Figure 18.6 Predicted groundwater drawdown in layer 4 Hawkesbury Sandstone (metres)

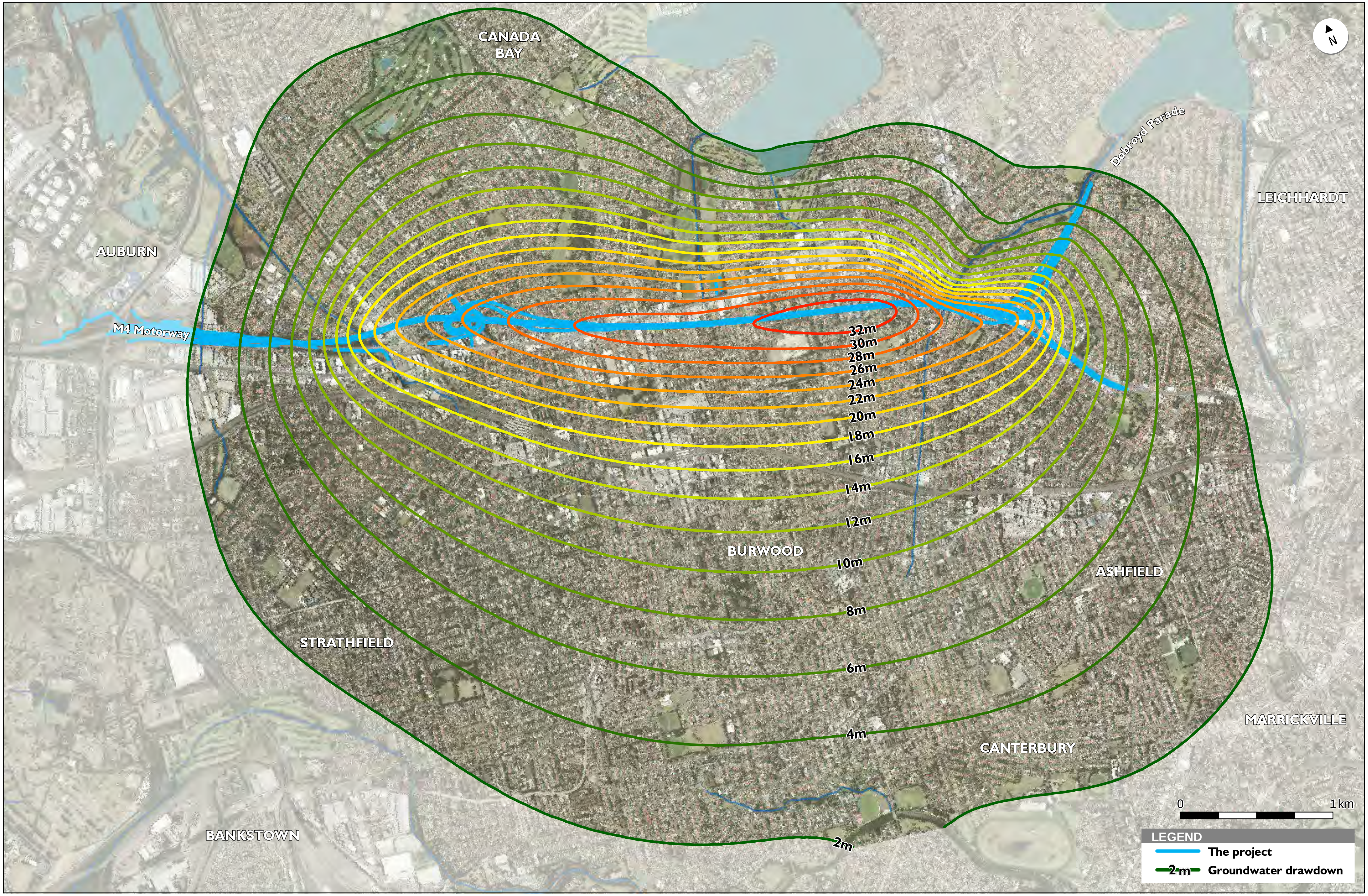

Figure 18.7 Predicted groundwater drawdown in layer 5 Hawkesbury Sandstone (metres)

18.4.2 Groundwater recharge change

The project is unlikely to significantly alter groundwater recharge. Surface disturbance as a result of the project would largely be limited to tunnel dive structures, cut-and-cover tunnels and on- and off-ramps. As none of the on- and off-ramps nor the mainline tunnels is cut through areas of alluvium, there would be no potential for the tunnels to block or otherwise interfere with significant shallow groundwater systems. It is possible that the approach structures could intercept localised shallow perched systems, but these would be managed on a case-by-case basis using local drainage systems.

The project could result in a minor reduction in groundwater recharge due to the increase in impervious area associated with surface roads. However, as there are extensive existing impervious areas in the project footprint and the increase would only be minor, it is unlikely to have a significant impact on groundwater levels.

As described in **section 5.8.3** in **Chapter 5** (Project description), operational tunnel inflow (after treatment) would ultimately be discharged to St Lukes Park Canal, which is a concrete-lined channel. Discharge volumes are discussed below in **section 18.4.3**. This discharge would not modify groundwater recharge conditions.

Discharge to St Lukes Park Canal is expected to increase the overall flows (particularly under low flow conditions) and is unlikely to result in adverse impacts on the existing water sharing conditions under the Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2011. Surface waterways near the project are heavily modified or concrete-lined and unlikely to have significant hydraulic connection with groundwater. Drawdown impacts associated with tunnel inflows are therefore expected to be minor.

18.4.3 Groundwater inflow rates and chemistry

Predicted inflow rates

Long-term groundwater tunnel inflows in the Hawkesbury Sandstone are typically in the order of one litre per second per kilometre. This is an average, long-term value and does not take into account localised or short-term inflows. It also reflects cases where localised high inflow areas of a tunnel have been grouted. Basaltic dykes are known to be areas of higher permeability than the surrounding sediments and are associated with higher inflows in tunnel excavations in the Hawkesbury Sandstone (Lees, Edwards and Grant 2005). It is likely that permeability and inflows, where these occur, will be higher than in in the surrounding sandstone.

Based on a proposed total tunnel length for the project of about 17 kilometres within sandstone, this equates to a potential inflow in the order of 17 litres per second into the tunnel during operation, or about 536 megalitres per year.

Modelling of a range of aquifer hydraulic properties and recharge rates (as described in **Appendix R**) has tested this assumption and indicates operational inflows are likely to be in the order of five litres per second (about 158 megalitres per year), but could also be as high as around 15 litres per second (about 473 megalitres per year), without partial grouting of the sandstone or sealing of shallow approach structures. As described in **section 18.5.1** of this chapter and **section 6.4.2** of **Chapter 6** (Construction work), a sprayed waterproof membrane would be installed in areas with medium groundwater inflows and, where there are significant groundwater inflows, grouting may also be used to minimise groundwater inflows.

Groundwater chemistry

The local groundwater chemistry and experience in other tunnels in the Hawkesbury Sandstone in the Sydney region demonstrate that this inflow is likely to contain elevated concentrations of iron and calcium carbonate, with the potential to cause staining and possible blockage of drainage systems in the long term. The scaling potential of the ambient groundwater may be exacerbated by leaching of chemicals, such as sodium silicate, used in grouts, as well as secondary ions derived from minerals dissolved in the highly alkaline grout leachate.

Given the depth of the tunnel and predicted long-term water levels, there is potential for lateral inflow from the east, of saline water from unlined tidal drains at the western and eastern ends of the tunnel. There is also the potential for drawing up of deeper saline groundwater. Such saline inflow may not develop immediately and may take several years to have an impact on inflow water quality; however, it is likely to develop over the design life of the tunnel.

During operation of the project there would be potential for spills and leaks to occur that may increase the presence of chemical constituents in groundwater seepage. The design of the tunnel drainage system would ensure that groundwater seepage collection did not interact with operational activities (such as tunnel washing and discharges from the deluge system during an emergency) and surface runoff, thereby reducing this risk to low.

