

Figure 7.4 shows an example of the track form for a Parramatta Light Rail Stage 1 bridge.

Figure 7.4 Image showing light rail track form for a Parramatta Light Rail Stage 1 bridge

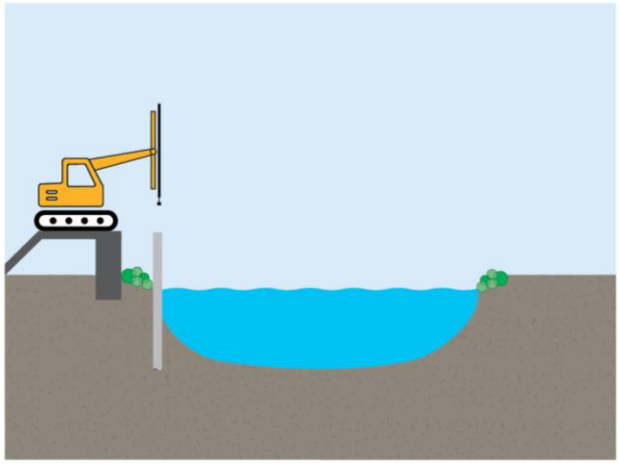
The proposed construction methods for the bridges over the Parramatta River have been refined to minimise potential impacts on environmentally sensitive areas, including contaminated land, river bed sediments, and the presence of mangrove vegetation along the shoreline (see section 5.5.2).

The sections of river within which the proposed bridge piers would be located are relatively shallow. It is therefore proposed to construct the bridges over the river by establishing temporary working platforms, supported by piles, on the northern and southern banks of the river, and progressively extending the platforms out into the waterway. Two temporary platforms would be established for each bridge, with lengths ranging from about 40 metres up to about 120 metres. The platforms would be installed in segments on top of piles within the riverbed, which would support a steel structure.

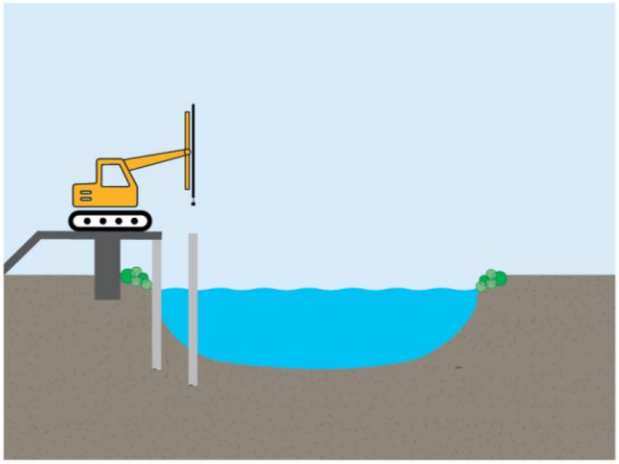
Piles for bridge piers would be installed from piling rigs located on top of the platforms or barges. Silt curtains would be installed at the proposed platform and bridge piles when there is a risk of mobilising sediments. Coffer dams (or similar) would also be installed within the area protected by silt curtains, to provide a dry working environment.

Lifting and installing the precast bridge segments on top of the piers would be undertaken using cranes located on the temporary platforms or barges (depending on crane reach).

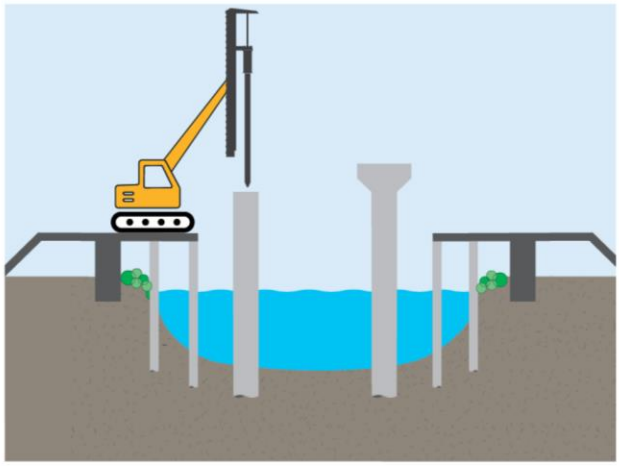
Figure 7.5 shows the typical process for constructing the bridges over the Parramatta River.



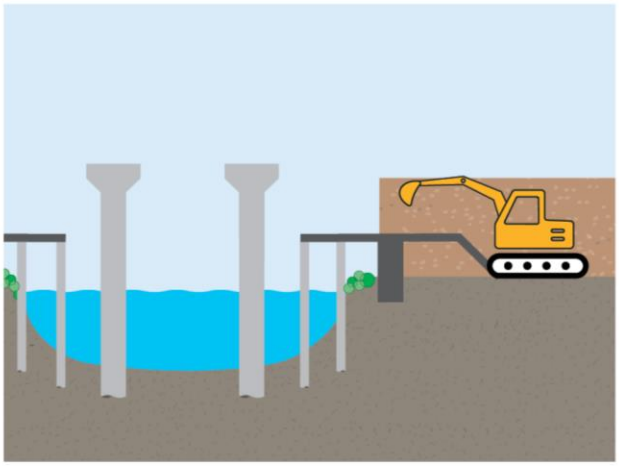
1 Install temporary working platform piles from land



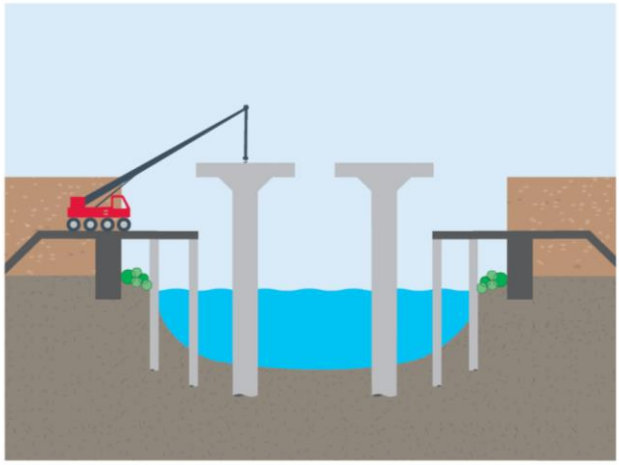
2 Install steel support onto pile then install next pile for temporary working platform



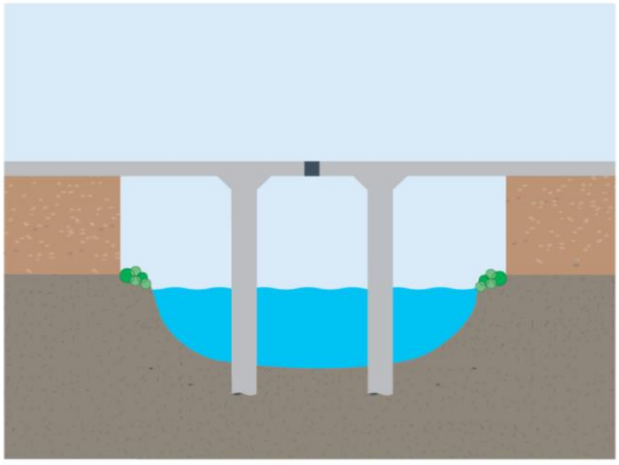
3 Drill and install piles for bridge piers. Construct pile caps and headstocks from temporary working platform



4 Construction of reinforced earth abutments



5 Bridge segments lifted into place from temporary working platforms or barge



6 Span meet at centre with final segment placed followed by bridge fitout

Figure 7.5 Typical process for bridge construction over the Parramatta River

Strengthening works

As described in section 6.5, the existing Holker Busway bridge would be retained however additional works would be required to strengthen the bridge to ensure compliance with current standards.

