2. Project details

This Chapter outlines the details of the Project, the alternatives considered, the potential future of the light rail network and the key objectives of the Project and anticipated benefits of the Project.

2.1 Project location and current land uses

The Project would commence, at its northernmost extent, at Gungahlin Place, within Hibberson Street (which will become a light rail/pedestrian walkway), and then travels east along the median of Flemington Road through the developing eastern town centre, turning south after approximately one kilometre. The Project alignment then continues south along Flemington Road towards the intersection of Flemington Road and the Federal Highway. The alignment then joins the Federal Highway, travelling along its median. After a sweeping curve the route then continues onto Northbourne Avenue continuing for approximately 3.2 kilometres to its southernmost extent at Alinga Street.

An illustrative alignment for the Project and its location in relation to the surrounding area is shown below in Figure 2.1.

The City of Canberra is located within a valley basin, with the Molonglo River running through the city centre, and is surrounded by the three peaks of Mount Ainslie to the east, Black Mountain to the west, and Mount Pleasant to the south east. The land along the Project alignment is generally flat and the alignment is generally straight, apart from several sweeping curves.

The Project corridor crosses a variety of distinct precincts across the city; extending from the new urban development area of Gungahlin, the industrial precinct of Mitchell, to the Federal Highway approach and the open space areas around Exhibition Park in Canberra (EPIC), the racecourse, Yowani and the sports fields, along the wide boulevard of Northbourne Avenue, and finally the built up commercial hub of Civic.

The majority of the Project, including the main track alignment, would have median alignment along the entire length of the Project. Land uses along the corridor vary significantly; they include a range of residential housing densities, industrial developments (in particular along Flemington Road) changing to primarily commercial uses towards the southern end of the alignment.
Source: HASSELL Architects

**Figure 2.1** Project location
2.2 Description of the Project

2.2.1 Project overview

The Project is anticipated to include the following key features:

- the construction of approximately 12 kilometres of light rail track primarily within the central median strip of existing road corridor
- 13 stops including major transport interchanges at Gungahlin, Dickson and Civic
- a light rail only/pedestrian friendly zone in Hibberson Street, Gungahlin
- platforms at all stops designed to a minimum of 33 metres and capable of extension to accommodate 45-metre long LRVs (allowing for extended LRVs as part of future operations)
- overhead line equipment providing traction power and seven electrical substation facilities for the provision of power along the route
- upgrade to existing bridge structures and construction of a new bridge along Flemington Road
- a series of crossovers and turnback facilities to allow light rail vehicles to turn back at certain points along the alignment
- the provision of new traffic signals at up to nine intersections that at currently not signalised
- passenger information systems at stops and on light rail vehicles
- a stabling depot and maintenance facility in Mitchell incorporating the Control Centre, the operator’s management, maintenance and administrative teams, the LRV maintenance building and stabling for the fleet of LRVs
- upgrades to the road layout in some sections of the route (e.g. modifications to slip lanes, right/left turns, footpaths and kerbs, etc.)
- upgrades of existing underground and overhead utilities and new drainage infrastructure
- changes to some parking conditions along the route
- public domain improvements including paving, street trees, lighting and street furniture.

An overview of the key components of the Project is shown in Figure 2.2a to Figure 2.2e.

Some elements of the Project described in this Chapter may be subject to further development during detailed design. Any design modifications which occur as a result of matters arising during the community exhibition of this draft EIS would be identified in the final EIS. Additional changes may also occur during the development application (DA) phase of the Project.

The following sections provide a more detailed description of the Project and cover:

- built form of the light rail – alignment, proposed light rail stops (design and locations), bridges and drainage structures, parking, overhead wiring, substations, signalling, communications and train control systems, retaining walls, and crossovers, turnbacks and the proposed existing stabling depot and maintenance facility
- construction of the light rail – describes how the Project would be constructed including program, methodology and workforce
- property requirements and leasing requirements – including any variations to existing Territory leases or Territory land boundary realignments required as part of the Project
- operation of the Project – the light rail operations including rail and stop operations, ticketing, and the stabling and maintenance facility operations.
Figure 2.2b Key features of the project
Figure 2.2c Key features of the project
Figure 2.2d Key features of the project

Legend
- Project Alignment
- Stop platform
- Substation sites
- Recommended feeder connection points
Figure 2.2e Key features of the project

Legend:
- Project Alignment
- Stop platform
- Substation sites
- Recommended feeder connection points
2.2.2 Built form of the light rail

Corridor alignment and track form

The Project corridor would comprise approximately 12 kilometres of a new light rail system between the Gungahlin town centre and Civic. The northern end of the alignment would run along a newly pedestrianised section of Hibberson Street between Gungahlin Place and Kate Crace Street, which would remove car/light rail conflicts in the area. The remainder of the Project alignment would comprise a central median arrangement within the following:

- the existing median along Flemington Road (north of Well Station Drive)
- a newly created median reservation approximately 8 metres wide on Flemington Road between Federal Highway and Well Station Drive
- the existing medians along Northbourne Avenue and Federal Highway.

Some minor road widening works would be required to accommodate the proposed stops and light rail alignment. These works are described through this section of the EIS. The land boundary realignments and leasing impacts are also discussed in section 2.2.4 of this EIS.

The track would be standard 1,435 millimetre gauge. The horizontal alignment design would allow a maximum vehicle speed of 70 kilometres per hour. The proposed trackform would generally consist of embedded rail, due to the reduction in the total depth of the trackform required.

The light rail tracks would be raised relative to the adjacent roadway to delineate trafficable areas from the light rail corridor. A raised height of approximately 200 millimetres is proposed in the median to provide this delineation and to reduce the risk that an errant vehicle would crash into a centre pole or other hazard in the median.

The Project would include an ‘inbound’ track (heading towards Civic stop away from Gungahlin) and an ‘outbound’ track (heading away from Civic stop towards Gungahlin) for LRVs and a series of cross-overs and turnouts throughout the corridor. The light rail zone within the median including the inbound track and the outbound would generally be approximately 7 metres wide for the length of the alignment, widening to approximately 10.4 where the alignment travels within the median of the Federal Highway and some sections of Northbourne Avenue. The typical distance between the tracks would also potentially increase slightly on curves along the alignment to allow for vehicle operation at these locations.

Crossover and turnout locations would likely include (subject to detailed design):

- a scissors crossover at Civic stop and at Gungahlin stop to allow for LRVs to change tracks and return in the opposite direction
- a turnback siding at Dickson, allowing an additional Civic-Dickson service
- manually-operated crossovers near Well Station Drive stop and Dickson stop (for use in the event of incidents on other parts of the track)
- a delta junction at the depot entrance allowing for various entry scenarios for LRVs to enter the stabling depot and maintenance facility.