Precipitation of iron and manganese

Dissolved iron and manganese in groundwater is derived from weathering of iron and manganese bearing minerals and rocks. Common in groundwater, iron and manganese naturally occur where there is little or no oxygen, typically in deeper bores (but not always), in areas where groundwater flow is slow, and in areas where groundwater flows through soils rich in organic matter.

Deposits formed by precipitation of iron flocculent and deposits associated with iron precipitating bacteria are known as ochre. Ochre is known to form in pipes, drains and bores – essentially anywhere there is a substrate and readily available source of soluble reduced iron (ie ferrous iron) in the groundwater. The formation of ochre deposits can result in severe clogging, leading to major failures in drainage systems and bores and the reduction of groundwater inflow into subsurface tunnels.

Under suitable conditions, manganese present in groundwater can also form a drain-clogging flocculant. Manganese will precipitate (ie form a solid) under oxidising conditions to form a black precipitate. When oxidation is bacterially enhanced, this precipitate becomes more gelatinous and poses a greater clogging risk. Manganese deposits are generally less common than ochre but, when they are present, they often occur in conjunction with ochre.

Ferrous (soluble) iron concentrations in groundwater flowing into a drain have been found to be a reasonable indicator of the potential for ochre clogging. High concentrations of ferrous (soluble) iron (above 10 milligrams per litre) indicate the potential for clogging of groundwater drainage and collection systems.

The groundwater quality data suggest there is likely to be potential for the development of ochre. As such, clogging issues may arise within groundwater drainage and collection systems and would need to be considered further during detailed design.

18.4.4 Potential impact on groundwater dependent ecosystems

Groundwater drawdown is required to be within 10 per cent of baseline levels within 40 metres of a significant groundwater dependent ecosystem, as defined by the NSW Aquifer Interference Policy. No groundwater dependent ecosystems have been identified within the area subject to drawdown of two metres or greater.

The level of groundwater dependency in the area is anticipated to be relatively low, with terrestrial vegetation, river base flow systems and aquifer systems potentially utilising groundwater in the saturated zone only during drought conditions.

It is noted that there are wetlands present near Homebush Bay (including Mason Park wetland); however, groundwater levels in that area are expected to be reliant on the Parramatta River and its associated tidal fluctuations. As such, they are not expected to be adversely affected by groundwater level decline associated with the project.

Based on the changes to water level and surface water discharges, it is unlikely that long-term tunnel drainage would have a significant impact on surface water bodies or groundwater dependent ecosystems. Discharged tunnel inflow would be treated to meet the requirements of the receiving water environment.

18.4.5 Impacts on other groundwater users

Groundwater level declines or drawdowns may affect up to four licensed bores which are likely to experience drawdowns of greater than two metres. Long-term drawdowns of these bores may be as much as 16 metres over the long term, which exceed the NSW Aquifer Interference Policy minimal impact considerations. Maximum predicted drawdowns are presented in **Table 18.5**. Any potential drawdown to other bores would be less than two metres.

Table 18.5 Maximum predicted bore drawdown

Bore ID	Maximum predicted drawdown
GW110899	16 m
GW024096	13 m
GW109699	13 m

Depending on the usage, bore construction and pump type, the impacts from the drawdown may vary from a slight increase in pumping costs, a need to lower pumps or re-equip bores, or the possibility of the need to drill, construct and equip deeper replacement bores or provide alternative water supplies at a cost equivalent to the current groundwater supply cost. To better define this impact, the potentially affected bores would need to be located and inspected to confirm whether they are still in use, and to determine their condition, equipment, depth and yield before construction of the project.

18.4.6 Impact on groundwater quality and contamination

Tunnel capture zone

The tunnel has a relatively large groundwater capture zone, including coastal areas and canals which will act as a source of saline groundwater inflow. However, as groundwater flow velocities are likely to be relatively low, the water from the entire capture zone is unlikely to travel to the tunnel over its design life. Due to typically low inflows in the Hawkesbury Sandstone, it is common practice for tunnels excavated in the Hawkesbury Sandstone to have local treatment applied during construction to reduce inflows to acceptable levels and continue to be drained during their operation, rather than being tanked or fully watertight along their full length. Tanked tunnels are not proposed as part of the project, due to the project tunnels being largely constructed within the Hawkesbury Sandstone, the high capital expenditure associated with a significant amount of additional excavation and the pre-cast concrete structure required for their construction, and the low value of the groundwater resource. The project tunnels are therefore proposed to be constructed with treatment to maintain inflows below the design criteria of one litre per second over any given kilometre.

Given the potential to draw in coastal or deep groundwater, the chemistry of inflow to the tunnel is likely to change over time., The most significant of these is the long-term potential to draw in seawater through the currently (relatively) fresh aquifer.

The project corridor contains numerous potential sources of contamination, such as service stations, light industrial and commercial facilities. Accordingly, there is some potential for groundwater contamination to be present. Construction of the project would serve to intercept and treat contaminated groundwater that would otherwise discharge to surface water systems. The impact of inducing contaminated groundwater to flow in to the tunnel or through adjacent, previously uncontaminated sites may require management measures. Contaminated groundwater entering the tunnel would be captured and treated, as described in **Chapter 5** (Project description), before being discharged to surface water systems. This would have a positive impact on the aquifer and surface water systems.

The project includes a drainage system that would keep groundwater seepage separate from surface water runoff and the surface water drainage system, minimising the potential for operational activities to affect groundwater seepage quality. Despite these measures, there would be a low level residual risk of impact from site activities that may require treatment before discharge. There would be other potential sources of contamination (refer **Chapter 16** (Contamination)) over the operational life of the tunnel, which could affect groundwater chemistry, with subsequent potential impacts on environmental and human health and water treatment requirements. This is discussed further in **section 18.4.8**.

Saltwater intrusion

Aquifer thickness is modelled to be about 200 metres. It is likely that saline groundwater underlies fresh groundwater throughout the project footprint. As the groundwater level drops over time, either by pumping from the bore or from tunnel drainage, the thickness of the freshwater aquifer decreases. As the water level at the tunnel eventually drops to below sea level, both the tunnel and existing bores would eventually draw in saline groundwater.

There are several areas where there is potential to laterally draw in seawater, where the tunnel or on- and off-ramps are close to coastal embayments or channels. There are no recorded groundwater users in these areas, and there are unlikely to be any such users, given the already relatively high salinity in the area and the availability of alternative water supplies.

There is some potential for 'upconing' of deep saline groundwater beneath existing bores where the groundwater level drops significantly. The risk, however, would depend on the bore depth and groundwater usage.

The greatest impact is likely to be an increase in tunnel inflow salinity over time. However, as the inflow over these areas is likely to be relatively small as a proportion of total tunnel inflow, the changes in overall inflow chemistry from seawater intrusion are likely to be only moderate. Discharges from the water treatment facility would be directed to St Lukes Park Canal, as discussed in **section 18.4.8**.

18.4.7 Potential for acid sulfate soil drainage

Modelling indicates drawdown of greater than two metres in the uppermost layer, representing alluvial sediments, in two areas mapped as being at low risk of acid sulfate soils and one area mapped as being at high risk of acid sulfate soils. However, drawdown within these areas would be limited by local recharge from the nearby coastline and tidal canals which would maintain saturated conditions. The high risk zone is an area of mangroves subject to regular tidal inundation which would prevent drying out and oxidising of potential acid sulfate soils.

18.4.8 Groundwater management, treatment and discharge

As described in **section 18.5.1** of this chapter and **section 6.4.2** of **Chapter 6** (Construction work), a sprayed waterproof membrane would be installed in areas with medium groundwater inflows and, where there are significant groundwater inflows, grouting may also be used. This would minimise groundwater inflows.