Minor works may also be required on the existing Hill Road bridge to ensure the bridge complies with current standards.

Works to the Holker Busway and existing Hill Road bridges would be subject to further investigation during design development, including the extent of works needing to be undertaken during periods of road closure. Any road closures would be co-ordinated with the Greater Sydney Operations and Sydney Olympic Park Authority.

7.3.3 Road works

As described in section 6.6, the road network would need to be modified to accommodate track infrastructure. Works are required to ensure that roads and footpaths continue to operate safely, that the road surface ties into the new track, and that the grade is sufficient to provide suitable drainage.

This would include changes to the road surface and lane arrangements, such as road widening, reconfiguration of traffic lanes, milling and resurfacing of pavement surfaces and intersection works. Road works would typically involve:

- removing existing kerb, gutters, median strips and redundant infrastructure
- milling and excavation to the level required for the installation of light rail infrastructure
- placing and compacting road base and road pavement works
- integration with existing road pavements (where required)
- constructing new kerbs, gutters and other drainage
- erection of directional, wayfinding, regulatory and other signage
- erection of roadside furniture
- installing new light rail infrastructure (see section 7.3.1)
- road paving and pavement marking
- constructing tie-ins to existing roads
- installing/modifying traffic lights, induction loops and signage
- public domain works (including landscaping) where required (see section 6.8).

In some areas, the profile of existing carriageways would be modified (raised or lowered) to tie into the light rail alignment.

Some on-street parking would be removed to facilitate construction. Further information is provided in Chapter 9 (Transport and traffic).

7.3.4 Active transport links

Works to construct the active transport links would vary along the route according to the configuration proposed. For the bridges, active transport links would be constructed as part of the bridge deck structure. In other areas, the active transport links would be constructed as part of other project elements, such as the modified roadway or areas adjacent to the roadway/stops.

Generally, where excavation for the active transport links is required, this would be completed as part of the overall project earthworks (see section 7.3.5). This would be followed by:

- installing formwork
- pouring concrete
- installing drainage and services (as required)
- finishing the surface (including painting and linemarking)
- installing signage (as required).

Figure 7.6 shows an example of the construction of an active transport link for Parramatta Light Rail Stage 1.

Figure 7.6 Image showing part of the Parramatta Light Rail Stage 1 active transport link under construction

7.3.5 Earthworks

Earthworks would be required to construct various infrastructure, including light rail infrastructure, bridges and substations, and undertake some road and utility works.

Figure 7.7 shows an example of earthworks for Parramatta Light Rail Stage 1.

Figure 7.7 Image showing earthworks underway for Parramatta Light Rail Stage 1

The estimated quantities of materials associated with earthworks are provided in Table 7.1 for each of the planned urban growth precincts along the project site (described in Chapter 2 (Location and setting)).

Table 7.1 Estimated volume of cut and fill material by precinct

Precinct	Estimated volume of material to be excavated (cubic metres)	Estimated volume of material required for fill (cubic metres)	Earthworks balance (cubic metres)
Camellia	9,000	2,500	6,500
Rydalmere East	7,000	13,500	-6,500
Ermington	21,000	6,000	15,000
Melrose Park	15,000	2,000	13,000
Wentworth Point	23,000	4,000	19,000
Sydney Olympic Park	19,000	0	19,000
Carter Street	7,000	0	7,000
Total	**101,000**	**28,000**	**73,000**

Fill material would generally be required for backfilling excavations, subgrade works where sections of the alignment are not underlain by existing road pavements, and retaining wall construction. The following hierarchy would apply to managing excavated materials, excluding activities associated with the remediation of contaminated land:

1. Material with suitable engineering properties that meets soil quality requirements would be reused within the project site, where practicable.
2. Excess usable material would be transported off site for reuse on other Transport for NSW project sites, recycling or disposal at an appropriately licensed facility (to be determined based on the waste classification).

3. Excess material (including contaminated material) that is unable to be reused within the project site or other Transport for NSW project sites would be transported off site for treatment and/or disposal at an appropriately licensed facility (to be determined based on the waste classification).

Where fill material is not available from project earthworks, suitable material (i.e. subject to a resource recovery exemption) may be sought from other projects to maximise the opportunity to divert waste from landfill.

Further information on waste management is provided in Chapter 22 (Waste and resources).

7.3.6 Other infrastructure

Modifications to the stabling and maintenance facility

Modifications to the stabling and maintenance facility at Camellia would include:

- providing a new temporary construction access road on the eastern side of the site
- preparing and levelling land within the new sections of the stabling and maintenance facility
- installing new drainage and services
- installing new stabling tracks and turnouts
- installing overhead wiring for the new tracks
- installing light rail systems and operational infrastructure
- adjustments to the maintenance building constructed by Parramatta Light Rail Stage 1.

The existing car park at the facility would also be extended with works involving:

- excavation to level the site
- placement and compaction of the road base
- construction of a new kerb and gutter
- laying asphalt surface and linemarking
- installation of ancillary elements such as paths and lighting
- general landscaping works.

The contamination capping layer installed as part of Parramatta Light Rail Stage 1 works would not be affected by the modifications.

Macquarie Street turnback facility

Construction of the turnback facility at Macquarie Street would include:

- removing existing kerb and gutters
- removing and excavating the existing road surface and road base to the formation level
- earthworks, including subgrade works for the track slab foundation and compaction of fill material
- placing steel reinforcement and formwork, concrete pouring, and pavement installation for track slab and kerbs
- installing new tracks including the crossover between Marsden and Church streets
- installing the turnout from the Parramatta Light Rail Stage 1 tracks at the intersection of Macquarie and Church streets
- installing below ground charging infrastructure to power the light rail vehicles

- installing an end of line light rail vehicle stop treatment
- road adjustments on Macquarie and Marsden streets to accommodate the light rail infrastructure (see section 7.3.3).

Traction power substations

Constructing the traction power substations would typically involve:

- constructing foundations, footings and conduits
- constructing and/or delivery and installation of substation structure and electrical equipment, including wiring fit out
- installing earthing and lighting systems
- installing high voltage cables between substations and light rail stops, and to the existing electricity supply network
- installing access paths and service parking bays as required
- ground finishing with concrete, pavers or other materials
- installing the facade.

Retaining walls

Retaining walls would vary in structure and construction methodology, depending on location. Construction activities would typically involve:

- excavating below the existing ground surface to prepare the foundation for the retaining wall
- installing steelwork/formwork and concrete pouring (for cast in situ walls)
- installing precast segments and retaining straps (for reinforced earth walls)
- installing subsurface drainage systems, including free draining aggregate and geotextile materials
- progressive backfilling and compaction
- installing any surface drainage proposed at the top or bottom of the retaining wall
- installing retaining wall finishes.

7.4 Finishing, testing and commissioning

7.4.1 Finishing works

At the end of construction in each work area, the contractor would remove all construction related equipment and infrastructure.

Finishing works would be undertaken progressively (as far as practicable) and would generally include:

- demobilising compounds and works areas, removing all equipment and temporary infrastructure
- removing materials, waste and redundant structures from the project site
- removing temporary fencing
- rehabilitation of disturbed areas in accordance with the rehabilitation strategy (see section 13.7)
- landscaping (see section 6.8.3)
- erecting directional and other signage, and roadside furniture such as street lighting.

7.4.2 Testing and commissioning

Testing and commissioning activities would typically include:

- testing infrastructure and electrical systems
- testing the substations and energising of track zones
- delivery and assembly of light rail vehicles at the stabling and maintenance facility
- testing the light rail vehicles
- line-wide testing of the track and intersection signalling and operations
- rectification of defects
- operation tests, including emergency simulations for track, electrical and operational systems.

