

## 6.6 Heritage Conservation Areas

### Item C2 – Beecroft-Cheltenham Heritage Conservation Area (Hornsby)

**Heritage Listing:** Hornsby LEP

**Significance:** Local

**Statement of Significance:**

The heritage conservation area covers the suburbs of Beecroft and Cheltenham in the Hornsby local government area. The heritage conservation area is part of a larger landscape of existing roads, houses and vegetation, and has been divided into five precincts under the Hornsby Development Control Plan 2013. The relevant precinct for this assessment is the Northern Triangle precinct.

“The Beecroft-Cheltenham Heritage Conservation Area is significant as an example of a government subdivision that was used to fund the development of a railway line. The area developed from 1893 as a township due to its proximity to Beecroft Station.

The Heritage Conservation Area demonstrates a multi-layered history of suburban subdivision, re-subdivision and development from the interim boom period of the Victorian crown land subdivision of 1887 to the 1960's, and less noticeably into the present day.

The area contains a fine collection of buildings from the Victorian, Federation, Arts and Crafts, Inter-War, and Post-War eras. There have been comparatively few demolitions to interrupt the “development diary” resulting in generally intact early residential fabric and streetscapes.

The Beecroft Village Precinct contains an important public reserve and community buildings including the Beecroft School of Arts and the Beecroft War Memorial that represent the aspiration of a growing suburb. The continuing focus in the Beecroft village for day to day activities and community interaction, together with the community buildings, clubs and activities show an enduring sense of community cohesiveness” (Hornsby Shire Council, 2013).

The Hornsby Development Control Plan 2013 also describes the character statement for the Northern Triangle precinct, which is as follows:

“The triangle on the northern side of Pennant Hills Road is an area of more recent development. This area remained semi-rural until the Inter-war period, with orchards still present in the early 1960s. The undulating landscape has an irregular subdivision pattern with varying lot sizes. Large Federation houses are located along Pennant Hills Road and Boundary Road, and at the southern end towards Chapman Avenue. The remnant forest canopy is important to the area's character” (Hornsby Shire Council, 2013).

**AECOM 2013 Inspection:** The listed conservation area was found to be in good condition with its local heritage significance unchanged.

**Item C7 – Wahroonga Heritage Conservation Area (Hornsby)****Heritage Listing:** Hornsby LEP**Significance:** Local**Statement of Significance:**

The heritage conservation area covers from John Hughes Place to Ingram Road and Isis Street, Wahroonga. The area is part of a larger landscape of existing roads, houses and vegetation. This heritage conservation area contains listed items I751, I752, I753, I754, I756 and I767 within its bounds (Hornsby Shire Council, 2014).

“The Wahroonga Heritage Conservation Area is an example of early 19<sup>th</sup> century subdivision with a consistent built form of modest single and two storey houses. The area is closely associated with the construction of the North Shore railway line and Pearces corner settlement” (Hornsby Shire Council, 2013).

**AECOM 2013 Inspection:** The listed conservation area was found to be in good condition with its local heritage significance unchanged.

**Item C8 – Wahroonga North Heritage Conservation Area (Hornsby)****Heritage Listing:** Hornsby LEP**Significance:** Local**Statement of Significance:**

The heritage conservation area covers from Highlands Avenue to Woonona Avenue and Alexandria Parade, Wahroonga. The area is part of a larger landscape of existing roads, houses and vegetation. This heritage conservation area contains items I7/01, I727, I728, I730, I732, I734, I738, I739, I741, I744, I745, I746, I747, I748, I749, I760, I769, I770 and I771 within its bounds (Hornsby Shire Council, 2014).

The Wahroonga North Heritage Conservation Area is closely associated with the opening of the North Shore Railway line in the 1890's, and includes land in the early estates of the locality, Bundarra Estate (1892) and its subsequent Federation development. It also includes the pre War and Inter War subdivisions of the Bundarra (Ingalara) Estate (1913), Wahroonga Heights Estate (1926) and the two divisions of the Highlands Estate (1933 and 1938) that led to the Inter War development of the area.

The Heritage Conservation Area is strongly associated with significant local persons including the Hordern Family and particularly the family matriarch, Caroline Hordern and the Hordern Family Estate which centred on their mansion, “Highlands House. The Heritage Conservation Area is aesthetically distinctive, with a strong collection of Federation residential buildings. This includes “Highlands House” (1892), “Neringla” (1895) and “Cherrygarth” (1897). The overlay of Inter War houses is unified and made complementary by the landscaped setting.

The Heritage Conservation Area is important as a reference site for Hornsby, particularly in relation to the early development of the area. The area has potential to reveal its pre-Victorian development and use through research. The Heritage Conservation Area demonstrates the post 1892 residential development of the area, exhibiting built and landscape qualities that are becoming rare within Hornsby and which are endangered by continuing unsympathetic development. (Sue Haertsch Planning 2010)

**AECOM 2013 Inspection:** The listed conservation area was found to be in good condition with its local heritage significance unchanged.

**Item C1 – Wahroonga Heritage Conservation Area (Ku-ring-gai)**

**Heritage Listing:** Ku-ring-gai Planning Scheme Ordinance

**Significance:** Local

**Statement of Significance:**

This area covers from John Hughes Place to Ingram Road and Isis Street, Wahroonga. The area is part of a larger landscape of existing roads, houses and vegetation.