As described in **section 5.8.3** in **Chapter 5** (Project description), the project would include a tunnel drainage system and water treatment facility located at Cintra Park to collect and treat tunnel groundwater. Discharges from the water treatment facility would be directed to St Lukes Park Canal. While this canal is tidally affected, surface water quality monitoring indicates that the downstream location in St Lukes Park Canal has salinity characteristics indicative of freshwater. Discharge of untreated saline groundwater may be required further downstream of the monitoring location, if the canal were to be used as a discharge point and if treatment for salinity is not proposed.

The criteria for treatment plant discharge to surface waters would be based on existing water quality conditions at the point of discharge, with specific environmental criteria being set using the statistical methods outlined in the *Australian Guidelines for Water Quality Monitoring and Reporting* (Australian and New Zealand Environment and Conservation Council (ANZECC) and Agricultural and Resource Management Council of Australia and New Zealand (ARMCANZ) 2000).

18.4.9 Summary of impacts having regard to the Aquifer Interference Policy

The predicted groundwater impacts have been compared against the minimal impact criteria in the NSW Aquifer Interference Policy (NSW Office of Water 2012a). This is summarised in **Table 18.6**. Any exceedances of these criteria have been considered to be potentially adverse and mitigation and monitoring measures have been proposed in **section 18.5**.

Table 18.6 Summary of impacts relative to NSW *Aquifer Interference Policy* minimal impact criteria

Type of impact	Minimal impact considerations for aquifer interference activities	Summary of impacts
Water table impacts	1. Less than or equal to 10% cumulative variation in the water table, allowing for typical climatic "post-water sharing plan" variations, 40 m from any (a) high priority groundwater dependent ecosystem, or (b) high priority culturally significant site, listed in the schedule of the relevant water sharing plan. A maximum of a 2 m decline cumulatively at any water supply work.	There are no groundwater dependent ecosystems or culturally significant sites within the extent of the drawdown zone created by the project. The modelling suggests that drawdown curves would intersect with some wetland systems and potential acid sulfate soils to the north of the project, which may be groundwater dependent. These wetland systems rely heavily on the Parramatta River for their water supply and as such there is a low risk of these features being affected by drawdown associated with the project. While the risk is low, monitoring and mitigation measures are proposed to reduce this risk further. A number of groundwater bores are registered for domestic use within the 2 m drawdown impact zone simulated by the modelling. These are considered to be potentially adversely impacted and mitigation and monitoring measures are proposed for these bores in **section 18.5**.
	2. If more than 10% cumulative variation in the water table, allowing for typical climatic "post-water sharing plan" variations, 40 m from any: (a) high priority groundwater dependent ecosystem; or (b) high priority culturally significant site; listed in the schedule of the relevant water sharing plan then appropriate studies (including the hydrogeology, ecological condition and cultural function) would need to demonstrate to the Minister's satisfaction that the variation would not prevent the long-term viability of the dependent ecosystem or culturally significant site. If more than 2 m decline cumulatively at any water supply work then make good provisions should apply.	Based on the reasons provided for minimal impact item 1 above, these criteria are not expected to be exceeded.
Water pressure impacts	1. A cumulative pressure head decline of not more than a 2 m decline, at any water supply work.	A number of groundwater bores are registered for domestic use within the two metre drawdown impact zone simulated by the modelling. These are considered to be potentially adversely impacted and mitigation and monitoring measures a proposed for these bores in **section 18.5**.

Type of impact	Minimal impact considerations for aquifer interference activities	Summary of impacts
	2. If the predicted pressure head decline is greater than specified in condition 1 above, then appropriate studies are required to demonstrate to the Minister's satisfaction that the decline would not prevent the long-term viability of the affected water supply works unless make good provisions apply.	As above.
Water quality impacts	1. Any change in the groundwater quality should not lower the beneficial use category of the groundwater source beyond 40m from the activity.	The inherent groundwater quality characteristics and urban environment suggest that the groundwater has limited beneficial use potential, particularly within the alluvium and Ashfield Shale aquifers. It is noted, however, that groundwater in the Hawkesbury Sandstone is used for domestic purposes. The modelling suggests that there may be saline water migration from Parramatta River to the project corridor, which may change the salinity of the groundwater between the mainline tunnels and Parramatta River. Given the innate groundwater chemistry (high metals), a low likelihood of future use (given that there is a reticulated water supply), and that the surrounding urban environment represents ongoing potential for residual impacts, this is not expected to result in a lowering of the beneficial use category of the aquifer system.
	2. If condition 1 is not met, then appropriate studies would need to demonstrate to the Minister's satisfaction that the change in groundwater quality would not prevent the long-term viability of the dependent ecosystem, significant site or affected water supply works.	Based on the above conclusions this item is not considered to be applicable.

18.5 Management of impacts

18.5.1 Project design features that manage impacts

Construction

As described in **section 6.10.3** in **Chapter 6** (Construction work), the project would include construction water treatment plants to treat tunnel groundwater at the following tunnelling sites:

- Underwood Road civil and tunnel site (C3), discharging to a concrete-lined stormwater canal that forms a tributary of Powells Creek
- Concord Road civil and tunnel site (C5), discharging to a stormwater pipe under Concord Road that ultimately discharges to Canada Bay
- Cintra Park tunnel site (C6), discharging to St Lukes Park Canal located along the eastern side of Concord Oval
- Northcote Street tunnel site (C7), discharging to a stormwater pipe under Parramatta Road that connects to Dobroyd Canal (Iron Cove Creek)

- Eastern ventilation facility site (C8), discharging to a stormwater pipe that connects into Dobroyd Canal (Iron Cove Creek).

The water treatment plants would be designed to treat groundwater to water quality guidelines within the environment protection licence and may consist of:

- Primary settling tanks/pond to remove sand and silt sediment fractions and oil and grease
- pH balance/metals oxidation tank, with primary flocculation
- Secondary flocculation tank
- Clarifiers to remove sediment and residual oil
- Sediment dewatering processes
- Inline process and discharge turbidity and pH monitoring with diversion valves to divert out-of-specification water for retreatment.

The volume of wastewater generated during construction would vary according to construction activities taking place within the tunnel, the amount of groundwater infiltrating into the tunnel, and the length of the tunnel that has been excavated. Anticipated water treatment and discharge volumes at the construction ancillary facilities are summarised in **Table 6.29** in **Chapter 6** (Construction work).

Discharge of treated groundwater is further discussed in **Chapter 15** (Soil and water quality).

Operation

As described in **section 6.4.2** of **Chapter 6** (Construction work), tunnel lining would be installed progressively following tunnel excavation to minimise groundwater inflows. The type of lining would depend on the local geology and rate of groundwater inflow. As the project is primarily located within low permeability sandstone and likely to be predominantly dry, a sprayed shotcrete lining would generally be used. In areas with medium groundwater inflows, a sprayed waterproofing membrane would also be installed, with a shotcrete or cast in situ concrete secondary lining. Where there are significant groundwater inflows, grouting may also be used to reduce the permeability of the surrounding rock mass.

As described in **section 5.8.3** in **Chapter 5** (Project description), the project would include a tunnel drainage system and water treatment facility located at Cintra Park to collect and treat tunnel groundwater. The water treatment plant would be designed to treat the anticipated maximum tunnel groundwater inflows of 17 litres per second.

The criteria for treatment plant discharge to surface waters would be based on existing water quality conditions at the point of discharge, with specific environmental criteria being set using the statistical methods outlined in the *Australian Guidelines for Water Quality Monitoring and Reporting* (ANZECC) and ARMCANZ 2000).

18.5.2 Environmental management measures

Environmental management measures to minimise impacts on groundwater during construction and operation of the project are provided in **Table 18.7**.