7.5 Construction timing

7.5.1 Working hours

Recommended standard hours

The *Interim Construction Noise Guideline* (DECC, 2009) provides the following hours for normal construction work:

- Monday to Friday: 7am to 6pm
- Saturday: 8am to 1pm
- no work on Sundays or public holidays.

The *Interim Construction Noise Guideline* notes that these recommended standard hours are non-mandatory and that work should be scheduled during these recommended standard hours unless work outside these hours can be justified.

The *Interim Construction Noise Guideline* further states that there are some situations where construction work may need to be undertaken outside of these hours such as works on public infrastructure to maintain the operational integrity of the road network or utilities, as this infrastructure provides a benefit to the greater community.

The guideline also notes that the consent authority may impose more or less stringent construction hours.

Primary project working hours

As the project would be constructed along road corridors for most of its length, including adjustments to a number of utilities in key locations, working hours are proposed that would extend the recommended standard hours outlined in the *Interim Construction Noise Guideline* to:

- Monday to Friday: 7am to 7pm
- Saturday: 7am to 7pm
- Sundays and public holidays: 7am to 7pm.

Where there is the potential for construction noise impacts, no work would be undertaken in that area one weekend per month, except in the following circumstances:

- where the substantial majority of potentially affected receivers agree that the work can be undertaken
- where construction works do not exceed the noise management levels specified in the *Interim Construction Noise Guideline* (Table 3) at residential sensitive receivers

- where emergency work is required to avoid the loss of life or damage to property, or to prevent environmental harm.

The proposal to construct the project during periods other than the recommended standard hours outlined in the *Interim Construction Noise Guideline* requires a strong justification to be provided and negotiation with the affected community.

The proposed primary project working hours would:

- be consistent with the aims of the *Interim Construction Noise Guideline* and the *Construction Noise and Vibration Strategy* (Transport for NSW, 2019a) which establishes a hierarchy for works to occur during less noise sensitive periods (refer below)
- reduce the duration of construction in any one location and associated amenity (including noise, access, etc) impacts
- permit works within the road corridor at times when traffic volumes are lower, reducing the potential for disruption to the general public and providing safety benefits for workers
- minimise potential disruptions to critical utilities during times of greatest needs
- enable works within Sydney Olympic Park to be planned around special events.

A similar approach was implemented during construction of Parramatta Light Rail Stage 1 which significantly reduced the number of nights worked and the associated noise and access impacts to the community.

The *Construction Noise and Vibration Strategy* notes that where work cannot be scheduled during the recommended standard hours, a hierarchy of working hours outside the standard hours should apply. As far as practicable, Transport for NSW would seek to minimise impacts by scheduling work during the recommended standard hours and then according to the following hierarchy of preferred working hours for work outside recommended standard hours:

1. Saturday afternoon periods between 1pm and 6pm
2. Sunday and public holiday day periods between 8am and 6pm
3. weekday evening periods between 6pm and 7pm
4. weekend evening periods between 6pm and 7pm
5. weekday evening periods between 7pm and 10pm
6. weekend evening periods between 7pm and 10pm
7. weekend night periods between 10pm and 8am
8. work during the weekday evening and night, scheduling the noisiest work first (between 6pm and 10pm) to minimise sleep disturbance in the night (between 10pm and 7am)
9. all other times outside the recommended standard hours.

Highly noise and vibration intensive works would be limited to the recommended standard working hours as far as practicable.

Potential construction noise and vibration impacts, which include consideration of the proposed primary project working hours, are described in Chapter 10 (Noise and vibration).

7.5.2 Work outside the primary project working hours

Discrete construction activities would need to be undertaken outside the primary project working hours at some locations to minimise the potential for road safety hazards and maintain operation of key roads and public transport facilities. Such works would include:

- delivery of oversized plant, equipment and structures that the police or other authorities determine require special arrangements to transport along public roads
- constructing track infrastructure and undertaking road works at busy intersections or where temporary road closures are required during periods of lower traffic volumes
- certain utility adjustments depending on the location and requirements of the utility provider, particularly where disruption to essential services, required system conditions (such as low-flow conditions for sewers) and/or considerations of worker safety do not allow work during standard working hours
- works associated with constructing the bridges over the Parramatta River to minimise navigation impacts
- works associated with constructing the bridge over Silverwater Road where temporary road closures are required during periods of lower traffic volumes
- emergency work to avoid the loss of life or damage to property, or to prevent environmental harm.

Managing out-of-hours work

An out-of-hours work protocol would be prepared to define the process for considering, managing and approving work outside the primary project working hours. The protocol would be prepared with regard to the *Construction Noise and Vibration Strategy* and the requirements of any environmental protection licences.

Further information about the approach to managing out-of-hours work is provided in Chapter 10 (Noise and vibration).

7.6 Construction resources and ancillary facilities

7.6.1 Temporary land requirements

In addition to the project's anticipated permanent land requirements (see section 6.9.1), some land would be required during construction only. These areas, which are listed in Appendix E (Preliminary land requirements), would be required for:

- construction compounds (see section 7.6.2 for activities which would occur at the compounds),
- to provide access to construction work areas
- for temporary traffic staging
- to relocate utilities
- to facilitate the manoeuvring of construction plant and machinery.

It is estimated that about 12.9 hectares of land would be required during construction, in addition to land within existing road corridors which would be used during construction and operation of the project. Use of this land would be via acquisition or a lease, licence or a memorandum of understanding with the relevant government agency or private landholder.

Further information about the project's land requirements, and the potential property impacts of these requirements, is provided in Chapter 13 (Land use and property).

7.6.2 Construction compounds and ancillary facilities

Construction compounds

Fifteen construction compounds are proposed to support construction activities in nearby work areas. The proposed compounds are listed in Table 7.2 and shown on Figure 7.8 and Figure 7.9.

Table 7.2 Indicative construction compounds

Reference (see Figure 7.8 and Figure 7.9)	Name	Location	Role of compound
1	Grand Avenue west	Grand Avenue, Camellia	Support works along the western section of the project site (including along the Sandown Line corridor and Grand Avenue) in Camellia.
2	Grand Avenue east	Grand Avenue, Camellia	Support works for the bridge between Camellia and Rydalmere from the southern side of the Parramatta River.
3	John Street	Eric Primrose Reserve, Rydalmere Wharf Car Park, John Street, Rydalmere	Support works for the bridge from the northern side of the Parramatta River and works around John Street and South Street, including the John Street stop.
4	Broadoaks Park	Broadoaks Park, Primrose Avenue, Rydalmere	Support works along South Street and bridge works at Silverwater Road.
5	Ken Newman Park west	Ken Newman Park, Hilder Road, Ermington	Support works east of Silverwater Road, including the River Road stop and works within Ken Newman Park.
6	Ken Newman Park east	Ken Newman Park, Heyson Avenue, Ermington	Support works within and around Ken Newman Park, including relocation of the water mains, and works along Boronia Street.
7	Hope Street	Hope Street, Melrose Park	Support works along Boronia Street and Hope Street, and works at the Atkins Road stop.
8	Wharf Road	Archer Park, Waratah Street, Ermington Boat Ramp, Wharf Road, Melrose Park	Support works for the bridge between Melrose Park and Wentworth Point from the northern side of the Parramatta River and works for the Waratah Street stop.
9	Wentworth Point north	Sanctuary Wentworth Point	Support works for the bridge from the southern side of the Parramatta River and for the alignment to and including the Footbridge Boulevard stop
10	Hill Road north	Hill Road (at Bennelong Parkway), Wentworth Point	Support works along Hill Road including the Hill Road light rail stop.
11	Hill Road south	Hill Road (north of Holker Busway), Sydney Olympic Park	Support works along Hill Road including Hill Road bridge construction.
12	Holker Busway	Holker Busway, Sydney Olympic Park	Support works along Hill Road and the Holker Busway, including bridge works and the Holker Street stop. The compound would include a construction workforce parking area for about 200 vehicles.
13	Australia Avenue	Australia Avenue, Sydney Olympic Park	Support works along Australia Avenue and the Jacaranda Square stop.