Figure 2.3 to Figure 2.7 provide indicative cross sections which illustrate proposed corridor arrangements for each section of the alignment. These figures show the location and indicative arrangement of traffic, bicycle (where applicable) and pedestrian lanes adjacent to the light rail alignment. Whilst the typical extent of the proposed Project works is shown, some impacts may occur outside of these areas which are shown as part of the Project impact footprint for the Project.
Figure 2.3  Typical LRV only/pedestrian friendly zone cross-section (Gungahlin)

Figure 2.4  Typical Flemington Road cross-section (northern end)

Figure 2.5  Typical Flemington Road cross-section (southern end)
Stops

The Project would include 13 stops, including three major transport interchanges at Gungahlin stop/terminus, Dickson stop and City stop/terminus and a special event stop at EPIC. The stops have been individually designed, taking into account existing topographical and other environmental and traffic constraints, whilst attempting to utilise a consistent design as the basis for each of the stops. The proposed stops for the Project include:

- Gungahlin Place stop (Gungahlin terminus – located to the east of Gungahlin Place)
- Manning Clark Crescent stop
- Mapleton Avenue stop
- Nullarbor Avenue stop
- Well Station Drive stop
- EPIC stop (Randwick Road). This stop is anticipated to be used to serve special events only
- Phillip Avenue stop
- Swinden Street stop
- Dickson stop
- Macarthur Avenue stop
- Condamine Street stop
- Elouera Street stop
- Alinga Street stop (City terminus – located in Northbourne Avenue north of Alinga Street).
The locations of the stops have previously been shown in Figure 2.2a to Figure 2.2e.

The distance between stops along the Project alignment would vary depending on the location along the route. Towards Gungahlin, the stops would generally be located between 750 and 900 metres apart to provide access for the residential areas adjoining the alignment. Along the remainder of Flemington Road and the Federal Highway, the stops would be more spread out, being between approximately 1 kilometre and 2.6 kilometres apart. This is reflective of the less densely developed nature of the adjoining land uses. Along Northbourne Avenue, the stops would generally be between approximately 570 metres and 800 metres.

**Stop design**

Individual stop configurations would have distinctive horizontal and vertical configurations (taking into account localised site conditions), the stop layout and integration with the adjoining areas would generally be similar.

Most stops would comprise either an island platform configuration or a side platform configuration. The Gungahlin and City terminus stops have been designed with side platforms as this maintains the main line track spacing, allowing for better light rail operation and improved integration with the adjoining pedestrian network. Along Northbourne Avenue, the stops have been designed with side platforms to achieve a consistent visual appearance with no track deviations along this long straight section. The remaining stops on Federal Highway and Flemington Road have been designed as island platforms to take up less room within the median, with the exception of the Swinden Street stop. This stop has been designed to accommodate a staggered stop arrangement, with one platform provided on each side of the intersection between Swinden Street and Northbourne Avenue.

As a majority of the stops would be located within the median, light rail stops would be connected from the median to the nearest footpath using signalised pedestrian crossings, generally at one end of the stop and predominantly using existing signalled intersections. The location of the crossing points would be such that pedestrians would have a clear view of an approaching LRV from either direction. Pedestrians, in turn, would also be clearly visible to the driver of any approaching LRV. Each crossing would have a minimum clear width sufficient to allow two wheelchair users to pass each other.

The platform at each stop would be 33 metres long by approximately 4 metres wide for side platforms and approximately 5.5 metres wide for island platforms. Platforms at all stops would be designed to be capable of future extension to accommodate 45-metre long light rail vehicles (allowing for extended LRVs as part of future operations).

A typical light rail stop (with a side platform arrangement design) is shown in Figure 2.8. The final placement of the platforms would be subject to further analysis during the detailed design phase of the project. Typical examples of light rail stop platform arrangements along the Project alignment are also provided in Figure 2.9.
Stop facilities

Each stop would provide a number of typical facilities. These are summarised below.

Stop furniture and shelters

Furniture at each stop would generally include a shelter, seats and general-waste rubbish bin(s). The shelters would be approximately 10 metres long and would consist of glazed panels and a roof to provide weather protection on each platform. The shelter would provide for both standing and seating space including space for wheelchairs and prams.

An electronic ticketing machine and an integrated services cabinet (containing communication and other electronic equipment for light rail operations) would also be integrated into the shelter of each stop.

The platforms would be designed as a modular kit of parts, with robust, durable and resilient materials, precise detailing and high quality equipment and furniture selection. Each stop would provide weather protection via a horizontal canopy and some vertical wind screen panels (refer to Figure 2.9). Anticipated stop patronage would determine the appropriate levels of shelter coverage required at each stop.
Figure 2.9 Typical stop platform and canopy layouts along the alignment

Note: Indicative only, subject to detailed design
Signage

Signage would be provided at each of the stops and would generally include the following items on totem(s) or other display signs/boards located on and around the stop platform:

- wayfinding
- statutory/warning signs
- customer information including:
  - stop name
  - fare information
  - network and locality map
  - local public transport information
- other hazard/warning/safety signs.

Security and safety

A number of security measures would be provided at each stop. These would include:

- closed circuit television (CCTV) cameras for passenger security and to deter vandalism. The CCTV would provide a direct link between each stop and the operations control centre for the light rail network at Mitchell
- an appropriate level of lighting would be provided to maximise passenger safety and to enable the operation of CCTV. Lighting levels would be determined during future design development of each stop
- emergency telephone/help point(s) and warning signs.

Paving for the platforms and paths would generally consist of non-slip, asphaltic concrete with contrasting concrete edging and incorporation of tactile requirements. Warning tactile paving would also be installed along the edge of the entire length of each platform.

The final security and safety measures proposed for each stop would be finalised during the future design development of the Project.

Bicycle parking facilities

A range of bicycle racks would be provided at all stops, with bicycle lockable shelters proposed to be provided at Gungahlin Place Stop and Well Station Drive Stop. The location for bicycle parking would either be within close proximity to the selected stops, near the end of the platform(s) or along the edges of approach paths. Spaces for bicycles racks and/or lockable shelters would be provided for at each stop with the final number of bicycle parking spaces to be determined during detailed design based on the anticipated demand at each stop. The bicycle racks and shelters would be integrated into the proposed landscaping for the stops.

Accessibility

Each of the stops would be fully accessible from the roadside footpaths, including pedestrian crossings across cycle lanes, traffic lanes and light rail lines. All platform areas would also be fully accessible for boarding, alighting, manoeuvring, waiting under shelter, and buying tickets.