The listed statement of significance for this site states:

“Wahroonga Heritage Conservation Area is of heritage significance for its distinctive residential streetscapes which evidence the transformation of early subdivisions of the 1890s into the later rectilinear grid lot street and lot pattern of later subdivisions including the Wahroonga Heights Estate. The area contains a significant collection of grand residences from the Federation and Inter-war periods, built following the opening of the North Shore railway line in 1890, many of these the residences of prominent families of this period, and often designed by prominent architects, for example the 1894 Ewan House (formerly Innisfail) designed by architect Howard Joseland. The western end of Burns Road and western side of Coonanbarra Road are representative streetscapes of intact more modest Federation period houses.

The through-block pathways and formal avenues of street trees within the area (in Burns Road, Water Street and Coonanbarra Road) along with the formal landscaping of Wahroonga Park, and its distinctive John Sulman-design shops in Coonanbarra Road facing the Park, are a tribute to the work of the Wahroonga Progress Association in the early 20th century (which included Sulman as a member), and have resulted in a high-quality and distinctive residential landscape” (Davies, 2010).

**AECOM 2013 Inspection:** The listed conservation area was found to be in good condition with its local heritage significance unchanged.

## **6.7 Non-listed heritage items**

During the surveys, areas of potential heritage value were investigated to look for items with heritage value that are not listed and may be impacted by the project. In general, it was found that unlisted items of potential were captured through locally listed heritage conservation areas. No items of heritage value that are not currently listed were considered as being at risk from direct impact from surface works associated with the project. Likewise, there would be potential negligible impacts to structures along the preferred project corridor as a result of tunnel construction. Nonetheless, existing condition surveys for properties within this corridor would be completed prior to construction. This is discussed further in **Section 8.2**.

## **6.8 Archaeological heritage**

In addition to listed archaeological sites identified within existing heritage registers (refer to **Chapter 5.0**), a review of historical parish maps and plans was undertaken for the study area to gain an understanding and appreciation of the potential archaeological heritage present within the identified impact areas. Apart from those areas previously identified as part of local government heritage studies, no new potential archaeological resources were identified. While there may be potential for intact archaeological deposits to be present, the localised footprint of surface works likely to cause impacts, coupled with the extent of current modern impacts associated with the existing road network makes impacts to this archaeology unlikely. This has not been considered further in this assessment. However, mitigation measures have been identified in the event of unexpected cultural heritage finds (refer to **Chapter 9.0**).

## 7.0 Significance Assessment

### 7.1 Significance Assessment Criteria

In order to understand how development would impact on a heritage item, it is essential to understand why an item is significant. An assessment of significance is undertaken to explain why a particular site is important and to enable the appropriate site management and curtilage to be determined. Cultural significance is defined in the Australia ICOMOS Charter for the conservation of places of cultural significance (the Burra Charter) as meaning "aesthetic, historic, scientific or social value for past, present or future generations" (Article 1.1). Cultural significance may be derived from a place's fabric, association with a person or event, or for its research potential. The significance of a place is not fixed for all time, and what is of significance to us now may change as similar items are located, more historical research is undertaken and community tastes change.

The process of linking this assessment with a site's historical context has been developed through the NSW Heritage Management System and is outlined in the guideline Assessing Heritage Significance (NSW Heritage Office, 2001), part of the NSW Heritage Manual (NSW Heritage Office & NSW Department of Urban Affairs and Planning, 1996). The Assessing Heritage Significance guidelines establish seven evaluation criteria (which reflect four categories of significance and whether a place is rare or representative) under which a place can be evaluated in the context of State or local historical themes. Similarly, a heritage item can be significant at a local level (i.e. to the people living in the vicinity of the item), at a State level (i.e. to all people living within NSW) or be significant to the country as a whole and be of National or Commonwealth significance.

Following amendments to the *Heritage Act 1977* in 2009, to be of State significance an item must meet two or more of the criteria outlined in **Table 2**. Items can be deemed to be of local significance if they meet one or more criteria. An item is excluded under this criterion if it is a poor example or has lost the range of characteristics of a type. The Heritage Council requires the summation of the significance assessment into a succinct paragraph, known as a Statement of Significance. The Statement of Significance is the foundation for future management and impact assessment.

A review of the significance assessment for of each listed heritage item is provided in **Table 3**. The review has been undertaken in light of the outcomes of the field inspections conducted to inform this report, in order to confirm whether the original significance assessment remains current and accurate.