Reference (see Figure 7.8 and Figure 7.9)	Name	Location	Role of compound
14	Dawn Fraser Avenue east	Dawn Fraser Avenue, Sydney Olympic Park	Support works along Dawn Fraser Avenue, including the Olympic Boulevard stop.
15	Dawn Fraser Avenue west	Dawn Fraser Avenue, Sydney Olympic Park	Support works at and around the Carter Street stop.

Construction compounds would generally include the following facilities:

- site offices
- staff and workforce amenities
- material storage and laydown, including stockpiling
- plant and equipment storage
- workshops and maintenance facilities
- staff and workforce parking (where sufficient space is available).

Some construction compounds would also include:

- work areas for larger infrastructure such as bridges, including at compounds 2 (Grand Avenue east), 3 (John Street), 8 (Wharf Road) and 9 (Wentworth Point north)
- soil, water and groundwater treatment facilities – dewatering and water treatment plants are proposed at compounds 2 (Grand Avenue east), 3 (John Street) and 8 (Wharf Road)
- erosion and sedimentation control devices, such as sedimentation basins and wheel wash facilities.

Additional or alternative compound locations (if required)

Although every endeavour has been made to identify the land likely to be required for construction (including the location of construction compounds), the construction contractor(s) may require additional or alternative construction compound locations. Additional or alternative compounds would be subject to the following criteria:

- located within or immediately adjacent to the project site
- not located next to sensitive land use(s) (such as residences), without the agreement of the landowner/landholder
- no impacts on heritage items (including areas of archaeological sensitivity), threatened species, populations or ecological communities beyond those identified by the EIS
- the compound(s) can be established and used in accordance with the approach to environmental management for the project and the mitigation measures provided in the EIS (see Chapter 23 (Approach to environmental management and mitigation)).

Where possible, any additional or alternative compounds would be located within the project site.

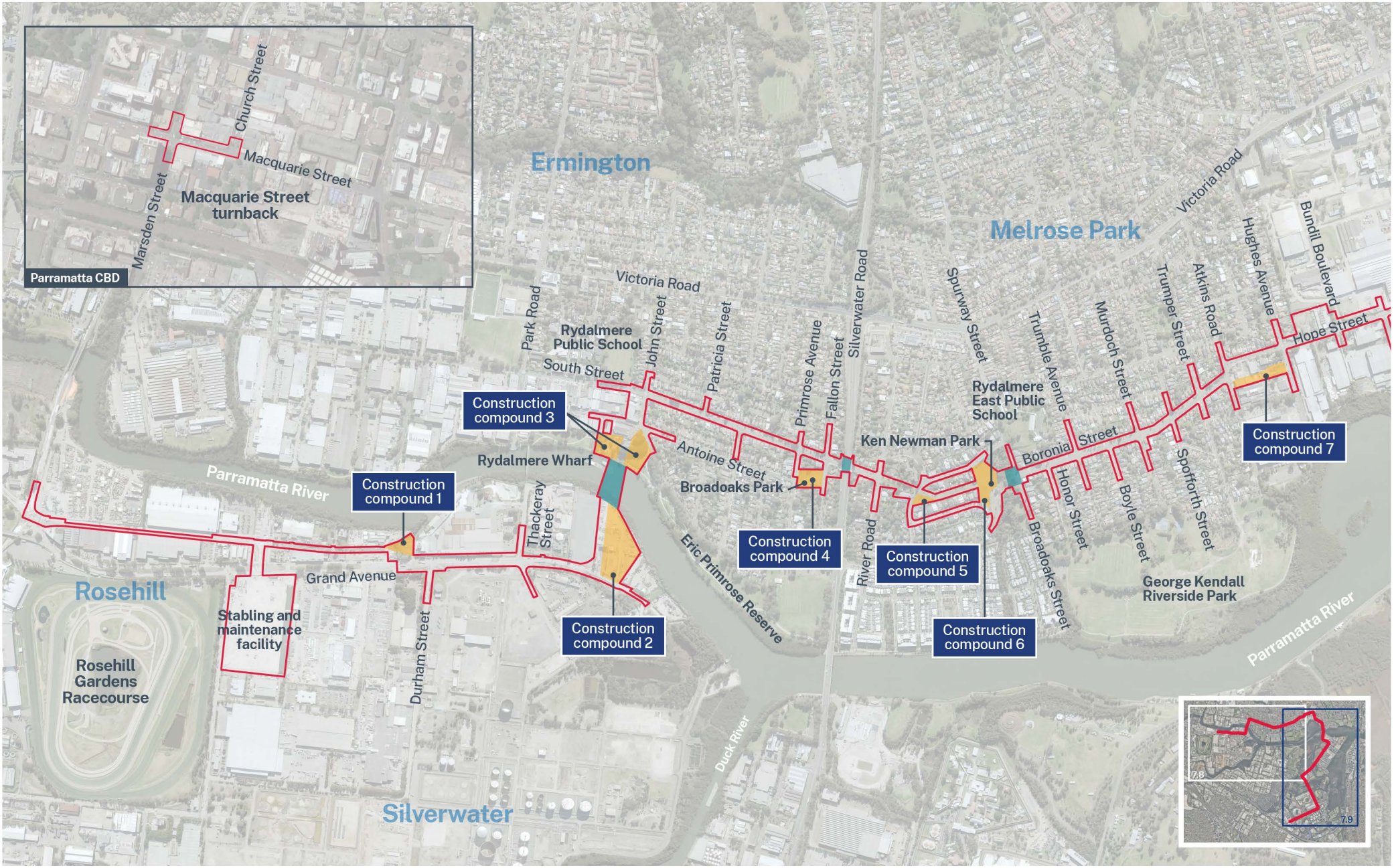


Figure 7.8 Proposed compound locations – map 1

LEGEND

Project site

Construction compounds

Bridge construction

0 0.5 km

N

Figure 7.9 Proposed compound locations – map 2

Minor construction ancillary facilities

In addition to the proposed compounds listed in Table 7.2, minor construction ancillary facilities would be provided to support construction at other locations within the project site. Such facilities would include laydown areas, worker parking, mobile site sheds/offices, toilets and storage facilities. The locations of these facilities would be determined by the construction contractor(s) in accordance with the following criteria:

- located within or immediately adjacent to the project site
- no impacts on biodiversity, soil and water, and heritage items beyond those identified by the EIS
- minimal potential for amenity impacts (including noise and vibration, traffic and access, air quality and visual impacts) beyond those identified and assessed by the EIS
- minimal potential for flooding and waste impacts.

7.6.3 Estimated workforce

The construction workforce requirements would vary over the construction period in response to the activities underway and the number of active work areas. It is estimated that a peak workforce of between 750 and 1,000 people would be required.

7.6.4 Plant and equipment

A variety of plant and equipment would be used during construction. This would include a range of large machinery, such as cranes, piling rigs, ballast tampers, excavators, milling/paving machines, semitrailers/ dump trucks, compactors, suction trucks and road sweepers. Smaller plant and equipment would include generators, welding equipment, concrete saws, elevated working platforms, bobcats, linemarking machines, jackhammers and personal tools.

A full list of plant and equipment is provided in Technical Paper 3 (Noise and Vibration).