Figure 2.10 summarises the proposed bus interchange locations, park-and-ride opportunities and bicycle parking facilities at each light rail stop.
Figure 2.10  Project interchange facilities
**Light rail priority along Hibberson Street**

The light rail terminus would be located at the intersection of Hibberson Street and Gungahlin Place which is a key north-south open-space connection as well as an important transport interchange between bus and light rail. Hibberson Street would become a ‘light rail priority street’ with limited vehicular access (emergency and service vehicles only) between Gungahlin Place East and Kate Crace Street. The existing street kerb line along this section of Hibberson Street would be retained (maintaining the separation between the proposed level of the light rail tracks and the existing footpaths).

The existing parking bays would be removed and replaced with footpath pavement. This would effectively result in the widening of the existing footpaths in these locations. The removal of cars and other vehicles on this section of Hibberson Street would allow for increased running speeds of the light rail vehicles compared to a pedestrian priority street, and would result in a typical ‘street condition’ for pedestrians with a standard kerb edge and pedestrian crossings in clearly marked locations. The proposed design would also provide an opportunity to further enhance the quality of this main street following the removal of the traffic and parking lanes, and the widening of existing footpaths.

An example of the typical layout of the Hibberson Street light rail only zone is shown in Figure 2.11.

![Figure 2.11 Typical layout of the Hibberson Street light rail only zone](source: HASSELL Architects)

**Changes to road configuration and access**

**Overview**

The impact of the light rail on the adjacent road network would vary along the length of the Project. There would be a number of changes to road configuration and access. These would consist of:

- modifications to the physical layout of intersections
- modification to lane numbers and/or lane widths along sections of the Project alignment along either entire sections of the road network or locally at intersections and stops
- removal or reallocation of bus lanes and bus priority lanes at intersections
- additional phases to be added to existing traffic signals to provide for light rail priority or light rail crossing movements
- removal of traffic access and turning movements across the median and conversion of the access to left-in/left-out from one carriageway only, at some locations
- at other locations where traffic access and turning movements across the median are considered necessary, the installation of traffic signals is required to ensure that all vehicle movements across the light rail are signalised and to provide safe pedestrian access to the platforms
at some signalised intersections, existing pedestrian crossings may need to be moved further back to provide adequate pedestrian storage between the median right turn lane and the light rail. To avoid a highly skewed pedestrian crossing it may be necessary at these locations to remove the left-turn slip lane and to signalise the left turn movement

preserving adequate emergency vehicle access along the entire Project alignment.

Details of the proposed changes to road configuration and access along the Project alignment are provided in the following sections.

Road upgrades and road changes

The proposed changes to the existing traffic and access arrangements would occur along five main sections of the alignment. These changes would broadly include the following road changes:

- Hibberson Street from Gungahlin Place East to Kate Crace Street would become a light rail priority zone closed to general traffic. Access to general traffic along this section of the alignment would be restricted to emergency and service vehicles only.

- On Flemington Road between Kate Crace Street and Well Station Drive, the proposed road and access changes would primarily be limited to intersection works. This would allow for two lanes of traffic in each direction to be maintained along this section of Flemington Road. Some widening works would be required between Kate Crace Street and Manning Clark Crescent (southern side) to maintain a west bound traffic lane.

- On Flemington Road between Well Station Drive and Lysaght Street, the proposed road and access changes would include widening of the existing carriageway to allow for two lanes of traffic in each direction, in addition to dedicated turning lanes where required. Construction of the new carriageway would occur to the west of the light rail alignment.

- On Flemington Road between Lysaght Street and the Federal Highway, the proposed road and access changes would be limited to intersection works and minimal road widening works. This would allow for two lanes of traffic in each direction along this section of Flemington Road. The existing southbound bus lane (toward Civic) between Sandford Street and Federal Highway would however be removed to allow for two lanes of general traffic.

Some widening works at the following intersections would also be required along this section of Flemington Road:

- Standford Street to allow for the proposed alignment of the light rail through the intersection
- Randwick Road intersections to allow for new left (into EPIC) and right (into Randwick Road) turning lanes
- Flemington Road and Federal Highway to accommodate two new right hand turning lanes and a new left hand slip lane from Flemington Road.

- On the Federal Highway and Northbourne Avenue through to Civic, the proposed road and access changes would be limited to works required at the intersections. In addition to proposed road and access changes required as part of the Project, the need for a new southbound lane from the current merge point south of the Barton Highway to the current widening point north of Antill Street (a distance of approximately 630 metres) has been identified based on future traffic predictions. This additional lane would not form part of the current Project and would be provided by others prior to 2031.

Other specific road changes along the Project alignment would include the following:

- closure and provision of cul-de-sacs along the Northbourne Avenue local road either side of the existing intersection of Northbourne Avenue (local road) and Swinden Street. New access points between the main Northbourne Avenue carriageway and Northbourne Avenue (local road) would be provided to allow access to the main Northbourne Avenue carriageway
Intersection changes

Modifications to the physical layout of each of the intersections that the Project alignment would pass would be required. This would include where road vehicles cross the light rail alignment and the existing road levels would need to be smoothly transitioned to match the proposed light rail levels. At some intersections, additional turning lanes would also be provided to allow improved transition between the main Project alignment and adjacent streets.

Signalised intersections are proposed wherever road traffic is permitted to cross the light rail. Existing signalised intersections would also be maintained. Some existing crossings of the Northbourne Avenue median would be retained and would not be signalised but would be modified to ensure pedestrians face the track before crossing. The existing right turn from Northbourne Avenue into Rudd Street would be banned under the current design.

All existing CCTV cameras, speed cameras and red light cameras at intersections would be retained and integrated with the traffic signal modifications.

Access changes

Given the central alignment of the Project within existing and proposed medians, changes to vehicular access for properties along the alignment would be minimal. Particular revised access arrangements for specific properties would be required for the following major traffic generating developments:

- The Canberra Paceway and Exhibition Park in Canberra
- Kamberra Wine Company | The Tom Elvin Centre
- Yowani Country Club, including the relocation and reconfiguration of the existing access point
- Netball ACT, including the sealing and formalisation of the existing surface car park adjacent to Northbourne Avenue.

Public domain and urban design

The layout, signage, street furniture and stops associated with the Project would all be design to have a coherent theme and contribute to the functionality and aesthetics of the system. The final design for the section of route along Northbourne Avenue would also be completed in consultation with the National Capital Authority (NCA). The urban design and landscape proposal would be ‘place based’ and respond to the unique characteristics and requirements for each location.

Upon completion of the construction works, affected areas would be revegetated with suitable plants. An offset planting program would also be instigated to replace the mature trees that were lost along the route.
Public art

While not a specific requirement of the Project, there is potential opportunity for public art to be integrated into the Project corridor or the overall design of the Project, incorporating the light rail other and adjacent public spaces. Development of public art strategies would be led by either NCA or the (ACT) Territory and Municipal Services (TAMS) for respective areas along the Project alignment. Project Co (the nominated operator) would work with both NCA and TAMS and other relevant stakeholders during detailed design of the Project.