Table 18.7 Environmental management measures – groundwater

Impact	No.	Environmental management measure	Responsibility	Timing
Managing groundwater general	GW1	Pre-construction surface and groundwater monitoring will continue on a monthly basis to establish baseline conditions.	Roads and Maritime	Pre-construction

Impact	No.	Environmental management measure	Responsibility	Timing
	GW2	Prior to construction, a groundwater monitoring plan for the construction and operational phases of the project will be developed in consultation with the Department of Primary Industries – Water and the NSW Environment Protection Authority. This will include: • Tunnel inflow rates and chemistry compared with the predicted inflows • Mineral precipitation relating to blockage of inflow collection, reticulation and treatment systems.	Construction contractor	Pre-construction,
Precipitation of iron and manganese	GW3	Following further groundwater monitoring, the potential for clogging of groundwater drainage and collection systems will be considered during detailed design. Where ferrous (soluble) iron concentrations remain high, consideration will be given to treating captured groundwater prior to discharge for: • Aeration to reduce dissolved iron and manganese • Settlement to remove precipitated iron and sediments.	Construction contractor	Pre-construction
Groundwater discharge to surface waters	GW4	The location of the groundwater discharge to St Lukes Park Canal will be confirmed following further surface water monitoring. Untreated saline groundwater will be discharged to a location that is influenced by existing saline conditions. If a suitable discharge location is unable to be identified, saline groundwater will be treated prior to discharge.	Construction contractor	Pre-construction

Impact	No.	Environmental management measure	Responsibility	Timing
Licensed bore drawdown	GW5	Management of licensed bores identified as being at risk of drawdown will include: • Inspect and confirm existing status of the licensed bores prior to tunnel excavation and, if active, confirm their current purpose • Monitoring water chemistry and water levels pre-construction, construction and during operation • Appropriate make good trigger levels and make good requirements for impacted bores • Where appropriate, provide compensatory measures for adverse impacts.	Construction contractor	Pre-construction, construction and operation
Ground movement and settlement	GW6	Further assessments will be undertaken during detailed design to determine the level of potential impact on structures and to identify feasible and reasonable mitigation and management measures required to minimise potential ground movement impacts and make good identified impacts.	Construction contractor	Pre-construction
	GW7	Prior to the commencement of tunnelling works, existing condition surveys will be undertaken on properties and structures within the project corridor (the zone on the surface equal to 50 m from the outer edge of the tunnels) and within 50 m of surface works.	Construction contractor	Pre-construction and construction

19 Non-Aboriginal heritage

This chapter outlines the potential non-Aboriginal heritage impacts associated with the M4 East project (the project). A detailed non-Aboriginal heritage assessment has been undertaken for the project and is included in **Appendix S**.

The Secretary of the NSW Department of Planning and Environment has issued a set of environmental assessment requirements for the project; these are referred to as Secretary's Environmental Assessment Requirements (SEARs). **Table 19.1** sets out these requirements as they relate to non-Aboriginal heritage, and identifies where they have been addressed in this EIS.

Table 19.1 Secretary's Environmental Assessment Requirements – non-Aboriginal heritage

Secretary's Environmental Assessment Requirement	Where addressed in the EIS
Heritage **–** including but not limited to:	
• Impacts to *State and local historic heritage* (including conservation areas, built heritage landscapes and archaeology) should be assessed. Where impacts to State or locally significant historic heritage are identified, the assessment shall:	**Chapter 19** (this chapter)
– Outline the proposed mitigation and management measures (including measures to avoid significant impacts and an evaluation of the effectiveness of the mitigation measures) generally consistent with the guidelines in the *NSW Heritage Manual* (Heritage Office and Department of Urban Affairs and Planning 1996),	**Section 19.4**
– Be undertaken by a suitably qualified heritage consultant(s) with relevant heritage expertise (note: where archaeological excavations are proposed the relevant consultant must meet the NSW Heritage Council's Excavation Director criteria),	**Appendix S**
– Include a statement of heritage impact for all heritage items (including significance assessment), This should include detailed mapping of all heritage items and how they are affected by the proposal,	**Section 19.2.2** and **19.3.2** **Appendix S**
– Include details of any proposed mitigation measures (architectural and landscape),	**Section 19.4**
– Consider impacts from vibration, demolition, archaeological disturbance, altered historical arrangements and access, landscape and vistas, and architectural noise treatment	**Section 19.3** and **Chapter 11** (Noise and vibration)
– Develop an appropriate archaeological assessment methodology, including research design, in consultation with the Department and the Heritage Council of New South Wales, to guide physical archaeological test excavations and include the results of these excavations, and	Not applicable. No physical archaeological test investigations are recommended.
– Provision of future mitigation strategies for all identified archaeological impacts that would arise from the project.	**Section 19.4**

19.1 Assessment methodology

19.1.1 Overview

The following methodology has been adopted in preparing this assessment:

- Review of statutory heritage lists, including the State Heritage Register, heritage schedules on Local Environmental Plans (LEPs), State agency Section 170 heritage and conservation registers (Section 170 registers), the National Heritage List and Commonwealth Heritage List
- Review of relevant heritage reports, archaeological zoning plans and archaeological assessments previously prepared for relevant items and areas along the route, as available

- Field survey of the project footprint to inspect listed heritage items, heritage conservation areas and to identify potential heritage items that may be affected by the proposed project. Assessments of potential heritage items were restricted to a visual analysis from the street and limited historical research
- Desktop and historical research to inform the impact assessment, including review of relevant conservation management plans and other plans of management
- Contact with heritage advisors at local councils and State agencies for further information regarding items on their heritage registers, where required.

The archaeological assessment methodology for the project is commensurate with the level of design and planning that has been undertaken to date. It has followed the assessment and reporting standards on previous recently approved State significant infrastructure projects such as the Sydney CBD and South East Light Rail and North West Rail Link projects.

For this project, archaeological test excavation would not alter the outcome of the assessment in terms of identifying previously unknown and unassessed archaeological relics, and therefore has not been undertaken at this stage. A conjectural program of archaeological test excavation within the project footprint could unnecessarily disturb historical archaeological relics which may not be otherwise impacted as an outcome of the final design. Consequently, archaeological test excavation during the EIS stage of the project could result in a higher level of heritage impact than targeted test excavation undertaken during the early works phase when the final design has been adopted.

19.1.2 Legislation and policy framework

The heritage assessment has been prepared to assess the impacts of the project in accordance with relevant legislation and policy as described in **Table 19.2**.

Table 19.2 Legislation relevant to the project – non-Aboriginal heritage

Legislation	Relevance to project
Heritage Act 1977 (NSW) (Heritage Act)	An excavation permit under section 139 is required to disturb or excavate any land containing or likely to contain a relic. This approval is not required by virtue of section 115ZG of the EP&A Act for a State significant infrastructure project approved under Part 5.1 of the EP&A Act.

The assessment has also considered the following guidelines:

- *Assessing Heritage Significance for Historical Archaeological Sites and 'Relics'* (Heritage Branch of the Department of Planning 2009)
- *Historical Archaeology Code of Practice* (NSW Heritage Office 2006a)
- *Archaeological Assessments: Archaeological Assessment Guidelines* (NSW Heritage Office 1996)
- *Historical Archaeological Sites: Investigation and Conservation Guidelines* (Heritage Council of NSW 1993)
- *Assessing Heritage Significance,* NSW Heritage Manual (Heritage Council of NSW 2002a)
- *Statements of Heritage Impact*, NSW Heritage Manual (Heritage Council of NSW 2002b)
- *How to Prepare Archival Records of Heritage Items* (NSW Heritage Office 2003)
- *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance 2013* (ICOMOS 2013).

19.1.3 Study area

The study area for the heritage assessment has been split into four broad areas and each area contains a number of historical archaeological management units (HAMUs) which correspond to the areas of potential archaeological significance. These are detailed below and shown in **Figure 19.1** to **Figure 19.7**:

- Area 1 − Homebush which includes HAMUs 1 to 3
- Area 2 − North Strathfield and Concord which includes HAMUs 4 to 7
- Area 3 − Cintra Park which includes HAMU 8
- Area 4 − Haberfield and Ashfield which includes HAMUs 9 to 11

The historical archaeological assessment considers the impact of the project on those areas that will be subject to surface works only, as the driven tunnels, which would be predominantly over 40 metres below ground, would not impact historical archaeology.