7.6.5 Construction materials

Construction materials would be confirmed further during design development and construction planning. The main materials are expected to include:

- steel – structural, rails and reinforcing
- concrete, sand and cement
- precast concrete
- asphalt and bitumen
- road base
- timber/plywood
- structural fill (where excavated material is not suitable)
- bentonite
- paving stones
- PVC conduit
- high density polyethylene (HDPE) materials
- water
- diesel
- lubricating oil
- prefabricated items such as railings, stop infrastructure, bridge components, etc.

Further details about resource use are provided in Chapter 22 (Waste and resources).

7.7 Transport and access

An outline of the proposed transport and access arrangements during construction is provided below. The potential impacts on transport, traffic and access, and the measures that would be implemented to manage these impacts, are described in Chapter 9 (Transport and traffic).

7.7.1 Heavy vehicle routes

Preliminary routes for the movement of construction heavy vehicles, have been proposed and are shown on Figure 7.10 and Figure 7.11. The roads shown on the figures are those which would be used by construction heavy vehicles; however, it is noted that some of these roads would only be used for inbound or outbound movements to take into account access restrictions at certain locations.

Construction would result in additional movements of the following vehicle categories on the road network:

- heavy vehicle deliveries of construction plant, supplies and infrastructure components
- heavy vehicle transport of spoil and waste materials (including contaminated materials)
- light vehicle movements, typically associated with workers travelling to site and general construction activities.

Heavy vehicle routes have been proposed to allow these vehicles to access and egress the arterial road network in a safe and efficient manner and, wherever possible, avoid or minimise impacts on local roads and residential areas. The proposed heavy vehicle routes would be subject to confirmation by the construction contractor(s).

Construction heavy vehicle movements would be scheduled to occur outside peak periods as far as practicable. The transport of over-sized loads would need to be undertaken outside peak traffic periods.

Further information on the proposed movements along the roads shown on Figure 7.10 and Figure 7.11 is provided in Technical Paper 2 (Transport and Traffic).

7.7.2 Construction traffic volumes

Table 7.3 provides estimated average daily and peak hourly construction vehicle movements.

Table 7.3 Estimated construction traffic volumes

	Heavy vehicles		Light vehicles (construction activities)		Light vehicle (workforce)	
Precinct/location	**Daily[1]**	**Peak[2]**	**Daily[1]**	**Peak[2]**	**Daily[1]**	**Peak[2]**
Parramatta CBD	50	4	24	6	75	30
Stabling and maintenance facility	50	4	24	6	63	25
Camellia	76	5	24	6	175	70
Rydalmere	120	8	24	6	175	70
Ermington	126	9	36	9	175	70
Melrose Park	50	4	24	6	175	70
Wentworth Point	92	6	24	6	175	70
Sydney Olympic Park	96	7	24	6	175	70
Carter Street	78	5	24	6	63	25
Total	**738**	**52**	**228**	**57**	**1251**	**500**

Notes: 1. Daily vehicle movements represent combined daily inbound and outbound movements (two way) for the peak construction period

2. Peak vehicle movements represent combined inbound and outbound hourly movements for the morning and afternoon peak periods (8-9am and 5-6pm). For light vehicles associated with construction activities, the afternoon peak has been reported as the expected worst case.

Generally, the maximum level of heavy vehicle movements is expected to be associated with concrete pours, which would typically be of short duration.

7.7.3 Construction workforce parking

Parking for the construction workforce would be provided at construction compounds, with the number of spaces to be confirmed by the construction contractor(s) during detailed construction planning based on the space available. A centralised construction workforce parking area, with space for about 200 vehicles, would also be provided as part of construction compound 12 (Holker Busway) (see section 7.6.2). Workers would be transported from this parking area to various work areas and construction compounds in the vicinity where on-street parking is limited.

The construction parking and access strategy would include measures to encourage staff to use alternative transport arrangements, including public transport (see Chapter 9 (Transport and traffic)).

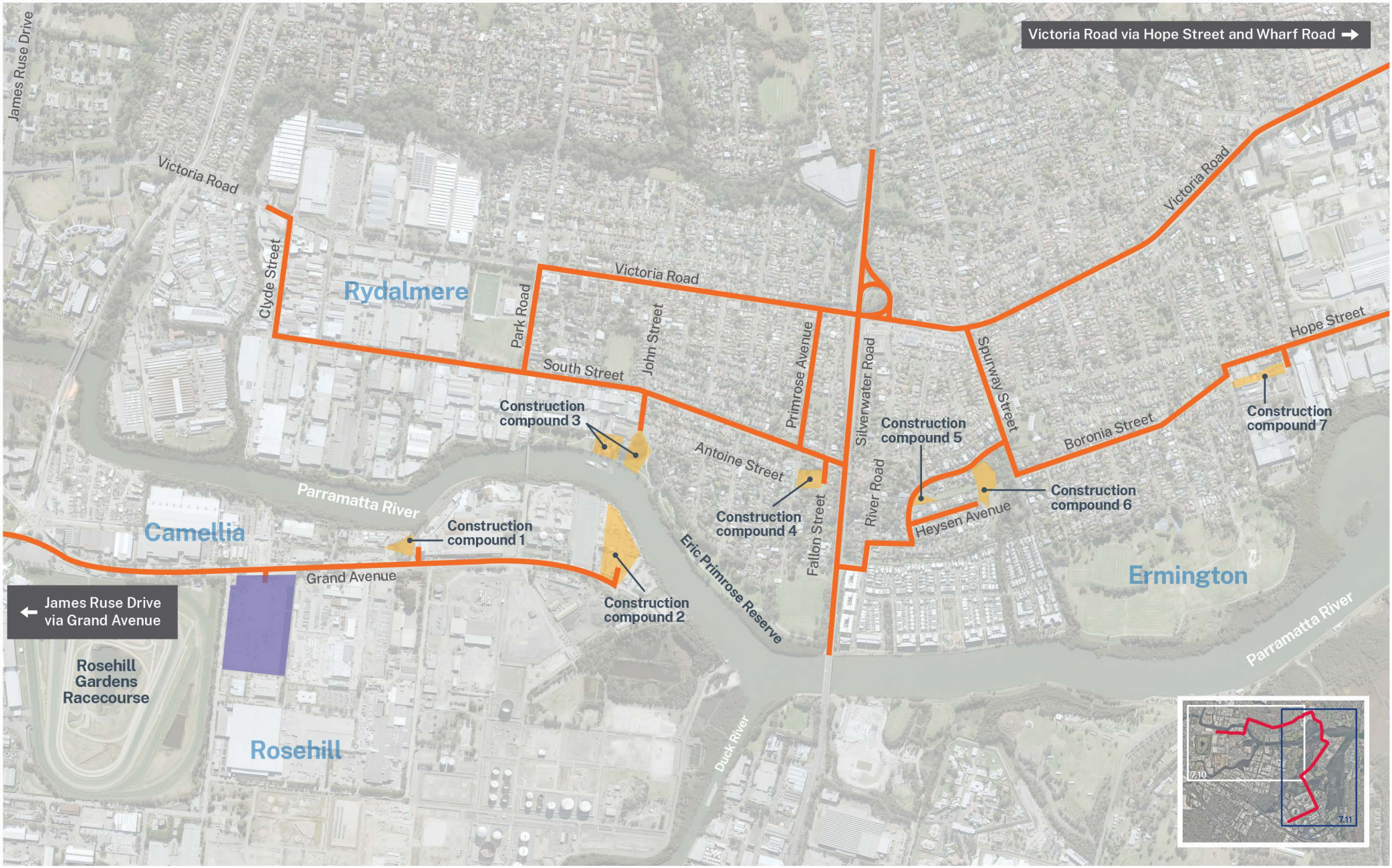


Figure 7.10 Preliminary heavy vehicle routes – map 1

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Heavy vehicle routes | Construction compounds | Stabling and maintenance facility

0 0.5 km

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Figure 7.11 Preliminary heavy vehicle routes–map 2

7.7.4 Changes to transport networks and facilities

The following sections outline indicative changes to road, public transport and pedestrian/cyclist infrastructure and facilities along and in the vicinity of the project site during construction. Changes to maritime infrastructure/use are considered in section 7.7.5. The location and duration of changes would be confirmed during detailed construction planning. Further information about the potential impacts of these changes and how these would be managed is provided in Chapter 9 (Transport and traffic).