Street trees

Approximately 860 existing trees would be removed as part of the construction of the Project. This would include a majority of mature trees within the existing median along Northbourne Avenue and some trees along Gungahlin Place, Hibberson Street, Flemington Road, and the Federal Highway. Further details regarding the proposed impact of the Project on existing street trees and the proposed mitigation and offset strategies are provided in Chapter 8 of this EIS. This would include replacement vegetation along the length of the Project alignment.

Stabling depot and maintenance facility

The Project would provide a stabling depot and maintenance facility in Mitchell. The stabling depot and maintenance facility would provide safe and secure storage of LRV’s, for efficient and economic inspections and regular repair and cleaning as part of LRV’s maintenance regime. The proposed stabling depot and maintenance facility site is generally ‘L’ shaped with a boundary maximum length of approximately 360 metres and a width of approximately 135 metres. The site would be fenced from general public access and some lighting would be used at night for safety and security of the site.

Access and egress of LRVs between the stabling facility and the main alignment would be via the new entry point along Flemington Road. New traffic signals are proposed to facilitate safe access between the light rail tracks on Flemington Road and the Depot for light rail vehicles only. Staff access to the site would be via the existing driveway network that currently provides access to the existing commercial and industrial complex located on Sandford Street. Approximately 68 staff car parking spots would be provided within the stabling and maintenance facility site.

The stabling depot and maintenance facility would generally provide for the following:

- 18 LRV stabling berths (33 metres in length, but allowing for future increase in LRV length)
- a wash plant
- future provision for a sand plant. Initially, sand will be supplied using a small mobile truck
- connections to the main line in both directions
- a LRV maintenance workshop
- an operational control centre
- offices for the operations and maintenance organisation
- facilities and parking for LRV drivers and other staff.

An indicative layout of the proposed stabling and maintenance depot is provided in Figure 2.12. Indicative cross-sections of the stabling depot and maintenance facility are provided in Figure 2.13. An indicative visualisation of the site is also provided in Figure 2.14.
Figure 2.12  Indicative layout of the Mitchell stabling depot and maintenance facility

Note: Indicative only, subject to detailed design
Associated light rail infrastructure and services

Power supply and overhead wiring

Overhead line equipment would be installed for the Project. This would comprise overhead wiring structures, foundations and poles, contact wire, catenary wire, tensioners, conductors, and other required infrastructure to the required standards for light rail construction and operation.

Centre poles would be used to support the overhead line equipment along all sections of the route. The track alignment has been developed with sufficient clearance to accommodate the placement of centre poles. Average separation of poles is proposed to be approximately every 30 metres. Poles and other required structures would be placed so as not to obstruct existing civil infrastructure such as public access ways and cycle routes.
Lighting

Shared road and light rail corridor lighting poles would be installed along Hibberson Street between Gungahlin Place and Hinder Street and along part of Flemington Road where existing street lighting is impacted. Light rail corridor lighting would be installed atop the overhead line equipment poles within the Northbourne median south of Antill Street. Opportunities for shared use poles along other sections of the alignment would also be considered as part of future stages of the design of the Project. Lighting levels would be designed to be compliant with TAMS requirements.

Substations

Electrical power supply for operation of the LRVs is required in the form of direct current (DC) power, which requires conversion of supply from the existing ActewAGL supply network. Seven substations would be required for the Project (inclusive of proposed substations within the stabling depot and maintenance facility at Mitchell). The substations would provide 750-volt DC electricity supply. To supply the required power for the network, the substations would typically be located approximately 1.5 to 2 kilometres apart along the alignment.

The locations of the proposed substations are shown on Figure 2.2a to Figure 2.2e and include:

- Flemington Road
- Collaroy Street
- Vicars Street
- Barton Highway
- Macarthur House
- Mort Street
- Stabling depot and maintenance facility.

Six of the proposed substation buildings would be single, typically dimensioned buildings. The seventh substation would be double sized within the stabling depot and maintenance facility site. A typical substation building would consist of a pre-fabricated, modular building of dimensions 12 metres by 4.5 metres by 3.8 metres (height) which could be fitted with an external materials facade to blend into specific local, urban environments. Each substation would also allow for maintenance access, crane access for equipment replacement and appropriate security fencing. Screening, including landscape screening, screening walls, and security fencing and gates would be considered during the detailed design of the substations with the final treatment design dependant on their locations.

Each of the proposed substations would be connected to the existing high voltage feeder network. The recommended feeder connection points for substations are shown on Figure 2.2a to Figure 2.2e. These sites have been considered as part of the overall impact assessment of the Project. The identification of the feeder connection points has been developed in consultation with ActewAGL with consideration of the overall impact to the existing high-voltage feed network.

The final locations would be refined during detailed design of the Project.
Other services

The Project would require a number of new and additional utility infrastructure to allow for the operation of the Project; including:

- cabling for communications systems (e.g. for CCTV systems, emergency telephones/help points, public address, passenger information displays)
- cabling for the signalling system
- cabling for power supply between the feeder connection points, substation locations and the main track alignment
- trackside signalling equipment (e.g. post-mounted signals, location cabinets, track circuits, points machines, etc.).

Utility infrastructure and services that would be required at stops would include:

- local power supply for stops (cabling, distribution boards, switchboards, etc.), lighting, signage, CCTV systems, public address and security systems
- water supply (e.g. for cleaning activities).

A number of existing utility services within the Project impact footprint would also be relocated, augmented or protected as part of the Project. The potential impacts to existing utility services resulting from the Project are detailed in Chapter 15.

Bridges, culverts and other structures

Bridges

Four bridges to accommodate existing crossings would be required along the proposed alignment, these include:

- **A single span bridge along Northbourne Avenue near the intersection with Morphett Street** – The existing bridge spans over an open storm drain.
- **A single span bridge along Flemington Road to the north of the intersection with Randwick Road** – This bridge exists now, but would be modified to accommodate the Project. The Project would include replacement and widening of the existing deck to allow for a new span between the existing bridge decks.
- **Single span bridge along Flemington Road near the intersection with Clare Burton Circuit** – This bridge would be built between the two existing bridges, which carry each carriageway of Flemington Road. The space between the two existing bridge decks is considered to be wide enough for a new bridge structure supporting two light rail tracks without impacting the existing bridges.
- **Single span bridge for access to the stabling depot and maintenance facility** – A new bridge would be required to connect the light rail alignment from Flemington Road to the proposed stabling depot and maintenance facility located near the intersection with Sandford Street. The new bridge would span over the existing drainage channel (Mitchell’s Channel) at this location. The bridge would consist of a single span bridge along the alignment to allow for access to the proposed stabling depot and maintenance facility.
Culverts

Twelve major culverts/drainage crossings of various sizes have been identified along the alignment. Where the Project would impact on existing culverts, a condition assessment and strength analysis would be undertaken at the detailed design phase to confirm whether the existing culverts can be retained as an asset. In some instances, culverts may need to be extended or replaced across the median where the Project would result in a wider transport corridor than currently exists, or where additional loading may weaken the existing culvert.