**Table 2 NSW Heritage significance criteria**

Criterion	Requirements
Criterion (a) - An item is important in the course, or pattern, of NSW's cultural or natural history (or the cultural or natural history of the local area).	<ul style="list-style-type: none"> <li>- items which demonstrate strong associations to past customs, cultural practices, philosophies or systems of government, regardless of the intactness of the item or any structure on the place;</li> <li>- items associated with significant historical events, regardless of the intactness of the item or any structure on the place;</li> <li>- significant cultural landscapes and other items demonstrating overlays of the continual pattern of human use and occupation; and/or</li> <li>- items where the physical fabric (above or below ground) demonstrates any of the points described above.</li> </ul>
Criterion (b) – an item has strong or special association with the life or works of a person, or group of persons, of importance in NSW's cultural or natural history (or the cultural or natural history of the local area).	<ul style="list-style-type: none"> <li>- items which demonstrate strong associations to a particular event, historical theme, people or philosophies, regardless of the intactness of the item or any of its structures;</li> <li>- items associated with significant historical events, regardless of the intactness of the item or any structure on the place; and/or</li> <li>- items where the physical fabric (above or below ground) demonstrates any of the points described above.</li> </ul>

Criterion	Requirements
Criterion (c) – an item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW (or the local area).	<ul style="list-style-type: none"> <li>- items which demonstrate creative or technical excellence, innovation or achievement;</li> <li>- items which have been the inspiration for creative or technical achievement;</li> <li>- items which demonstrate distinctive aesthetic attributes in form or composition;</li> <li>- items which demonstrate a highly original and influential style, such as an important early (seminal) work of a major architect; and/or</li> <li>- items which demonstrate the culmination of a particular architectural style (known as climactic).</li> </ul>
Criterion (d) – an item has strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons.	<ul style="list-style-type: none"> <li>- items which are esteemed by the community for their cultural values;</li> <li>- items which if damaged or destroyed would cause the community a sense of loss; and/or</li> <li>- items which contribute to a community's sense of identity.</li> <li>- Items are excluded if:</li> <li>- they are valued only for their amenity (service convenience); and/or</li> <li>- the community seeks their retention only in preference to a proposed alternative.</li> </ul>
Criterion (e) – an item has potential to yield information that will contribute to an understanding of NSW's cultural or natural history (or the cultural or natural history of the local area).	<ul style="list-style-type: none"> <li>- has the potential to yield new or further substantial scientific and/or archaeological information</li> <li>- is an important benchmark or reference site or type</li> <li>- provides evidence of past human cultures that is unavailable elsewhere</li> </ul>
Criterion (f) – an item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history (or the cultural or natural history of the local area).	<ul style="list-style-type: none"> <li>- provides evidence of a defunct custom, way of life or process</li> <li>- demonstrates a process, custom or other human activity that is in danger of being lost</li> <li>- shows unusually accurate evidence of a significant human activity</li> <li>- is the only example of its type</li> <li>- demonstrates designs or techniques of exceptional interest</li> <li>- shows rare evidence of a significant human activity important to a community</li> </ul>
Criterion (g) – An item is important in demonstrating the principal characteristics of a class of NSW's: <ul style="list-style-type: none"> <li>- cultural or natural places; or</li> <li>- cultural or natural environments.</li> </ul>	<ul style="list-style-type: none"> <li>- is a fine example of its type</li> <li>- has the principal characteristics of an important class or group of items</li> <li>- has attributes typical of a particular way of life, philosophy, custom, significant process, design, technique or activity</li> <li>- is a significant variation to a class of items</li> <li>- is part of a group which collectively illustrates a representative type</li> <li>- is outstanding because of its setting, condition or size</li> <li>- is outstanding because of its integrity or the esteem in which it is held</li> </ul>

Table 3 Summary significance assessment of listed heritage items

LEP / Ordinance	LEP No.	Item	Original significance assessment							AECOM assessment
			a	b	c	d	e	f	g	
Hornsby LEP	A60	Loretto [sic] Convent group—grounds, gates and cemetery		•	•					Significance confirmed.
Hornsby LEP	A61	Blackwood Memorial Sanctuary, including North Road culvert			•			•	•	Significance confirmed.
Hornsby LEP	A62	Observatory Park — Observatory site and park			•			•	•	Significance confirmed.
Hornsby LEP	A66	Remains of Maltworks			•					The heritage item actually meets criteria B, F and G due to its association with the Chilvers family and its representativeness and rarity.
Hornsby LEP	C2	Beecroft - Cheltenham Conservation Heritage Area	•	•	•			•	•	Significance confirmed.
Hornsby LEP	C7	Wahroonga Heritage Conservation Area	•	•	•			•	•	Significance confirmed.
Hornsby LEP	C8	Wahroonga North Heritage Conservation Area	•	•	•			•	•	Significance confirmed.
Hornsby LEP	I68	Street trees			•			•	•	Significance confirmed.
Hornsby LEP	I98	Street trees			•			•	•	Significance confirmed.
Hornsby LEP	I111	Street trees			•			•	•	Significance confirmed.
Hornsby LEP	I138	Pennant Hills Golf Club—grounds			•			•	•	Significance confirmed.
Hornsby LEP	I475	Street trees			•			•	•	Significance confirmed.