Road network and infrastructure

Construction would be subject to comprehensive traffic management measures to ensure the continuing functionality of surrounding roads, and the safety of the public, motorists and construction personnel (see section 9.6).

Some changes to the road network would be required to accommodate construction, including:

- installation of temporary traffic signals to allow for the safe movement of construction traffic
- temporary road, access or lane closures
- temporary intersection adjustments or closures
- temporary traffic changes during removal of the existing bridge and construction of the new bridge over Silverwater Road.

The closures would generally be for short periods, limited to the duration of works requiring the closure. Alternative access arrangements would be provided.

Public transport

A number of bus routes that currently use South Street, Boronia Street, Atkins Road and Hope Street (and bus stops in these streets) would be affected by full and partial closures of these streets. Similarly, existing bus stops on Park Street, adjacent to Olympic Park Station, would be affected.

Bus stops would be relocated along their existing routes where practicable. Rerouting of bus services would be required where bus stops are not able to be relocated along the existing routes. The details of any changes to bus stops and/or routes would be determined in consultation with Transport for NSW, bus operators and relevant authorities.

Temporary closures of the navigation channel in the Parramatta River and other closures of Rydalmere Wharf (see section 7.7.5) would affect the operation of the F3 Parramatta River ferry during these periods.

The commuter car park at Rydalmere Wharf would be closed for most of the construction period (up to three years). An alternative parking area would be identified during detailed construction planning.

Further information about potential impacts to public transport (buses and ferries) is provided in section 9.3.3.

Pedestrian and cycle facilities

Changes to the road network and access restrictions around work areas would affect pedestrian footpaths and cycle facilities in some locations. Alternative access arrangements (such as detours) would be provided. Temporary detours or realignment would be required in the following key locations:

- Parramatta Valley Cycleway at Eric Primrose Reserve, Rydalmere and at Wharf Road, Melrose Park
- shared use path through Koonadan Reserve
- the existing access path to Rydalmere Wharf which would also be closed for most of the construction period.

All pedestrian and cycle facility adjustments would be undertaken in accordance with relevant accessibility requirements and legislation, including the *Disability Discrimination Act 1992*.

Figure 7.12 shows an example of pedestrian detour arrangements for Parramatta Light Rail Stage 1.

Further information about potential impacts to active transport is provided in section 9.3.4.

Figure 7.12 Image showing pedestrian detour arrangements during construction of Parramatta Light Rail Stage 1

On-street parking and loading zones

On-street parking may be removed in some locations to provide sufficient space to undertake construction and maintain access along the road network. The duration of any temporary loss of parking could range from less than a day to longer periods, depending on the works required in individual locations. In some locations, on-street parking would need to be permanently removed (see section 9.3.5).

Loading zones, accessible parking, taxi ranks and service vehicle zones affected by the operational project would be relocated, where possible, to the permanent location proposed for these users in adjacent side streets.

7.7.5 Changes to maritime infrastructure and navigation

The temporary working platforms proposed as part of constructing the bridges over the Parramatta River (see section 7.3.2) would occupy portions of the Parramatta River waterway. During certain periods (such as major bridge lifts for areas not proposed to be serviced from the temporary working platforms), barges would occupy the remaining waterway area. This would result in a need to close the navigation channel. It is anticipated that closures of the navigation channel would occur at the following locations and durations:

- for the bridge between Camellia and Rydalmere – two closures of about two months each
- for the bridge between Melrose Park and Wentworth Point – one closure of up to three months.

In addition, the navigation channel may need to be temporarily closed for short periods, such as when crane lifts extend over the river and have the potential to affect the safe operation of watercraft.

Use of the river by vessels upstream of the bridge work areas would be restricted during periods where the navigation channel is closed. Closures of the navigation channel would restrict access to upstream facilities, including public and private ferry wharves, boat ramps, and for recreation users and commercial operators.

Rydalmere Wharf

As described in Chapter 2 (Location and setting), Rydalmere Wharf is located close to the project site and work area for the bridge between Camellia and Rydalmere. It is anticipated that the wharf would also need to be closed (in addition to the navigation channel closures) on at least two occasions, for up to three months during each period, to facilitate bridge construction.

Ermington Boat Ramp

Ermington Boat Ramp, located at the southern end of Wharf Road in Melrose Park, is within the project site and close to the work area for the bridge between Melrose Park and Wentworth Point. The road access to the boat ramp is also within the work area. It is therefore anticipated that the boat ramp would need to be closed for a period of up to three years.

Further information about potential impacts associated with these changes is provided in section 9.3.

7.7.6 Special events

The construction contractor(s) would be responsible for considering known special events in the construction program and making appropriate arrangements to manage the impacts of construction (including traffic management and contingency arrangements) during these events. The traffic management requirements of special events may require adjustments to times of construction and routes used by heavy vehicles, as well as varying approved road occupancy license conditions for construction.

7.8 Utilities and services

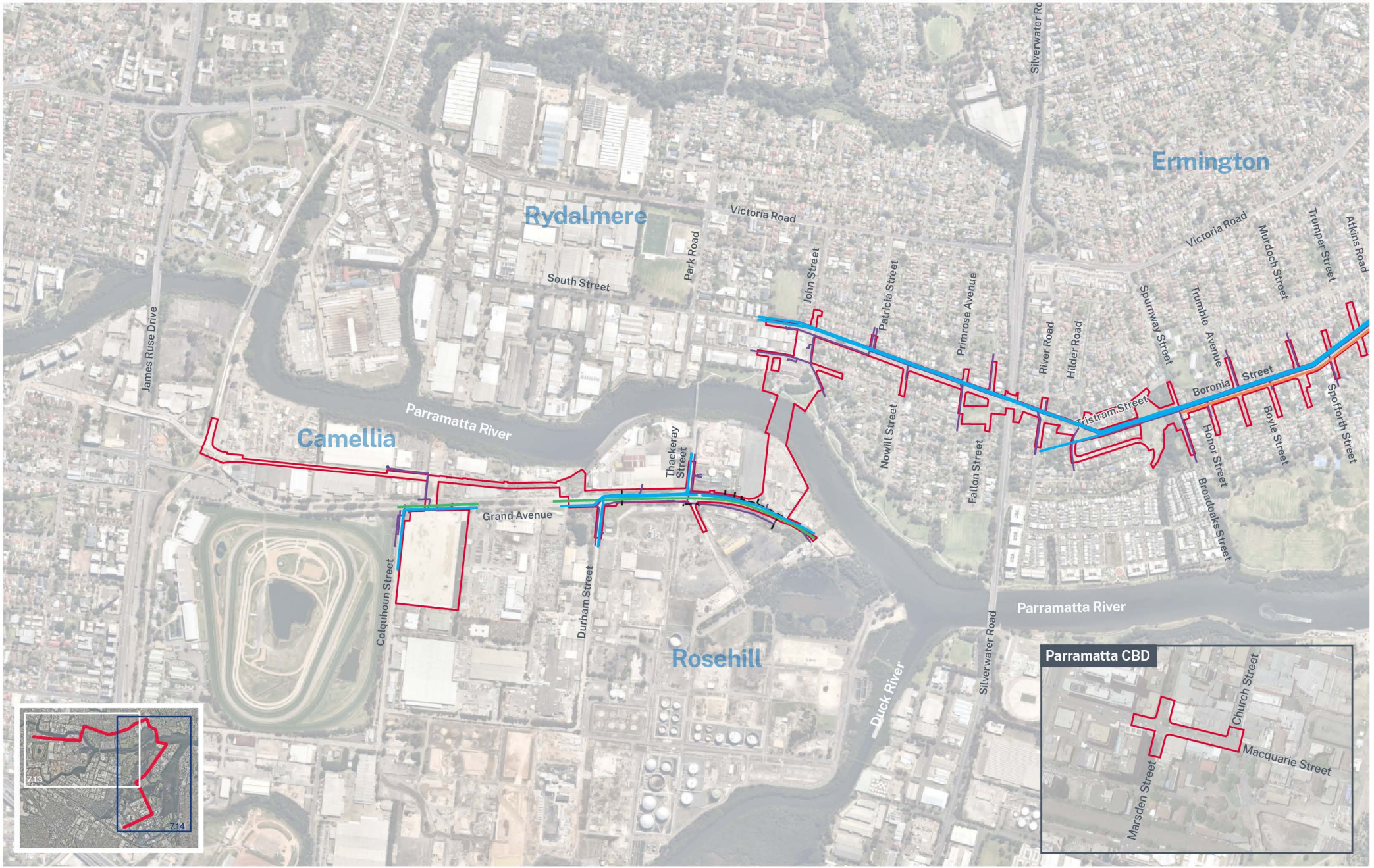
Utilities infrastructure, such as drinking and recycled water supply, stormwater drainage, wastewater, electricity, gas, fuel and telecommunications, are located within the project site. These include critical utilities, such as the Sydney Water trunk mains, high voltage transmission lines, and high pressure gas and fuel lines (see Figure 7.13 and Figure 7.14) that form a critical function in the respective utility supply. Some of these utilities may be sufficiently aged such that works in the vicinity of the utilities may increase the risk of unexpected failures to occur.