Retaining walls

New retaining walls are likely to be required at the following locations:

- **Flemington Road Southbound between Resource Management Centre Junction and Morisset Road** – A new retaining wall up to approximately 2.8 metres high and approximately 500 metres in length

- **Flemington Road Northbound south of Sandford Street** – A new retaining wall up to approximately 1.5 metre high in the vicinity of the National Archives Building.

- **Federal Highway Eastbound to Flemington Road Northbound** – A new retaining wall up to approximately 0.8 metres high.

The proposed retaining walls would be subject to further design development to confirm their height and extent once additional detailed survey has been obtained and further design work carried out.

Drainage and stormwater infrastructure

Drainage elements that would form part of the Project would include:

- additional drainage for the light rail track zones to meet agreed design criteria
- modifications to the existing pit and pipe network associated with clashes with the rail track slab/influence zone
- modifications to the existing pit and pipe network associated with changes to the horizontal road/kerb alignment
- modifications to existing surface drainage regime as a result of minor level changes, local catchment boundary adjustments and increased flows as a result of adjustments to impermeable areas.

Drainage and flooding criteria, to be refined in subsequent project stages (i.e. detailed design), would include:

- stormwater runoff from the light rail network would be captured where feasible by existing stormwater drainage network
- the construction of the Project would minimise, where possible, the effects on existing overland flow paths
- where existing drainage pipes exist within the footprint of the Project alignment, these pipes and associated pits would require relocation
- additional drainage structures would be designed to mitigate the effects of changes to local catchments, where required
- track drainage would be designed to limit water depth to 15 millimetres or less at, or adjacent to the track surface during whichever is larger of the 10 year average recurrence interval (ARI) or the design ARI of the adjacent road
the above design criteria would be assumed to apply even where the existing downstream network is determined to have less than a 1 in 10 year ARI capacity, to allow for the potential for upgrades to the downstream network by the relevant asset owners.

- Transverse trench drains (cut-off drains) would be adopted at the upstream end of each light rail stop and generally every 50 metres to collect rail groove drainage.

- Where capacities of existing overland flow paths would be reduced as a result of raised pavement levels, equivalent capacity would be provided in an underground network to maintain existing total.

**Stormwater run-off**

The Project alignment occurs along developed corridors, such as existing roads and it is reasonable to assume there would not be substantial increases in stormwater runoff as a result of the Project. However, some reduced overland flow capacity along the road corridor would occur due to increases in impervious surface areas such as light rail tracks and stop platforms.

Given the constrained and already developed corridor it is not proposed to include stormwater detention within these areas. The final requirements for drainage and stormwater infrastructure would be refined during detailed design of the Project.

### 2.2.3 Construction of the Project

**Overview**

For the purpose of this EIS, an indicative construction plan and method are provided in this Chapter. The detailed construction staging plans and methods would be determined by the construction contractor(s) after the design is developed and before construction begins.

The actual construction method may vary from the description in this Chapter as a result of detailed site survey, geotechnical investigation works, condition assessment of existing structures, identification and location of underground utilities and services, on-site conditions identified during pre-construction activities (such as those detailed in section 7.2), development of the design, and community consultation including consideration of submissions received.

The final construction plan and methods would be consistent with statutory requirements (including any occupational health and safety regulations) and all approval conditions issued for the Project.

**Project program**

**Construction and delivery strategy**

The Project would be delivered as a public private partnership (PPP). The construction contractor and operator of the Project (hereafter referred to as ‘Project Co’) would be responsible for design, construction, supply of LRVs, operation and maintenance of the Project. Key to the delivery of the Project would be the early commencement of utility diversions in order to leave a clear path for the construction of the permanent infrastructure. Utility works would be executed at various discrete locations concurrently. This would start while the design and procurement of the permanent infrastructure (such as tracks and stops) are being finalised.
Once construction of the main Project alignment commences, work would focus on the Mitchell Depot and the modification to the carriageway between Well Station Drive and Randwick Road. This would allow track construction to be completed in this section first. This section is required early to allow commissioning of the LRVs and driver training. Work would then progress towards both the north (towards Gungahlin Place Stop) and south (towards Alinga Street Stop). Upon completion of the carriageway improvements, the track and rail systems would then be installed. Finally landscaping would take place and new trees would be planted along the alignment. Once the physical construction is complete there would also be a period of testing of the systems and trial running of the vehicles before services commence.

**Project timeframe**

Construction of the Project would take approximately three years, with work commencing at multiple sites along the alignment from the fourth quarter of 2016 (subject to planning approval). The Project is expected to be commissioned (i.e. become operational) in the fourth quarter of 2019/early 2020. This program is based on the current design and preliminary construction staging. Therefore, the program is indicative and may change once Project Co is engaged.

An indicative timing for the construction and commissioning phases for the Project is shown in Table 2.1.

**Table 2.1  Estimated construction and commissioning phases for the Project**

<table>
<thead>
<tr>
<th>Stage</th>
<th>Commencement date</th>
<th>Completion date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site establishment</td>
<td>April 2016</td>
<td>Aug 2016</td>
</tr>
<tr>
<td>Early works</td>
<td>July 2016</td>
<td>December 2016</td>
</tr>
<tr>
<td>Main civil construction works</td>
<td>October 2016</td>
<td>December 2018</td>
</tr>
<tr>
<td>Demobilising</td>
<td>January 2019</td>
<td>August 2019</td>
</tr>
<tr>
<td>Testing, training and commissioning</td>
<td>January 2018</td>
<td>August 2019</td>
</tr>
</tbody>
</table>

* Subject to planning approval

The overall project program would be divided into a number of stages and activities, as outlined below.

**Construction methodology**

Table 2.2 summarise the likely construction phases and associated construction activities for the Project. A number of the associated activities within the construction stage would be programmed to occur concurrently to meet the proposed Project program.

Addition detail regarding the key construction activities is provided in the following sections.