LEP / Ordinance	LEP No.	Item	Original significance assessment							AECOM assessment
			a	b	c	d	e	f	g	
Hornsby LEP	I590	Street trees			•			•	•	Significance confirmed.
Hornsby LEP	I596	Garden			•					Significance confirmed.
Hornsby LEP	I603	House			•					Significance confirmed.
Hornsby LEP	I607	Loretto [sic] Convent group—grounds, gates and cemetery		•	•					Significance confirmed.
Hornsby LEP	I618	St. Agatha's Primary School—grounds (excluding buildings)			•			•	•	Significance confirmed.
Hornsby LEP	I619	"Cheddington" and stables (formerly "Niara")				•				The main building 'Cheddington' has been significantly renovated and extended. The stables have had only minor modification.
Hornsby LEP	I626	House			•					Significance confirmed.
Hornsby LEP	I630	House			•					Significance confirmed.
Hornsby LEP	I652	"Camira"			•					Significance confirmed.
Hornsby LEP	I653	Mount St. Benedict's Convent and grounds		•	•					Significance confirmed.
Hornsby LEP	I654	Observatory Park — Observatory site and park			•			•	•	Significance confirmed.
Hornsby LEP	I660	Fence			•					Repainted.
Hornsby LEP	I661	Fence			•					Vegetation growth has obscured the fence.

LEP / Ordinance	LEP No.	Item	Original significance assessment							AECOM assessment
			a	b	c	d	e	f	g	
Hornsby LEP	I662	House and fence			•					Significance confirmed.
Hornsby LEP	I666	"Bushloe"			•					Significance confirmed.
Hornsby LEP	I680	House			•					Significance confirmed.
Hornsby LEP	I681	House			•					Significance confirmed.
Hornsby LEP	I682	House			•					Significance confirmed.
Hornsby LEP	I683	"Hillcourt"			•					Significance confirmed.
Hornsby LEP	I684	"Karoola"			•					Significance confirmed.
Hornsby LEP	I689	House			•					Significance confirmed.
Hornsby LEP	I690	House			•					Significance confirmed.
Hornsby LEP	I691	The Maze			•					Significance confirmed.
Hornsby LEP	I710	Street trees			•			•	•	Significance confirmed.
Hornsby LEP	I714	"Loch Maree House" and garden			•					Significance confirmed.
Hornsby LEP	I716	House			•					Significance confirmed.
Hornsby LEP	I723	House			•					Significance confirmed.
Hornsby LEP	I724	Gardens			•			•		Significance confirmed.



LEP / Ordinance	LEP No.	Item	Original significance assessment							AECOM assessment
			a	b	c	d	e	f	g	
Hornsby LEP	I725	House			•					Significance confirmed.
Hornsby LEP	I731	Garden			•					Significance confirmed.
Hornsby LEP	I743	Street trees			•			•	•	Significance confirmed.
Hornsby LEP	I750	Street trees			•			•	•	Significance confirmed.
Hornsby LEP	I755	House			•					Significance confirmed.
Hornsby LEP	I762	Garden			•					Significance confirmed.
Hornsby LEP	I767	St Pauls Church - Pearces Corner			•					Significance confirmed.
Hornsby LEP	I768	Street trees			•			•	•	Significance confirmed.
Hornsby LEP	I769	Street trees			•			•	•	Significance confirmed.
Hornsby LEP	I770	"Cherrygarth" and garden			•					Significance confirmed.
Hornsby LEP	I771	"Neringala" and garden			•					Significance confirmed.
Hornsby LEP	I772	Street trees and bushland			•			•	•	Significance confirmed.
Hornsby LEP	I791	House			•					Significance confirmed.
Ku-ring-gai Planning Scheme Ordinance	C1	Wahroonga Heritage Conservation Area	•	•	•			•	•	Significance confirmed.
Ku-ring-gai Planning Scheme Ordinance	I897	Timber Cottages Group			•					Significance confirmed.

LEP / Ordinance	LEP No.	Item	Original significance assessment							AECOM assessment
			a	b	c	d	e	f	g	
Ku-ring-gai Planning Scheme Ordinance	1898	Timber Cottages Group			•					Significance confirmed.
Ku-ring-gai Planning Scheme Ordinance	1900	Timber Cottages Group			•					Significance confirmed.
Ku-ring-gai Planning Scheme Ordinance	1901	Timber Cottages Group			•					Significance confirmed.
Ku-ring-gai Planning Scheme Ordinance	1902	Timber Cottages Group			•					The structure currently at the listed address is a two storey brick house. The timber structure previously registered here has likely been demolished and council has recommended its removal from the heritage schedule of the LEP.
Ku-ring-gai Planning Scheme Ordinance	1953	"Bolton Grange" Dwelling House			•					Significance confirmed.
Ku-ring-gai Planning Scheme Ordinance	1955	"Matakana" Dwelling House			•					Significance confirmed.
Ku-ring-gai Planning Scheme Ordinance	1956	"Cullingral" Dwelling House			•					Significance confirmed.
Ku-ring-gai Planning Scheme Ordinance	11012	"Poole House" Dwelling House			•					Significance confirmed.
Draft Ku-ring-gai LEP	1855	Dwelling House			•					Significance confirmed.
Draft Ku-ring-gai LEP	1954	Dwelling House			•					Significance confirmed.
Draft Ku-ring-gai LEP	1957	"Mansfield" Dwelling House			•					Significance confirmed.