Where utilities are located within the project site, it may be necessary to:

- relocate utilities with the potential to be directly affected by construction
- provide physical protection for utilities that may be indirectly affected by vibration or accidental impact
- modify construction methods to avoid impacting a nearby utility, such as by using smaller plant and equipment, hand excavation and compaction tools.

Appropriate treatments would be confirmed during design development and construction planning in consultation with the utility provider/asset owner, and in accordance with relevant standards and requirements.

Where utilities are identified as being of increased risk of failure, pre-condition surveys and other measures would be implemented to ensure the proper functioning and integrity of the utilities, prior to further investigation and design work taking place. Further details of the management measures proposed are provided in section 19.6.



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Project site

Existing key utilities (indicative only)

Jemena gas mains

Sydney Water trunk mains

Ausgrid and Endeavour Energy high voltage power lines

Ampol fuel lines

VIVA fuel lines

Note: extent of utilities limited to about 20 metres beyond footprint only

Figure 7.13 Location of key utilities - map 1

0 500m

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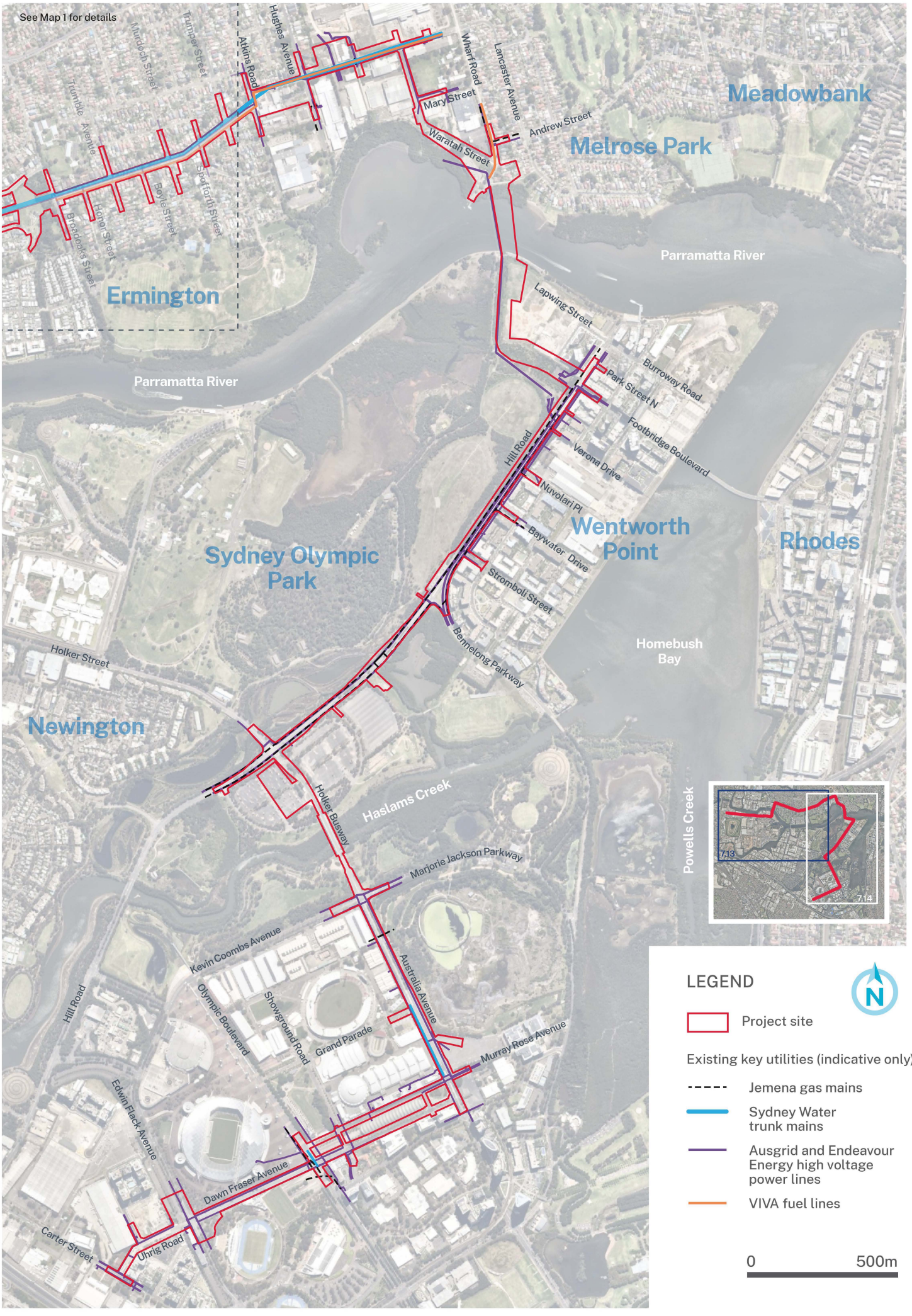

Note: extent of utilities limited to about 20 metres beyond footprint only

Figure 7.14 Location of key utilities - map 2

Table 7.4 provides an overview of the key utilities identified to date within the project site, and the proposed treatment of these utilities. Most of these utilities are located underground; however, some have above-ground components. Consultation with service providers has been carried out and is ongoing. Further consideration of the proposed treatment to minimise impacts would continue during design development in consultation with service providers.