**Table 2.2  Anticipated construction activities for each stage of the Project**

<table>
<thead>
<tr>
<th>Stage</th>
<th>Key construction activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site establishment</td>
<td>▪ Surveys (e.g. locating services/utilities).</td>
</tr>
<tr>
<td></td>
<td>▪ Property adjustments and land boundary realignments.</td>
</tr>
<tr>
<td></td>
<td>▪ Geotechnical investigations.</td>
</tr>
<tr>
<td></td>
<td>▪ Prepare arborist reports.</td>
</tr>
<tr>
<td></td>
<td>▪ Install environmental controls.</td>
</tr>
<tr>
<td></td>
<td>▪ Vegetation clearing/tree trimming.</td>
</tr>
<tr>
<td></td>
<td>▪ Mobilisation of resources, preparation of management plans and procuring long lead time items.</td>
</tr>
<tr>
<td></td>
<td>▪ Communication and consultation stakeholders along the route.</td>
</tr>
<tr>
<td>Stage</td>
<td>Key construction activities</td>
</tr>
<tr>
<td>-------</td>
<td>-----------------------------</td>
</tr>
</tbody>
</table>
| Early works | - Establishment of site compounds for storage, parking, offices and facilities for construction personnel.  
- Establishment of traffic management plans and road configuration changes.  
- Procurement of construction plant and equipment with a long lead time.  
- Relocation or protection of major utilities.  
- Site preparation works. This includes tree removal works, stripping top soil and erection of safety barriers around the sites of work.  
- Modifications to existing bus routes. This would include the provision of temporary stops where required and signage in consultation with TAMS and ACTION.  
- New roads and drainage works (Including cycle lanes, kerbs and gutters, signage, traffic signals and line markings).  
- Construction of bridge and culvert infrastructure. These will require piled foundations, concrete head stocks and precast concrete beams. The track slab would then be built on top of the concrete beams.  
- Environmentally sensitive areas, such as heritage sites, threatened species and other sensitive flora and fauna areas would be demarcated and protected so construction works do not adversely impact on them. |
| Main civil construction works | - Earthworks.  
- Road and intersection modification works.  
- Civil works – including drainage infrastructure.  
- Track installation and track slabs.  
- Construction of light rail stops including provision of access, facilities, security, safety (CCTV), lighting and furniture, and other customer facilities and wayfinding information, including passenger information display systems (PIDS) to advise customers of the next few services.  
- Surfaces and paving in the proposed light rail corridor.  
- Installation of the OHW masts and running the overhead wiring and testing.  
- Power supply including, substations and overhead lines, concurrent installation of the combined services route (CSR) and cable containment for traction power, low voltage power, and communications.  
- Rail systems and signalling, as required.  
- Construction of depot and stabling yard.  
- Temporary and permanent changes to property access, local traffic circulation and car parking.  
- Temporary and permanent road, traffic and intersection modifications.  
- Public domain modifications along the route, including strategies for access, streetscapes (paving, trees and furniture within the project corridor) and lighting.  
- Rail/road interaction including traffic signal prioritisation.  
- Temporary and permanent removal and/or relocation of on-street parking, loading zones, cycling infrastructure, taxi ranks, bus stops and other public transport facilities.  
- Road works for establishment of pedestrianised zone on Hibberson Street. |
| Demobilising | - Restoration of the road to pedestrian and road traffic (where appropriate).  
- Removal of temporary construction facilities.  
- Rehabilitating and landscaping work sites and the affected area.  
- Removing environmental controls once areas are established. |
| Testing and commissioning | - Integration of new signalling system with existing road signalling system.  
- Commissioning and trial running of light rail infrastructure, including electrical connections to overhead wiring and signals. |
Track and rail systems work

*General track works*

The majority of the route would be built on the existing median strip. This would reduce impact on traffic during construction. Track construction would begin once a clear corridor along a substantial part of the alignment has been established, with utility services diverted where necessary prior to works beginning. The progress of track construction would be linear within sections of the route between intersecting streets, with the intersections being constructed behind or in advance of the adjacent sections with closures of the intersections put in place. Typically the rail installation would entail the following activities:

- track installation, welding and track finishing (installation of a topping slab, asphalt in-fill or paver in-fill)
- installation of overhead wiring foundations and posts, where required
- permanent reinstatement of affected areas, including installation of road line markings
- systems integration, testing and commissioning.

One or more sections could be constructed simultaneously, depending on the construction methodology, traffic restrictions for the route under consideration, resources and the availability of access to the work sites.

*Rail systems and overhead line equipment installation*

Rail systems installation would follow the track construction. Installation of the overhead wiring would start after a sufficient number of adjacent sections of the route are completed. Cables for power and communications would also be installed during this stage. Construction activities would vary along the alignment, however, would typically involve:

- relocation/protection of utilities (where required) and preparation of new services
- offsite fabrication of overhead wiring post and delivery to the worksite
- erection of posts
- stringing overhead wires.

*Roadway/carriageway works*

In areas where the median is not wide enough to accommodate the light rail system the carriageway would be modified to maintain access for road vehicles. A number of intersections would also be upgraded and modified. Works would be undertaken in accordance with the relevant TAMS standards and specifications. To accommodate the final alignment of the new light rail tracks, the existing road profile would need to be modified in some areas (primarily at intersections) to ensure a smooth road surface.

*Stop and terminus works*

Stop construction and fit out would be undertaken as the work front moves progressively along as separate work sites so as to not interfere with the corridor works. The construction of the base of the stops would be carried out during the track installation. The superstructure of each of the stops would be prefabricated elements including precast concrete planks for the platform and modular shelter structures. Indicative construction activities during the establishment of light rail stops would vary between locations; however, would generally include the following:

- service/utility relocation and protection works
- installation of light rail services and conduits
- formation of stop platforms
• installation of services, including communications and electrical (including charging units for the wire free section of the track)

• installation of stop canopy, signage, seating, tactile indicators and paving and other finishing works.

The driver amenities would also be built at the two terminating stops in parallel with the stop construction. The fit out, installation of permanent safety and security measures, passenger information displays and help points, fare collection arrangements, lighting and public address (PA) facilities would follow the completion of the main stop superstructure installation.

Maintenance depot

Construction of the stabling depot and maintenance facility would commence early to provide a staging point for the delivery of the LRVs. The stabling depot and maintenance facility works would be carried out concurrently with the main Project alignment works. The maintenance depot works would be divided into two main components as follows:

• track work – construction of tracks, stabling areas and associated infrastructure within the stabling depot and maintenance facility

• buildings – buildings include the maintenance shed and office, wash plant, substation and other associated infrastructure.

Substations

The substations enclosures will be fabricated off site with the transformers, switchgear and other equipment already fitted. This would reduce the duration of works on site and allow more extensive testing to be completed in the factory before delivery to site. These units would then be delivered to site and installed on the foundations by crane.

The proposed sites for substations would be near existing roads (refer to Figure 2.2a to Figure 2.2a) so equipment could be delivered through public roads. Delivery of equipment would depend on the substation building’s design and the fencing around the building, and vehicular access to the substation.