LEP / Ordinance	LEP No.	Item	Original significance assessment							AECOM assessment
			a	b	c	d	e	f	g	
Draft Ku-ring-gai LEP	1959	"Hindfell" Dwelling House			•					Significance confirmed.
Draft Ku-ring-gai LEP	1960	Dwelling House			•					Significance confirmed.
The Hills LEP	128	Windsor Road from Baulkham Hills and Box Hill	•	•	•	•	•			The sections of road that represent this listing are not within the study area. Nonetheless, it is noted that those sections of the road within the study area have been recently modified following the construction of additional ramps at the Windsor Road interchange as part of the Hills M2 Motorway Upgrade project.

## 8.0 Issues and potential impacts

The following section draws upon information provided in **Chapter 5.0** and **Chapter 6.0** to address the issues and potential impacts on identified heritage items during the construction and operation of the project. These impacts would need to be reviewed during detailed design.

### 8.1 Potential impact areas

For the purpose of the historic heritage impact assessment, the potential areas of impact have been divided into the following components:

- **Windsor Road compound**, which would be used for construction only (C1).
- **The southern interchange**, including on-ramps- and off- ramps, the southern ventilation facility, the motorway control centre and southern interchange construction compound (C5).
- **The main alignment tunnels**.
- **Wilson Road site**, which would be the Wilson Road compound (C6) during construction and the Wilson Road tunnel support facility during operation.
- **Trelawney Street site**, which would be the Trelawney Street compound during construction (C7), and the Trelawney Street tunnel support facility during operation.
- **Pioneer Ave compound** which would be used for construction only (C8).
- **The northern interchange**, including on-ramps and off-ramps, surface road works, the northern ventilation facility, the M1 Pacific Motorway tie-in works and the three construction compounds (northern interchange compound (C9), Bareena Avenue compound (C10) and Junction Road compound (C11)).

With the exception of the Windsor Road compound (C1), no listed heritage items are located in proximity to the Hills M2 Motorway integration works (including the Darling Mills Creek compound (C2), the Barclay Road compound (C3) and the Yale Close compound (C4)). These areas have therefore not been considered further in this report.

Potential impact areas are shown in **Figure 3** to **Figure 7**, with more detailed descriptions of activities that would be undertaken at each of the sites listed above provided in Chapter 5 of the environmental impact statement for the project.

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Figure 3 Impact Area - Hills M2 Motorway integration works



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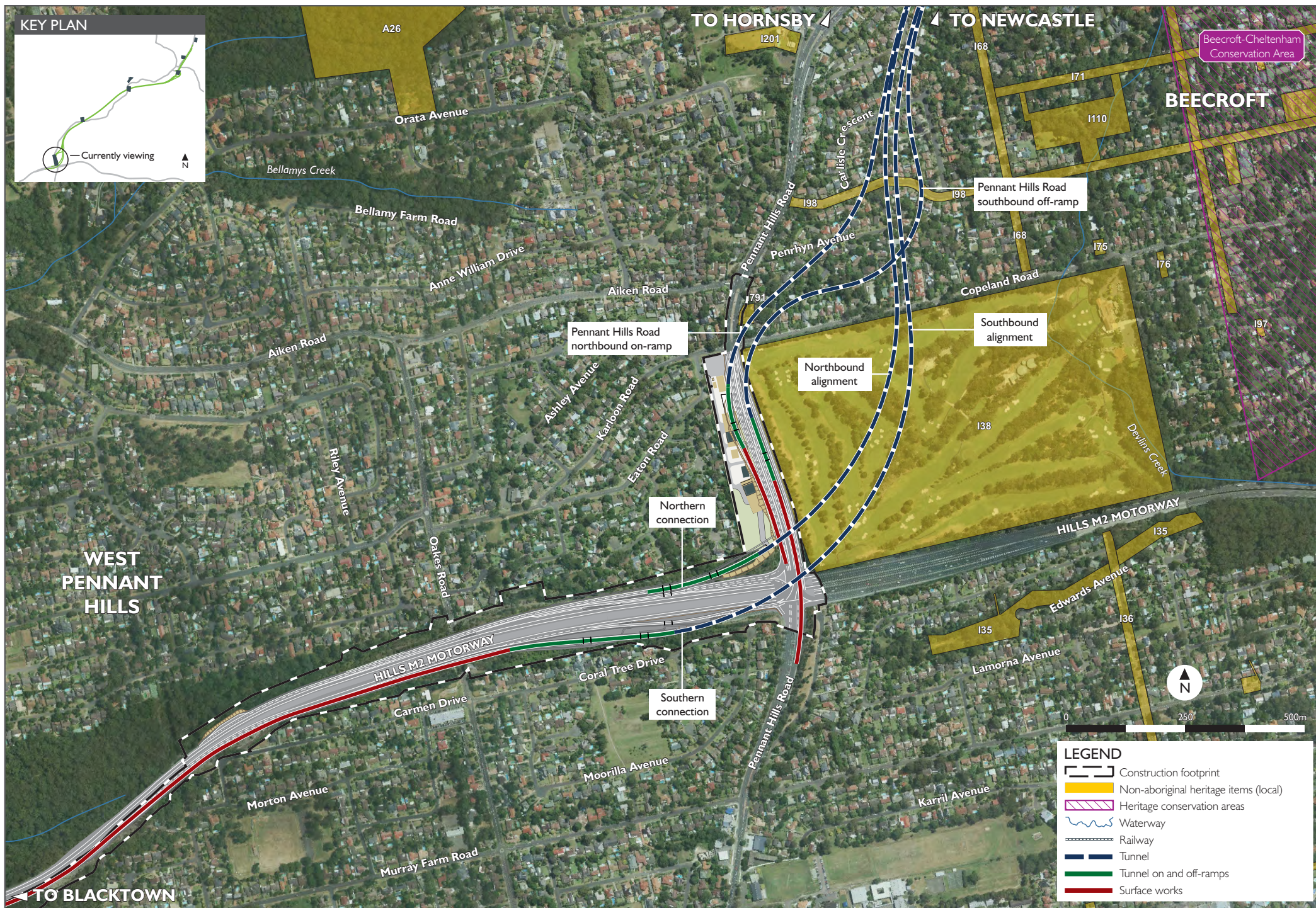