The built heritage and landscape impact assessment adopts a broader study area of the proposed construction footprint plus 100 metres on either side to include heritage items and Heritage Conservation Areas that may be subject to visual or vibration impacts.

19.1.4 Assessment of historical archaeological resources

The historical archaeological potential associated with various phases of the study area's history has been evaluated based on previous historical archaeological assessment, excavations, historical information gathered for this study (maps and photographs) and field survey.

Each of the four areas has been divided into historical archaeological management units (HAMUs) which correspond to the areas of potential archaeological significance. Significance is broken down as follows:

- State significant archaeological resource − known or potential
- Locally significant archaeological resource − known or potential
- No archaeological resource present.

A preliminary heritage significance assessment (relating to archaeological research potential) for each HAMU has been undertaken. Each HAMU was assessed for archaeological potential and designated with high, moderate or low archaeological potential, based on an assessment of later development that may have impacted or removed archaeology, as well as the nature and durability of potential archaeological remains, thus their likelihood to be extant. The nature of the potential State and local significant archaeological resources are described in **Table 19.3**.

Table 19.3 Nature of archaeological resources for local and State significant historical archaeology

Significance	Historical archaeological resources
State significant	• Archaeological site listed on the State Heritage Register that are known to have State significance and/or an area with the potential to contain 'relics' of State significance • High to exceptional research potential, depending on the level of intactness of the resource • Meets NSW Heritage Significance criteria and/or Archaeological Significance criteria for State (or higher) significance (as defined by the relevant NSW Heritage Division publications) • Likely to also contain locally significant archaeological resources.
Locally significant	• Known archaeological sites of local significance (ie listed on the LEP or State Heritage Inventory as locally significant); and/or areas with the potential to contain 'relics' of local significance • Still has the possibility to contain unexpected State-significant relics not identified by previous research • Meets the NSW Heritage Significance criteria and/or Archaeological Significance criteria threshold for local significance (or, in unexpected cases, State significance).

Figure 19.1 Areas and historical archaeological management units - map 1

Figure 19.2 Areas and historical archaeological management units - map 2

Figure 19.3 Areas and historical archaeological management units - map 3

Figure 19.4 Areas and historical archaeological management units - map 4

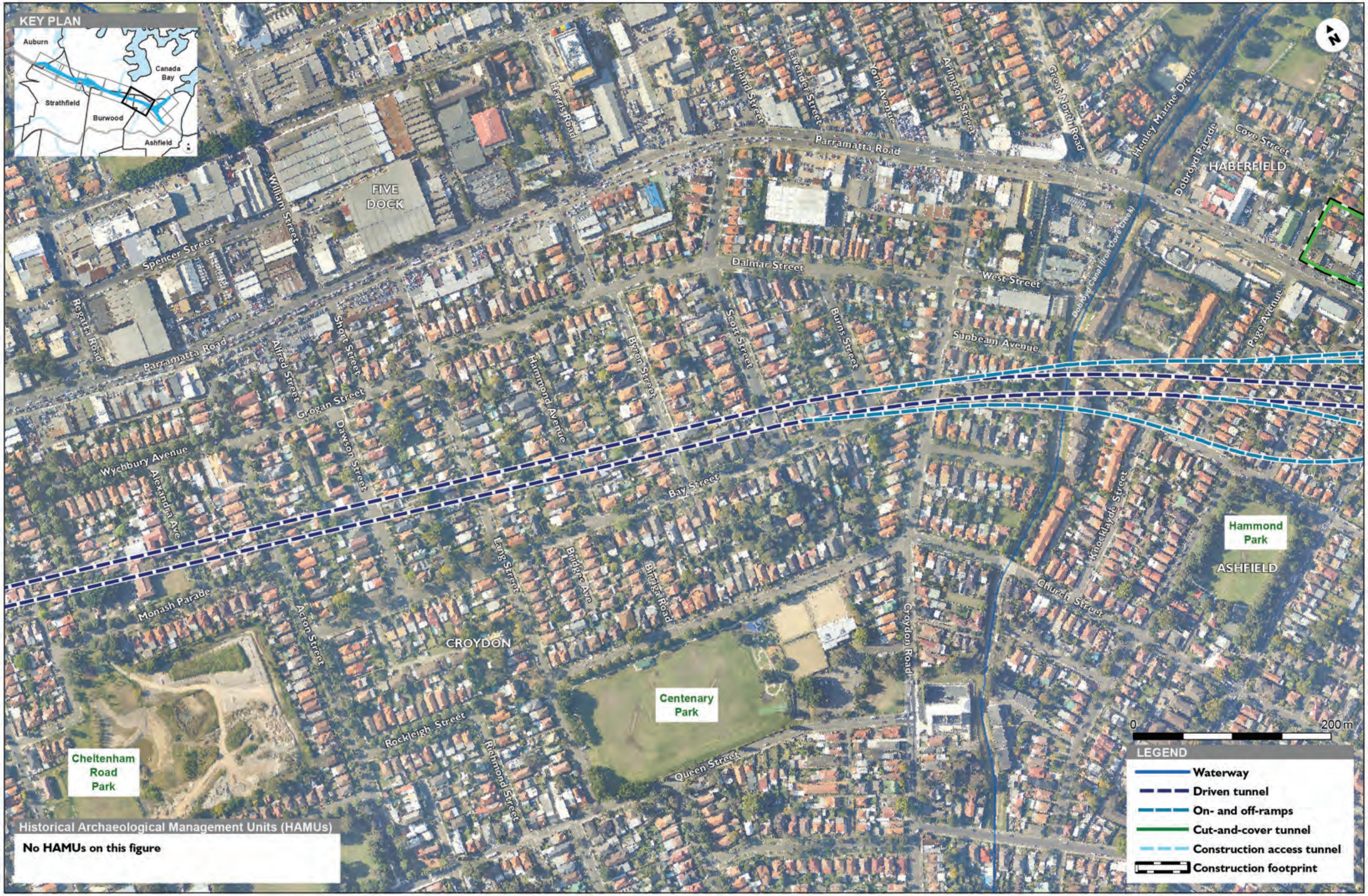

Figure 19.5 Areas and historical archaeological management units - map 5

Figure 19.6 Areas and historical archaeological management units - map 6

Figure 19.7 Areas and historical archaeological management units - map 7

19.1.5 Assessment of heritage impacts

An assessment of built heritage significance has been prepared for each heritage item or potential heritage item identified within a potential impact zone of 100 metres on either side of the project to include heritage items and Heritage Conservation Areas that may be subject to visual or vibration impacts. This has drawn data from State and national statutory and non-statutory heritage registers and conservation plans relevant to the study area.

With respect to potential heritage items, only those areas that would be demolished for surface works and not currently protected by being within the boundaries of conservation areas were surveyed for their potential heritage values. Properties within the Powell's Estate Heritage Conservation Area that have been assessed as being contributory items in the Canada Bay Development Control Plan and those within the Haberfield Conservation Area assessed as contributory buildings received an initial assessment, but were not considered further. The following methodology was used to identify potential heritage items:

- Field surveys (limited to the street) to identify properties with potential aesthetic and representative significance and to assess integrity of the external form, details and associated landscapes
- Review of non-statutory registers to identify whether the heritage significance of the property had been recognised
- Review of relevant Local Environmental Plans, Development Control Plans and the State Heritage Inventory to identify whether the property is included within a heritage conservation area
- Review of the State Heritage Inventory and relevant heritage studies to assess whether the property could be considered rare in the Local Government Area
- Historical research into the development of the area to identify properties that may have historical heritage values.

The methodology used to rate the severity of an impact is explained in **Table 19.4**.