The construction staging would be phased to allow testing and commissioning of traction power, low voltage supply, and systems to take place as programmed.

The following general steps would be required to construct the substations on the Project:

• site formation and installation of site drainage

• install and test earth rods/mats (earth grid)

• the substation’s enclosures would be fabricated off site with the transformers, switchgear and other equipment already fitted. This would reduce the duration of works on site. These units would then be delivered to site and installed on the foundations by crane

• substation equipment testing, commissioning and connection to new and existing power supply points.

Intersections

Intersection construction work would be limited to two locations at any one time, locations to be spaced at approximately six kilometre intervals to minimise impacts. The proposed methodology would be to complete the track slab across half of the intersection, switch traffic, and to complete the work on the remaining half. Intersection specific traffic control plans would be prepared and implemented for each intersection/ trafficked area. New traffic signal installation would take place during traffic control periods where appropriate. Some intersection works may also require complete closure through intersections to allow for works to be completed (e.g. during night time or weekend periods).
Structures

The three new bridges would be assembled from precast concrete beams supported on concrete piles and cast in place. This would reduce the duration of works on site. As described above, an existing bridge on Randwick Road would also require widening. A number of culverts may also require strengthening.

Services relocation and/or protection

There are numerous interfaces with utilities that must be addressed on a case by case basis. At intersections this is more severe and the additional conflict with live traffic will also be managed. The track slab design and track alignment would be optimised to minimise the depth of excavation required. Any utilities that may clash with the infrastructure to be built would be relocated or protected during construction (refer to Chapter 15).

Where feasible and acceptable to the asset owner, the relocated assets would be installed in the new combined services route. Assets that are not affected would still be protected temporarily to prevent damage during construction. The asset owners would be consulted and the required design approvals obtained before utilities are modified or relocated. Works would also be planned to minimise impact on consumers. This may include utility activities be completed at off peak times (potentially at night or on weekends).

Typical method of work for service/utility relocation/protection would include:

- identify clashing utility, agree works to divert or protect if required with asset owner
- set up safe work area with suitable signs and fencing
- carry out site investigations (including potholing) to confirm location of utilities in the ground
- expose at the two ends of the route for relocation
- construct the new route (either by open cut or non-disruptive excavation) and lay the new service (duct, cable, pipe) as appropriate and survey the location on completion
- place warning tape, backfill and reinstate the route
- commission the new service to the new route, mark the old as redundant and reinstated the disturbed area.

Earthworks and excavations

A large quantity of spoil would be excavated to allow for construction of the new infrastructure (in particular the proposed tracks). Concrete, backfill material and equipment for the track systems and construction of the stops and stabling depot and maintenance facility would then be imported. Part of the spoil would be used for general fill requirements and excess fill would be taken off-site. Estimate earthwork quantities are provided in Table 2.3. These volumes are an indicative estimate based on the current level of design. Further refinement of the required earthworks would be undertaken during future phases of the Project design and development. Additionally, any changes to the proposed construction methodology by Project Co may impact on overall earthwork and excavation amounts.

Table 2.3 Estimated earthwork quantities

<table>
<thead>
<tr>
<th>Material</th>
<th>Indicative quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Topsoil stripped</td>
<td>15,000 cubic metres</td>
</tr>
<tr>
<td>Spoil</td>
<td>135,000 cubic metres</td>
</tr>
<tr>
<td>Unsuitable material* (to be disposed of)</td>
<td>19,000 cubic metres</td>
</tr>
<tr>
<td>Select backfill</td>
<td>24,000 cubic metres</td>
</tr>
</tbody>
</table>

*May vary pending further geotechnical investigation
Deep excavations

Deep excavation works (i.e. works greater than 2 to 3 metres) would be required at certain locations. Potential deep excavations have been identified to include:

- Within the stabling depot and maintenance site, including excavations for general earthworks and specific depot elements such as the tram wash.
- New box culverts are proposed to be installed in the channel to access the stabling depot and maintenance facility.
- The new bridge near Randwick Road for the proposed pile caps.
- If the retaining wall along Flemington Road is greater than 2.8 metres high, the excavation for the base slab would require deeper excavation.

Construction work hours

Construction would be staged along the alignment to minimise disruption to residents, businesses and existing transport operations and would typically occur during standard work hours. This would include civil construction, some utility diversions (where this would have minimal impacts), road works, rail systems construction of stops and building and civil works within the stabling depot and maintenance facility site.

Standard construction hours for the construction of the Project would be:

- Between 7.00 am and 6.00 pm Monday to Saturday.
- No construction work to be carried out on Sundays or during public holidays.

Various components of work may also be required to be taken outside of normal construction hours. These activities would include:

- work across major intersections along the Project alignment
- overhead wiring, testing and commissioning
- utility diversion works where impacts to services cannot be otherwise reasonably managed within standard working hours
- oversize deliveries/unloading and collection of machinery that can only travel between specified hours
- works that can take place so as to be inaudible at the nearest residential receivers
- works required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm.

Some works would, however, be required to occur outside of these standard construction hours. This may include evening and night-time periods. Typical activities which may need to occur in outside of standard construction hours would include:

- work across major intersections along the Project alignment
- overhead wiring, testing and commissioning
- utility diversion works where impacts to services cannot be otherwise reasonably managed to minimise impacts of these works on traffic or local businesses and residents
- oversize deliveries/unloading and collection of machinery that can only travel between specified hours
works that can take place so as to be inaudible at the nearest residential receivers

- works required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm.

These procedures are outlined in greater detail in section 7.4 of this EIS. Construction works required to be undertaken during special events would be co-ordinated between Project Co and the event organisers and/or other relevant stakeholders prior to the event(s) occurring.

Construction resources and materials

Concrete, backfill material and equipment for the rail systems and construction of the stops and stabling depot and maintenance facility would require imported construction materials. Estimated bulk material quantities are shown in Table 2.4.

<table>
<thead>
<tr>
<th>Resource/material</th>
<th>Indicative quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diesel</td>
<td>Approximately 3,400,000 litres</td>
</tr>
<tr>
<td>Rail (steel)</td>
<td>3,000 tonnes</td>
</tr>
<tr>
<td>Steel reinforcement</td>
<td>7,400 tonnes</td>
</tr>
<tr>
<td>Structural steel</td>
<td>1,900 tonnes</td>
</tr>
<tr>
<td>Concrete</td>
<td>74,000 cubic metres</td>
</tr>
<tr>
<td>Asphalt</td>
<td>9,500 tonnes</td>
</tr>
<tr>
<td>Water</td>
<td>45,000 kilo litres</td>
</tr>
<tr>
<td>PVC ducts</td>
<td>100,000 metres</td>
</tr>
</tbody>
</table>

No concrete batching plant would be required as concrete materials would be delivered to site as required. New aggregates, building supplies and concrete would be sourced from local suppliers based at either Mitchell or Fyshwick, Specialist equipment and materials would be delivered from suppliers via the interstate routes from either from Melbourne or Sydney by road, as required.