Figure 4 Impact area - southern interchange



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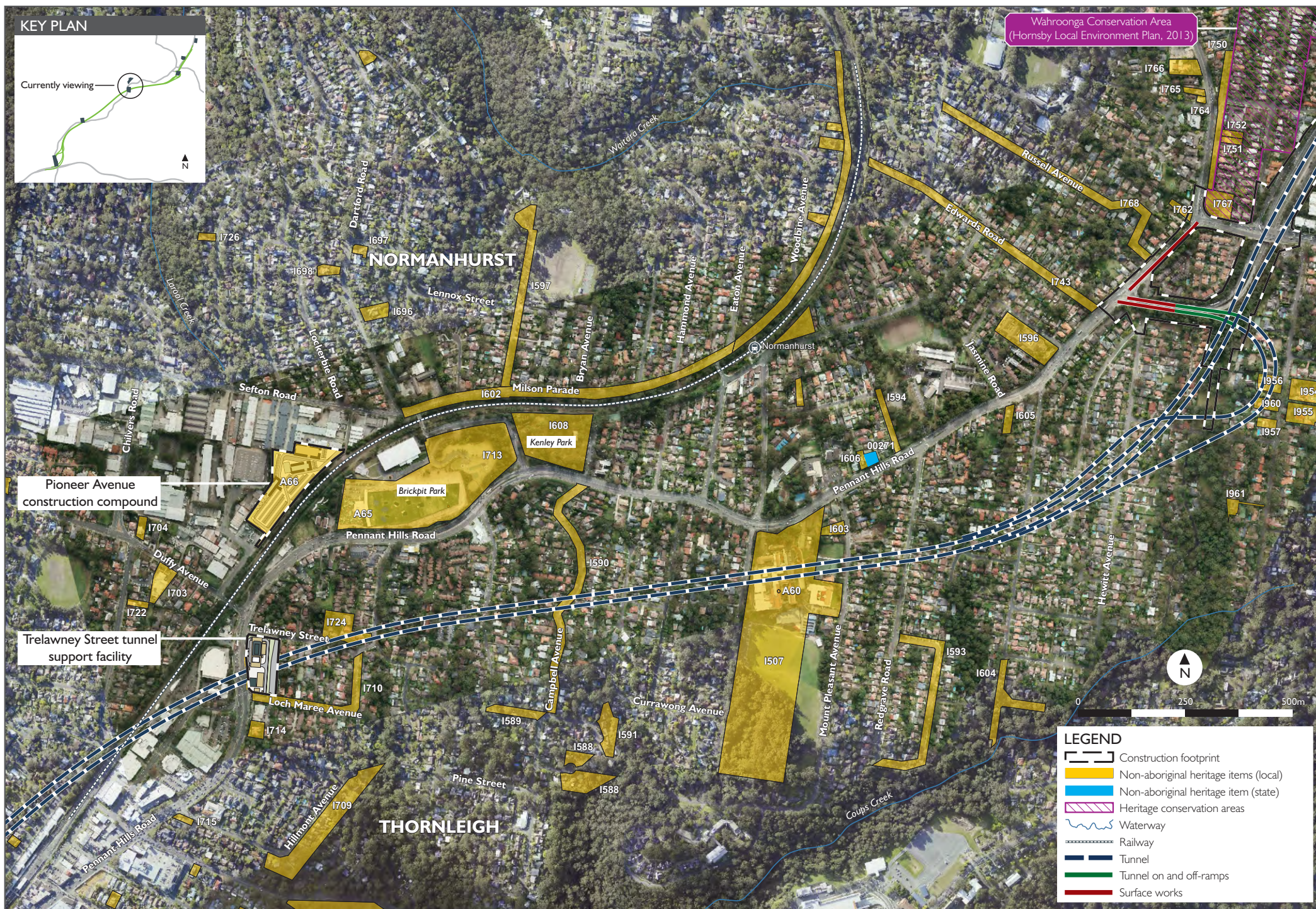






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**Figure 6 Impact area - Trelawney Street and Pioneer Avenue construction compound and tunnels**