Table 7.4 Indicative key utility treatment during construction

Utility	Service provider	Location (suburbs)	Proposed treatment
Water			
Drinking water trunk mains	Sydney Water	Camellia, Rydalmere, Ermington, Melrose Park	Protection and relocation[1] (see section 7.8.1). A valve set in Ken Newman Park would also be relocated.
Recycled water pipeline	Sydney Olympic Park Authority	Wentworth Point	Relocation
Drinking and recycled water	Sydney Water	Sydney Olympic Park	Relocation
Electricity			
High and low voltage transmission lines including 11 kV lines	Endeavour Energy	Camellia, Rydalmere, Ermington, Melrose Park	Relocate underground
132 kV electricity transmission line	Ausgrid	Melrose Park and Wentworth Point	Protection
High and low voltage transmission lines including 11 kV lines	Ausgrid	Wentworth Point, Sydney Olympic Park, Lidcombe	Relocate both above and underground
Gas and fuel			
High pressure gas mains	Jemena	Camellia, Rydalmere, Ermington, Melrose Park, Wentworth Point, Sydney Olympic Park, Lidcombe	Protection and relocation
High pressure fuel line	Viva Energy Australia	Melrose Park	Protection and relocation
High pressure fuel line	Ampol	Camellia	Protection

Note: 1. In some locations, there would be a need to remove aged cast iron water mains and replace them with steel.

Relocating and protecting utilities would typically involve:

- identifying utilities using surface tracing and other non-destructive methods (for example potholing)
- exposing the utility (for protection works) or excavating a new trench for relocation works
- installing appropriate bedding material and pipeline/conduit/utility (for relocation works)
- undertaking remedial works on existing utilities if required (for protection works)
- excavating and installing pits at cutover locations, including any new infrastructure (for relocation works)
- backfilling and compacting trenches and pits
- installing protection slab or other infrastructure (for protection works)
- testing and commissioning
- removing redundant utilities
- reinstating disturbed areas.

Utility works would generally be contained with the project site; however, the final treatment could include the requirement for some works (such as connection works, usually within the road reserve or easements) in locations outside the project site.

Figure 7.15 shows an example of laying a small diameter water main for Parramatta Light Rail Stage 1.

Figure 7.15 Image showing the laying of a small diameter water main in Westmead (Parramatta Light Rail Stage 1)

7.8.1 Works to Sydney Water's trunk mains

Three underground pipelines that form part of Sydney Water's trunk mains are located within and adjacent to the project site in Camellia, Rydalmere, Ermington and Melrose Park (see Figure 7.13 and Figure 7.14). These pipelines convey drinking water to Sydney's northern suburbs as part of Sydney Water's Ryde Water Delivery System. The pipelines range in diameter from 900 to 1,200 millimetres.

The pipelines traverse Ken Newman Park between Hilder Road and Boronia Street. Two of the pipelines located within the western end of park would need to be relocated to allow the light rail infrastructure to be constructed across the park. The third pipeline would need to be replaced with a new steel pipeline and protected in its current location.

The relocation works would involve building new sections of pipeline along Tristram Street within the existing road reserve. The new sections would be about 280 metres long and would connect with the existing pipelines near the intersection of Hilder Road and Tristram Street (to the west) and within Ken Newman Park (to the east) (see Figure 7.16). The existing sections of the two pipelines would be decommissioned once the new sections are connected.

The new sections of pipeline would be constructed using standard pipeline installation methods, including:

- excavating trenches along the new pipeline alignment
- installing new sections of pipeline within the trench
- installing new pits and valves

- connecting the new sections of pipeline to the existing pipelines
- decommissioning the existing sections
- commissioning and testing new sections of pipeline (if required)
- backfilling trenches and reinstatement of the ground surface.

The approach to managing other sections of the trunk mains, which are located within the project site at Grand Avenue/Thackeray Street, South Street (between John Street and River Road), Boronia Street (between Broadoaks Street and Atkins Road) and Hope Street (between Atkins Road and Waratah Street) would be confirmed during detailed construction planning. It is anticipated that this would involve protection of the existing utility rather than relocation, subject to condition assessment and further design investigations. Some sections of pipeline in Melrose Park may need to be upgraded prior to protecting them during construction.

All proposed works to Sydney Water's pipelines would be undertaken in consultation with Sydney Water.

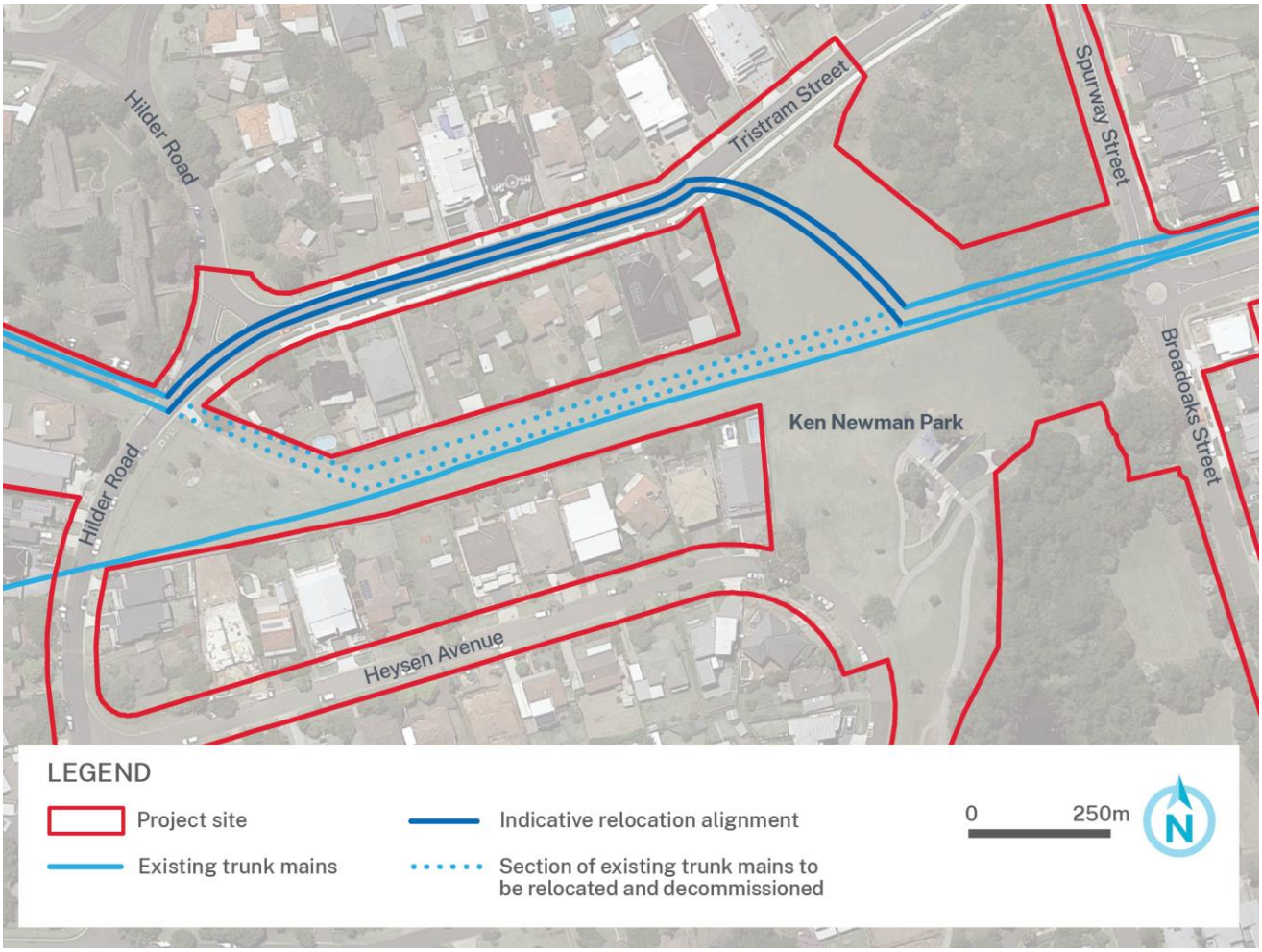

Figure 7.16 Relocation of Sydney Water trunk mains at Ken Newman Park