Table 19.4 Ranking of heritage impact

Rating	Definition
Major adverse	Actions that would have a severe, long-term and possibly irreversible impact on a heritage item. Actions in this category would include partial or complete demolition of a heritage item or addition of new structures in its vicinity that destroy the visual setting of the item. These actions cannot be fully mitigated.
Moderate adverse	Actions that would have an adverse impact on a heritage item. Actions in this category would include removal of an important part of a heritage item's setting or temporary removal of significant elements or fabric. The impact of these actions could be reduced through appropriate mitigation measures.
Minor adverse	Actions that would have a minor adverse impact on a heritage item. This may be the result of the action affecting only a small part of the place or a distant/small part of the setting of a heritage place. The action may also be temporary and/or reversible.
Neutral	Actions that would have no impact on a heritage item.
Minor positive	Actions that would bring a minor benefit to a heritage item, such as an improvement in the item's visual setting.
Moderate positive	Actions that would bring a moderate benefit to a heritage item, such as removal of intrusive elements or fabric or a substantial improvement to the item's visual setting.
Major positive	Actions that would bring a major benefit to a heritage item, such as reconstruction of significant fabric, removal of substantial intrusive elements/fabric or reinstatement of an item's visual setting or curtilage.

19.2 Existing environment

19.2.1 Historical archaeology

Historical archaeological overview

Parramatta Road is one of the oldest and most significant roads in NSW and was the first highway constructed in Australia. Since at least 1790, it has served as the main thoroughfare west out of Sydney and has instigated development along both sides of its 23 kilometre route. An initial track between the two settlements of Sydney and Parramatta became the basis for 'the road to Parramatta', which was laid out in 1797. The route has been largely unaltered since its construction.

Until the 1850s the route to Parramatta from Sydney ran through country estates and farm sites. There were scattered settlements, a few roadside inns with associated industries and the Government's 700 acre Longbottom Farm and Longbottom Stockade (housing for convict road gangs) near where Concord lies today.

A number of large private estates were located along Parramatta Road. The only colonial house that remains along Parramatta Road is Yasmar (185 Parramatta Road), built in 1856 on part of the Ramsays' Dobroyd Estate.

The subdivision of the large estates and farms along Parramatta Road took place from the 1840s to the 1920s. Development began in the areas closer to Sydney, such as Ashfield, where a small village developed in the 1840s and where much of the land was sold as small acreage allotments from the 1860s. It was the 1920s, however, that produced the most intense period of development. The arrival of the car in the early years of the twentieth century and improved services such as water and sanitation transformed the suburban landscape and the roads that served it.

Parramatta Road has served the industrial districts of Sydney with early brickworks and other industry developing on it from the 1850s. In 1906 the NSW Government resumed land at Homebush for the State abattoirs and brickworks, which operated from the site until 1988. In the twentieth century larger factory complexes became more common along Parramatta Road, such as the Peak Frean and Arnott's Biscuits factories at Ashfield and Homebush respectively.

Area 1 − Homebush

Homebush Farm was built by Thomas Laycock in 1796, and was later developed into the Homebush Estate. In this area the State abattoir was built in 1907, and became the State brickworks in 1911. Wentworth Hotel was built on the corner of Flemington Street and Parramatta Road in 1886 and rebuilt in the 1930s. The majority of residential development in the area between Homebush Bay Drive and Powells Creek did not begin until the 1920s, when the land was re-subdivided into smaller residential lots. From the 1930s, Powells Creek was 'straightened', moved eastwards and finally transformed into a concrete stormwater canal which exists today.

The area west of Homebush Bay Drive remained as open paddocks until it was developed for the Sydney Olympics in 2000.

Area 1 includes HAMUs 1 to 3, shown in **Figure 19.1** and **Figure 19.2** and described in **Table 19.5**:

- HAMU 1 − Homebush Bay Drive to Wentworth Reserve
- HAMU 2 − Coleman Avenue to Pomeroy Street
- HAMU 3 − Pomeroy Street to Powells Creek.

Table 19.5 Historical archaeological management units in Area 1 - Homebush

Feature	Description
HAMU 1 – Homebush Bay Drive to Wentworth Reserve	
Listed archaeological items	No heritage register listings specifically reference significance of the potential historical archaeological resource.

Feature	Description
Archaeological potential	There is low potential for archaeological evidence to be present associated with the following: • Agricultural use (c1883–1970s). Archaeological evidence of grazing/agriculture activities, if found, is likely to be ephemeral in nature and its location not possible to predict based on current documentary evidence • 1897 Stormwater drain is likely to have been upgraded and maintained as required. Sites or features in this HAMU are likely to have been highly disturbed by the construction of the M4 in the late 1970s to early 1980s (the section of the M4 from Concord Road to Auburn opened in 1982). Some sites or features may have been previously disturbed by the installation of services or other landscape modifications such as land clearing.
Significance level	Local
HAMU 2 − Coleman Avenue to Pomeroy Street	
Listed archaeological items	No heritage register listings specifically reference significance of the potential historical archaeological resource.
Archaeological potential	There is low potential for the archaeological evidence to be present associated with the following: • Potential agricultural uses pre 1910. Archaeological evidence of grazing/agriculture activities, if found, is likely to be ephemeral in nature and its location not possible to predict based on current documentary evidence • Early twentieth-century development (residential subdivision and development commenced in this area in 1910) • Evidence of early alignment of Verley Drive • Evidence of early twentieth century services. Sites or features in this HAMU are likely to have been highly disturbed by the construction of the M4 (late 1970s to early 1980s). Some sites or features may have been previously disturbed by the installation of services or other landscape modifications such as land clearing.
Significance level	Local
HAMU 3 − Pomeroy Street to Powells Creek	
Listed archaeological items	No heritage register listings specifically reference significance of the potential historical archaeological resource.
Archaeological potential	Prior to 1800 land within this HAMU was an undeveloped part of the Underwood landholdings. From the 1920s to the 1970s complete residential subdivision and development of the area occurred and Ismay Reserve around the creek (then concrete stormwater canal) was created. There is low potential for the archaeological evidence to be present associated with the following: • Agricultural and market garden use (1880–1920). Archaeological evidence of agriculture activities, if found, is likely to be ephemeral in nature and its location not possible to predict based on current documentary evidence • Evidence of early twentieth century services. There is moderate potential for archaeological evidence to be present associated with: • Lots within the HAMU (excluding those within the footprint of the existing M4), in particular lots where buildings have been demolished and not redeveloped. These could contain evidence associated with early twentieth-century development • The natural environment, such as soil profiles associated with the original course of Powells Creek. Some sites or features in this HAMU are likely to have been highly disturbed by the construction of the existing M4 (late 1970s to early 1980s) and by the installation of services.

Feature	Description
Significance level	Local

Area 2 − North Strathfield and Concord

Land from the eastern side of Powells Creek to Concord Road was originally part of Thomas Rowley's large Burwood land holding. Parts of this holding were sold in the early nineteenth century to Edward Powell and George Robert Nicholls. George Robert Nichols subdivided a portion of his land in1837 to create the Village of Concord; however, very little development took place until the 1920s.

The Government's Farm was established in the 1790s and is located on parts of the North Strathfield and Concord areas.

Thornleigh House was constructed in the early 1870s by Charles Thorne on part of the subdivision. This house remained on a large block bound by Concord Road, Sydney Street and Thornleigh Street until 1926, when the site was purchased by the Methodist Church and the house demolished to make way for a church. The gates from Thornleigh House remain on Concord Road as the entrance to the church grounds.

Two acres of Powells land were resumed by the Commissioner for Railways in 1882 for the construction of the Strathfield to Hornsby section of the Northern Line, which opened in September 1886. The railway crossed Parramatta Road just west of Queen Street via a level crossing. In 1914 the crossing was removed and a railway bridge was built over Parramatta Road in its place. A new cutting was made for Parramatta Road to pass underneath the railway line.

Construction of the M4 from Concord Road to Auburn was completed in 1982, with a new improved connection to Parramatta Road opened 1984. This process included the demolition of many of the buildings between Sydney Street and Parramatta Road, including all the properties on the western side of the original alignment of Concord Road south of Alexandra Street.