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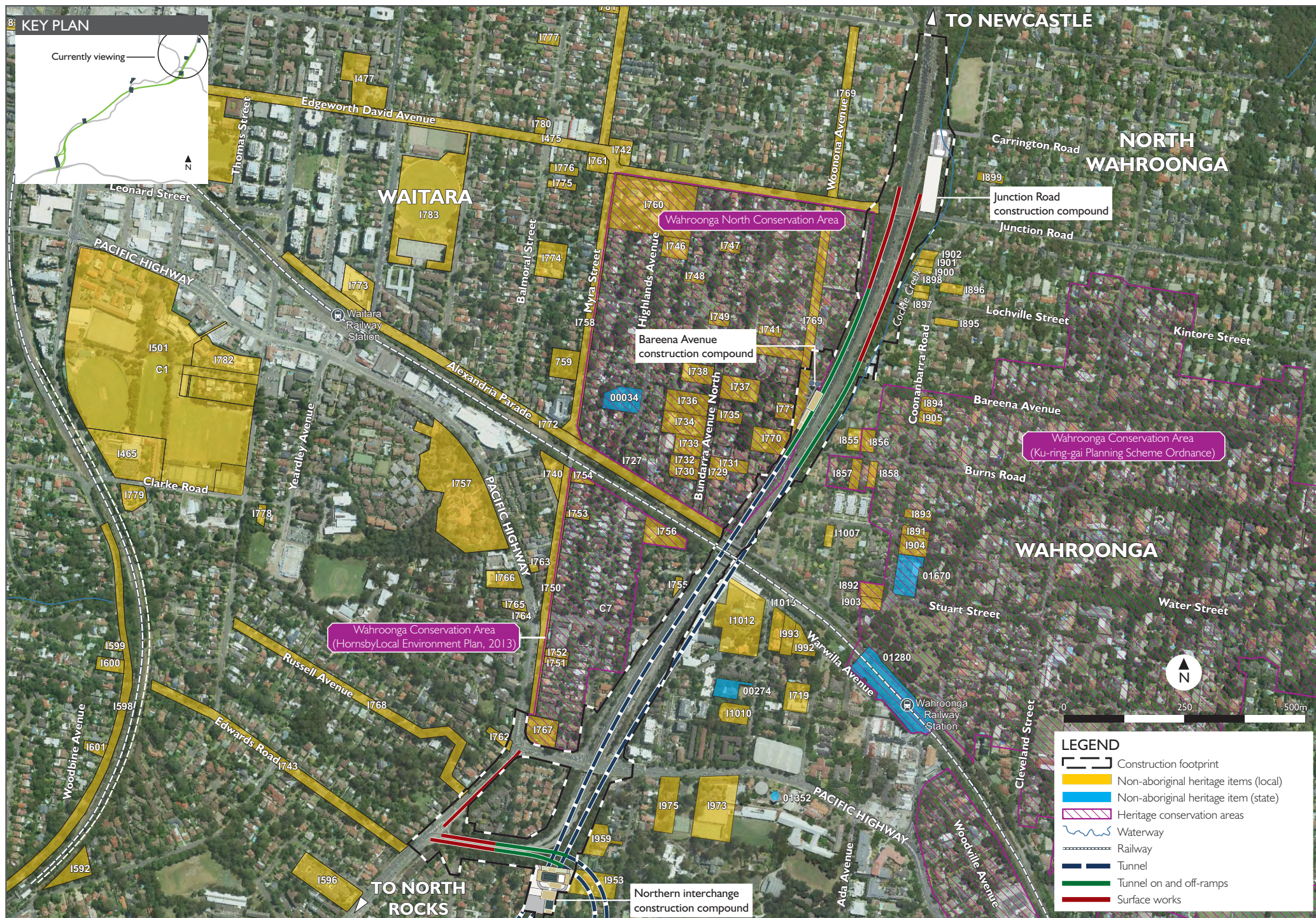


Figure 7 Impact area - the northern interchange



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## 8.2 Potential impact types

Impacts on non-Aboriginal heritage items have been categorised as follows:

- **Direct** – where the project would be located within the curtilage of the heritage item and / or involve the demolition or modification of the heritage item.
- **Potentially direct** – where the project may impact on the heritage item subject to the condition of the item, more detailed investigation, construction methodologies and / or the implementation of mitigation and management measures.
- **Indirect** – where the project would change the visual context and surroundings of a heritage item.

Table 4 Potential impact types

Impact	Description
<b>Direct</b>	
Heritage vegetation removal	Road widening and construction activities resulting in the requirement to remove heritage listed vegetation.
Acquisition	Impacts resulting from the full or partial acquisition (and associated demolition) of properties that contain heritage items.
Change in heritage conservation area values	Construction of a new element within a heritage conservation area.
Demolition	Demolition of structures for construction compound.
<b>Potentially direct</b>	
Acoustic treatment	Properties, some of which may be listed heritage items, may qualify for at-property acoustic treatment. This may impact on the fabric or the significance of the heritage item.
Vibration, settlement and groundwater drawdown from tunnelling works	The area of potential impact for the main alignment tunnels, on-ramp and off-ramp tunnels includes a zone on the surface equal to a distance of 50 metres from the outer edge of the underground tunnels. The potential impacts on non-Aboriginal heritage items would be a potential indirect impact by virtue of: <ul style="list-style-type: none"> <li>- construction vibration as the road headers pass underneath properties;</li> <li>- the settlement of land if tunnelling activities are conducted underneath or close to heritage features; or</li> <li>- impacts on tree roots, in the case of street trees, depending on the depth of the tunnelling activity.</li> </ul>
Vibration from surface works	Depending on the setback of buildings from the construction footprint, there is the potential for vibration impacts associated with surface road works, building construction and / or the cut-and-cover sections of the main alignment tunnels, and on and off-ramps.
Dust	Construction activities may result in the generation of dust where works are at the surface or during the handling of spoil. Spoil handling would be in part undertaken inside acoustic sheds at compounds. Air quality impacts during construction would be managed by implementing standard and best practice mitigation measures. As such, this potential impact has not been considered further.