Water

The water used for dust suppression, earthworks and irrigation of the landscaped areas would be obtained from the Inner North Reticulation Network (Stormwater). Standpipes (operated by TAMS) are currently located on the corner of the Valley Avenue and Gungahlin Drive, Gungahlin and also in Mitchell on the corner of Flemington Road and Morisset Road.

Groundwater bores would not be used during construction of the Project.

Plant and equipment

Table 2.5 outlines the indicative construction equipment required for construction of the Project.
### Table 2.5  Indicative plant and equipment requirements

<table>
<thead>
<tr>
<th>Plant description</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Heavy vehicles and equipment</strong></td>
<td></td>
</tr>
<tr>
<td>150, 250 and 500 tonne cranes</td>
<td>Bridges, substations and depot</td>
</tr>
<tr>
<td>Asphalt paver</td>
<td></td>
</tr>
<tr>
<td>Double drum roller and rubber tyre multi wheel rollers</td>
<td></td>
</tr>
<tr>
<td>Front End loader</td>
<td>Carriageway works and compound construction</td>
</tr>
<tr>
<td>Tipper</td>
<td>Civil, Drainage, roads and combined services route</td>
</tr>
<tr>
<td>Compressor</td>
<td>Civil, utilities and track work</td>
</tr>
<tr>
<td>Water Cart</td>
<td>Carriageway works and dust suppression</td>
</tr>
<tr>
<td>Forklift</td>
<td>Compounds</td>
</tr>
<tr>
<td>Light trucks</td>
<td>Deliveries and traffic management</td>
</tr>
<tr>
<td>11 tonne to 15 tonne excavator with hydraulic hammer</td>
<td>Demolish kerb, gutter and footings</td>
</tr>
<tr>
<td>100 tonne Crane</td>
<td>Depot and compounds</td>
</tr>
<tr>
<td>Flat-bed truck/ Crane truck</td>
<td>General deliveries</td>
</tr>
<tr>
<td>Lighting tower</td>
<td>Night works at intersections/Roadwork</td>
</tr>
<tr>
<td>Elevating work platform</td>
<td>Overhead line equipment and building</td>
</tr>
<tr>
<td>Float</td>
<td>Plant deliveries and movements</td>
</tr>
<tr>
<td>Service trucks</td>
<td>Plant maintenance</td>
</tr>
<tr>
<td>12 to 15 tonne rollers</td>
<td>Roads, compounds, site clearance, sub grade and fill</td>
</tr>
<tr>
<td>D6 Bulldozer</td>
<td></td>
</tr>
<tr>
<td>Excavators (various including 2 tonne to 30 tonnes)</td>
<td>Roads, track, drainage, site clearance, utilities works</td>
</tr>
<tr>
<td>20 tonne Franna Crane</td>
<td>Stops, Overhead line equipment track and compounds</td>
</tr>
<tr>
<td>Road sweeper</td>
<td>Street cleaning</td>
</tr>
<tr>
<td>21 tonne to 25 tonne excavator with hydraulic hammer</td>
<td>Structural demolition</td>
</tr>
<tr>
<td>Piling rig (30 tonne/50 tonne)</td>
<td>Structures</td>
</tr>
<tr>
<td>Concrete pump and trucks</td>
<td>Track slab, foundations and kerbs</td>
</tr>
<tr>
<td>Slipform machine</td>
<td></td>
</tr>
<tr>
<td>Chipper</td>
<td>Tree removal works</td>
</tr>
<tr>
<td>Stump grinder</td>
<td></td>
</tr>
<tr>
<td>Directional drill</td>
<td></td>
</tr>
<tr>
<td>Sucker truck</td>
<td>Utilities, combined services route and drainage</td>
</tr>
<tr>
<td>Trench roller</td>
<td></td>
</tr>
<tr>
<td>Backhoe</td>
<td>Utilities, landscaping and drainage</td>
</tr>
<tr>
<td>Utes</td>
<td>All construction activities</td>
</tr>
<tr>
<td><strong>Small plant and equipment</strong></td>
<td></td>
</tr>
<tr>
<td>Chainsaws</td>
<td></td>
</tr>
<tr>
<td>Concrete saws</td>
<td></td>
</tr>
<tr>
<td>Generators</td>
<td></td>
</tr>
<tr>
<td>Hydraulic power pack</td>
<td>Various construction works and compound sites</td>
</tr>
<tr>
<td>Pneumatic jack hammers</td>
<td></td>
</tr>
<tr>
<td>Wacker plate</td>
<td></td>
</tr>
<tr>
<td>Water pumps</td>
<td></td>
</tr>
<tr>
<td>Welders</td>
<td></td>
</tr>
</tbody>
</table>
Construction workforce

The construction workforce would vary depending on the stage of construction and associated activities. During peak construction activities, the Project will employ approximately 900 workers and the average workforce would be approximately 500 workers.

Construction footprint and ancillary sites

Construction impact footprint

The construction footprint represents the construction impact boundary or the area within which construction activities would occur. Construction works would take place along the full length of the Project corridor and would include:

- the proposed light rail works within the median of Hibberson Road, Flemington Road, the Federal Highway and Northbourne Avenue
- construction of the road infrastructure upgrades to accommodate access paths to the stops and intersection upgrades
- the proposed construction compound locations
- the access points into the rail corridor for construction vehicles
- the proposed stabling depot and maintenance facility at Mitchell
- substation sites and access to and connection with proposed feeder connection points along the alignment. These locations are generally adjacent to the Project alignment.

The construction footprint for the Project is shown in Figure 2.15a to Figure 2.15e.

The impact footprint which has been assessed as part of the Project represents the blocks of land which would potentially be impacted by the construction (and operation) of the Project. Further discussion of the Project impact footprint is provided in Part C of this EIS.

Construction sites and compounds

There are five main construction compound areas of varying sizes proposed, in addition to the central median in which the Project is to be constructed. To minimise impacts from the construction compounds, the selection of the construction compound locations took into consideration the following site factors:

- located on relatively level ground
- accessible for construction traffic and deliveries
- away from or able to be separated from existing sensitive ecological or heritage sites/items
- close to key construction activities (such as stop locations) to minimise transport of materials and equipment
- within the existing median to minimise impacts on private and public property.

Any new construction compound proposed would be subject to relevant additional environmental assessment to determine consistency with the current Project design, in accordance with relevant ACT Government planning and assessment processes.
Figure 2.15b: Construction footprint and construction compounds

Legend:
- Project impact footprint boundary
- Construction compound sites