Area 2 includes HAMUs 4 to 7, shown in **Figure 19.3** and described in **Table 19.6**.

- HAMU 4 − Sydney Street (south) to Parramatta Road
- HAMU 5 − Concord Road south (from Sydney Street to Alexandra Street)
- HAMU 6 − Thornleigh House
- HAMU 7 − Concord Road north (from Sydney Street to Napier Street).

Table 19.6 Historical archaeological management units in Area 2 – North Strathfield and Concord

Feature	Description
HAMU 4 − Sydney Street (south) to Parramatta Road	
Listed archaeological items	The following listing is for the site as a whole and do not specify archaeological items: • House, 64 Concord Road (Canada Bay LEP 2013 item no. I108)
Archaeological potential	There has been limited modern redevelopment in this HAMU from the late twentieth century to today. Thus, there is moderate potential for archaeological evidence to be present associated with: • Late nineteenth-century subdivision and residential development (from 1886 to 1900) • Early twentieth-century subdivision and residential development within areas where original buildings remain. Some sites or features in this HAMU are likely to have been disturbed by the installation of modern services.
Significance level	Local

Feature	Description
HAMU 5 − Concord Road south (from Sydney Street to Alexandra Street)	
Listed archaeological items	The following listing is for the site as a whole and do not specify archaeological items: • Street Trees, Edward Street (Canada Bay LEP 2013 item no. I182) • Street Trees, Sydney Street (item no. I431). The original Thornleigh House property is located within both HAMU 5 and 6 but has been discussed in HAMU 6 below.
Archaeological potential	Prior to 1910, there was limited development in this area. There is low potential for the archaeological evidence to be present associated with the 1843 village of Concord buildings, water tanks and wells. There is moderate potential for archaeological evidence to be present associated with: • Early twentieth-century development (1910–1920s when complete residential subdivision and development of the area occurred) • Early to mid-nineteenth-century development. Some sites or features in this HAMU are likely to have been highly disturbed by the construction of the existing M4 and realignment of Concord Road (late 1970s to early 1980s), and by the installation of modern services.
Significance level	Local
HAMU 6 − Thornleigh House (former)	
Listed archaeological items	The following listing is for the site as a whole and do not specify archaeological items: • Wesley Uniting Church and Hall, 81 Concord Road (Canada Bay LEP 2013 item no. I99) • Street trees, Sydney Street (item no. I431).
Archaeological potential	There is low potential for the archaeological evidence to be present associated with the following: • Early road alignment of Concord Road. There is moderate potential for archaeological evidence to be present associated with: • Early twentieth-century development (1914-1926—residential subdivision and development, creation of Sydney Street) • Mid-nineteenth-century development of Thornleigh (constructed in c1858). Thornleigh House was demolished in 1926 and the Concord Wesley Church constructed. The original driveway of Thornleigh House is still extant as the Concord Road entry to the Church grounds. While the extent of the driveway present has been reduced over time, the remnant is intact with good integrity. Some sites or features in this HAMU are likely to have been highly disturbed by the installation of modern services.
Significance level	Local
HAMU 7 − Concord Road north (from Sydney Street to Napier Street)	
Listed archaeological items	The following listing is for the site as a whole and do not specify archaeological items: • House (Creewood), 99 Concord Road (Canada Bay LEP 2013 item no.I100).
Archaeological potential	Creewood and its outbuildings, at 99 Concord Road were built prior to 1884. • There is low potential for the archaeological evidence to be present associated with the pre-1884 uses. Any archaeological evidence, if found, is likely to be ephemeral in nature and its location not possible to predict based on current documentary evidence • There is moderate potential for archaeological evidence to be present associated with early twentieth-century residential subdivision development (1917 onwards). Some sites or features in this HAMU are likely to have been disturbed by the installation of modern services.
Significance level	Local

Area 3 – Cintra Park

Cintra Park is located in a vast area of parklands and playing fields that extends north to Lyons Road and defines the character of this part of Concord. Concord Oval, St Lukes Park and Cintra Park lie on land that was originally part of the Government's Longbottom Stockade and Farm. The Longbottom Stockade was located in the vicinity of existing grandstand at Concord Oval. The stockade housed convict road gangs working on Parramatta Road and became a detention centre for a group of French Canadian political exiles in 1840, and then 'police paddocks' for 200 mounted police horses. Part of the site was subdivided into small acre farms in 1858.

Concord Oval and Cintra Park lie on part of the site dedicated for use as a recreation area in 1886. Concord Oval itself was reconstructed in 1932 and rebuilt in 1985.

Area 3 includes HAMU 8, Cintra Park (east of Concord Oval, Concord), shown in **Figure 19.4** and described in **Table 19.7**.

Table 19.7 Historical archaeological management units in Area 3 – Cintra Park

Feature	Description
HAMU 8 – Cintra Park (east of Concord Oval, Concord)	
Listed archaeological items	There is one heritage item in this HAMU: • St Luke's Park gateway/entrance—gates and trees only (Canada Bay LEP 2013 item no. I308).
Archaeological potential	There is low potential for archaeological evidence to be present associated with the pre-1880s Longbottom Stockade buildings, Canadian exiles and mounted police paddocks within Cintra Park. Remains are not anticipated due to historical maps and records indicating there are no previously recorded structures associated with this era on the Cintra Park land. Records indicate that structures associated with the stockade were located within the land now occupied by Concord Oval, near Loftus Street (formerly Stockade Street). Structural remains may be located within the land occupied by the overflow carpark north of the oval. There is moderate potential for the archaeological evidence to be present associated with the following: • The pre-1880s phase agricultural and grazing activities • 1896 east pavilion in St Luke's Park, demolished • The natural environment, such as soil profiles associated with the original course of the small unnamed creek running to Hen and Chicken Bay. Evidence of early land grants, the Longbottom Stockade and agricultural use may have high research potential, depending on the nature and extent of the remains. Some of these archaeological sites or features may have been previously disturbed by the installation of modern services, construction of paths and roadways and landscape modification to create the modern playing fields (1948-2003).
Significance level	Potentially State, if intact relics associated with the Longbottom Stockade are identified on site.

Area 4 – Haberfield and Ashfield

The Dobroyd Estate was established in 1805 and comprised the area that is now the suburb of Haberfield. Yasmar was constructed in 1855 on part of the estate along Parramatta Road. This house still exists today, just outside the project area. Most of the estate remained undeveloped until 1915. Some of the Dobroyd Estate was sold to Richard Stanton in 1901. Stanton was inspired by the 'City Beautiful' town planning movement and marketed Haberfield as the 'Garden Suburb' with tree-lined streets, neighbourly gardens and period architecture. The suburb was completed by the 1930s.

Ashfield Park Estate was created in the early nineteenth century and covers much the same area as the current suburb of Ashfield. Subdivisions of the land began in 1838, leading to the beginnings of the Village of Ashfield. A railway had opened in 1855 with a station near the Village of Ashfield, which led to the development of wealthy merchant mansions. The area surrounding Parramatta Road developed gradually, with residential houses and commercial properties being constructed in the early twentieth century, and was fully developed by the 1930s. From the 1980s much of the land along Parramatta Road was redeveloped as industrial and commercial sites.

Area 4 comprises HAMUs 9 to 11, shown in **Figure 19.6** and **Figure 19.7** and described in **Table 19.8**.

- HAMU 9 − Northcote Street tunnel site
- HAMU 10 − Wattle Street interchange
- HAMU 11 − Parramatta Road interchange.

Table 19.8 Historical archaeological management units in Area 4 – Haberfield and Ashfield

Feature	Description
HAMU 9 − Northcote Street tunnel site	
Listed archaeological items	No listings specifically reference significance of the potential historical archaeological resource.
Archaeological potential	There is low potential for archaeological evidence to be present associated with: • Underwood estate agricultural activities (c1883–1890) • The natural environment, such as soil profiles associated with the original creek to the south of Parramatta Road. There is moderate potential for archaeological evidence to be present associated with: • Late nineteenth and early twentieth-century residential subdivision and development. Some sites or features may have been previously disturbed by the installation of modern services.
Significance level	Local
HAMU 10 − Wattle Street interchange	
Listed archaeological items	No listings specifically reference significance of the potential historical archaeological resource.
Archaeological potential	There is low potential for archaeological evidence to be present associated with: • Evidence of Dobroyd estate agricultural uses (c1883–1901s) such as postholes of timber fence lines. If found, such evidence of agricultural activities is likely to be ephemeral in nature and its location not possible to predict based on current documentary evidence • Early road alignment of Wattle Street • Earlier sewage pumping station buildings on the site of the present structure in Reg Coady Reserve. There is moderate potential for archaeological evidence to be present associated with: • The natural environment, such as soil profiles associated with the original course of Iron Cove creek and dam (pre-1890) • Early twentieth-century (1885–1920s/1930s) residential subdivision and development • Early road alignment of Dobroyd Parade. While limited modern redevelopment in the late twentieth century has increased the potential for any archaeological evidence to survive intact within this HAMU, some sites or features are likely to have been disturbed by the demolition of housing, widening of Wattle Street, construction of the City West Link and the Reg Coady Reserve from 1991 to 2000. Some sites or features may have been previously disturbed by the installation of modern services.
Significance level	Local
HAMU 11 − Parramatta Road interchange	
Listed archaeological items	No listings specifically reference significance of the potential historical archaeological resource.

Feature	Description
Archaeological potential	There is low potential for archaeological evidence to be present associated with: • Underwood estate agricultural use (c1883–1890). Archaeological evidence of grazing/agriculture activities, if found, is likely to be ephemeral in nature and its location not possible to predict based on current documentary evidence • The natural environment, such as soil profiles associated with the original creek to the south of Parramatta Road. There is moderate potential for archaeological evidence to be present associated with: • Late nineteenth and early twentieth-century residential subdivision and development (1890-1930). Some sites or features may have been previously disturbed by the installation of modern services.
Significance level	Local

19.2.2 Heritage items and conservation areas

In total there are 134 heritage items within 100 metres of the project, listed on the following heritage registers, of which four of these items are listed on two registers concurrently:

- Local environmental plans:
  - Auburn – none
  - Strathfield – 14
  - Canada Bay – 70
  - Burwood – 11
  - Ashfield – 25
- State agency section 170 register – 16 (two are also listed on the Strathfield local environmental plan)
- State Heritage Register – two (both are also listed on the Ashfield local environmental plan)
- National Heritage List – none
- Commonwealth Heritage List – none.

In addition, there are 11 heritage conservation areas listed under LEPs within 100 metres of the project. Heritage items and conservation areas within 100 metres of the project are shown in **Figure 19.8** to **Figure 19.14**, and a detailed list is provided in **Table 6.1** of the Non-Aboriginal Heritage Impact Assessment in **Appendix S**.

The following sections provide details of the items and conservation areas that would potentially be directly affected by the project.

Area 1 − Homebush

The development in this part of Homebush consists of a mix of interwar Californian bungalows, modern single- and two-storey houses and terraces, and large-scale industrial and former industrial sites. The area is cut in two by the existing M4, the construction of which affected the character of the area by the removal or truncation of a number of residential streets.

There are four listed heritage items and one heritage conservation area located within Area 1 that would potentially be directly affected by the project (see **Table 19.9** and **Table 19.10**). During the heritage assessment an additional house was identified as a potential heritage item (refer **Appendix S**). The locations of these items are shown in **Figure 19.8** and **Figure 19.9**.

Figure 19.8 Non-Aboriginal heritage items and heritage conservation areas – Map 1

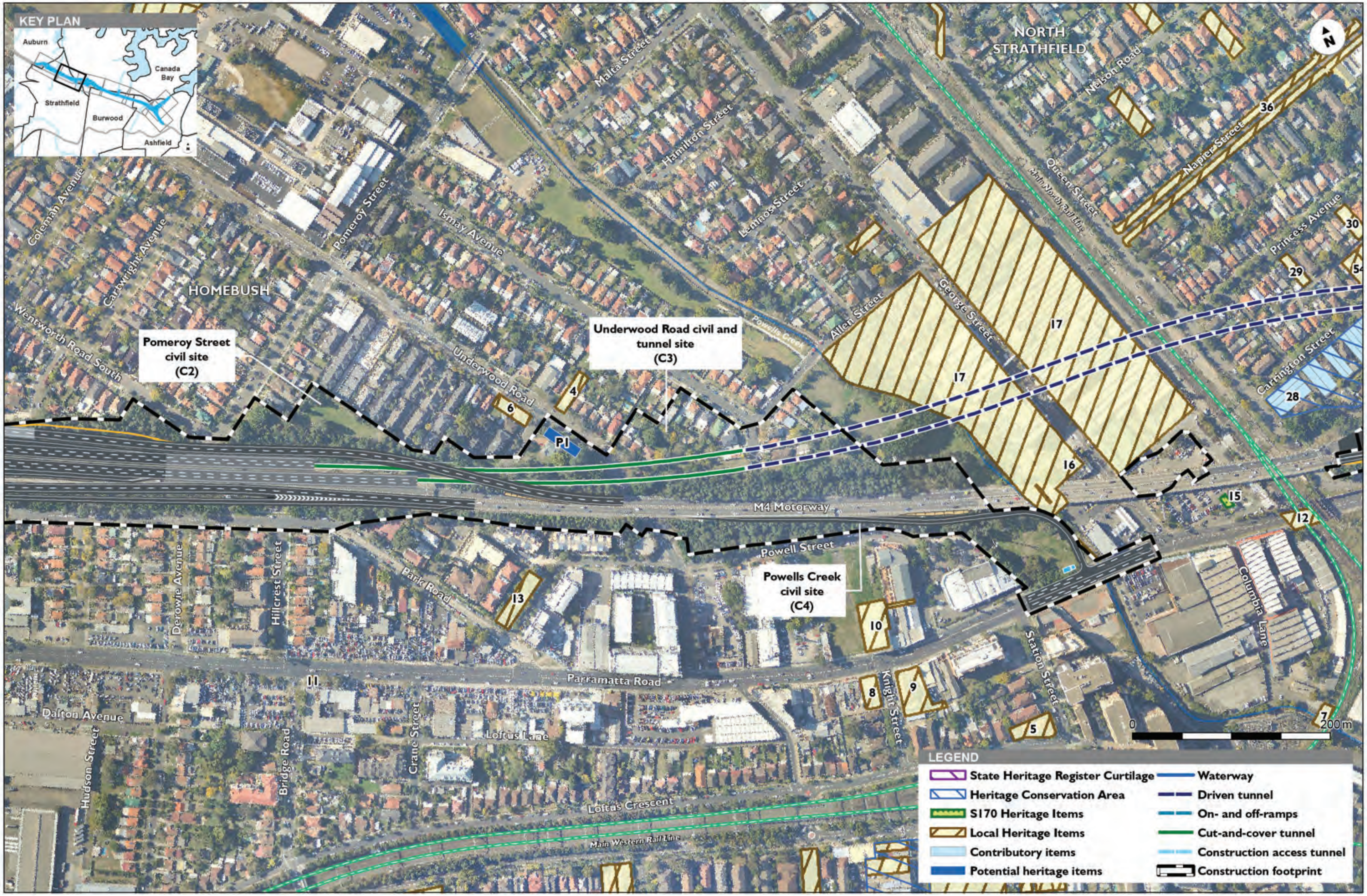

Figure 19.9 Non-Aboriginal heritage items and heritage conservation areas – Map 2

Figure 19.10 Non-Aboriginal heritage items and heritage conservation areas – Map 3

Figure 19.11 Non-Aboriginal heritage items and heritage conservation areas – Map 4