Impact	Description
<b>Indirect</b>	
Visual	<p>There may be temporary and permanent visual impacts as result of the project. These may include:</p> <ul style="list-style-type: none"> <li>- construction of new road infrastructure or ancillary facilities;</li> <li>- alterations to surface roads;</li> <li>- new noise walls or modifications to existing noise walls, including changes to the height of noise walls;</li> <li>- removal of vegetation; or</li> <li>- establishment and use of construction compounds.</li> </ul>

### 8.2.1 Vibration

Technical working paper: noise and vibration (AECOM, 2014) provides an assessment of potential construction vibration impacts as a result of works at surface and below ground (tunnelling).

The extent of potential vibration impacts to structures would be dependent on the type of equipment, the activity being undertaken and the separation distances. Earthworks, tunnelling and bridge works are expected to be the major vibration causing activities, given the activity and the type of equipment being used.

In summary, the noise and vibration assessment for the project concludes that:

- for tunnelling activities, the predicted vibration levels at heritage items are estimated to be around 2 mm/s or less, which is below the recommended maximum level of vibration that would be applicable to heritage structures set within the German Standard DIN 4150 - Part 3 - Structural Vibration in Buildings – Effects on Structures (refer to **Table 5**). These levels are designed to minimise the risk of cosmetic surface cracks and are set well below the levels that have the potential to cause damage to the main structure. Examples of threshold or cosmetic cracking include minor non-structural effects such as superficial cracking in cement render or plaster.
- for surface works, such as at the northern interchange and southern interchange, cosmetic damage to buildings would be unlikely where the building is distanced from the project by five metres to 25 metres (depending on the vibration-generating equipment being used and the location of that equipment within each construction area). Safe working distances for vibration intensive plant equipment are outlined in the technical working paper: noise and vibration (AECOM, 2014), along with recommended mitigation measures where works within these setbacks cannot be avoided.

**Table 5** Structural damage vibration limits relevant to heritage structures

Type of structure	Vibration Velocity (mm/s)			
	At Foundation at a Frequency of			Vibration at the Horizontal Plane of the Highest Floor
	Less than 10Hz	10Hz to 50 Hz	50Hz to 100Hz	All frequencies
Structures that because of their particular sensitivity to vibration, do not correspond to commercial, industrial, or residential building types and have intrinsic value (e.g. buildings that are under a preservation order)	3 mm/s	3 to 8 mm/s	8 to 10 mm/s	8 mm/s

### 8.2.2 Ground settlement

The ground settlement as a result of the project, and its potential impacts on heritage structures would be dependent on the geotechnical conditions, the depth of the tunnelling activity, the number of storeys of the building, and the position, condition and masonry of the structure itself.

Section 7.8 of the environmental impact statement for the project provides an assessment of the potential impacts of ground settlement on structures. Specific to heritage items, it is noted that:

- for the majority of items, no or very little settlement (five millimetres or less) has been estimated along the preferred project corridor. The magnitude of potential movement would be minor, and therefore the risk of damage to structures would be negligible.
- for a limited number of properties located near the southern and northern interchanges, settlement of around 10 millimetres has been estimated, with an angular distortion of up to around 0.03 per cent. Based on Burland et al (1996) and the angular distortion predicted at those properties, the degree of damage to the structure as result would be negligible. Examples of visible potential impacts would be cosmetic and could include hairline cracks less than around 0.1 millimetres.

However, it is noted that these results are preliminary and do not take into account the specifics of the property itself. Further assessments and property condition reports would be undertaken during detailed design to determine the level of potential impact on structures and to identify what mitigation and management measures would be required to minimise potential ground settlement impacts.

### 8.2.3 Acoustic treatment

Technical working paper: noise and vibration (AECOM, 2014) identifies properties that may be eligible for at-property acoustic treatment, due to the potential for exceedances of applicable noise criteria at these locations. Depending on the level of noise exceedance, at-property treatment may include for example, sealing of wall vents or upgrading of window and door seals.

Three of the properties identified for at-property acoustic treatment are or contain listed heritage items, namely:

- "Hindfell" Dwelling House (Draft Ku-ring-gai LEP reference: I959).
- St Pauls Church - Pearces Corner (Hornsby LEP reference: I767).
- "Cherrygarth" and garden (Hornsby LEP reference: I770).

The need for acoustic treatment at each property would be confirmed during detailed design, in consultation with the relevant landowners, and with consideration of potential impacts to heritage values.

Should at-property acoustic treatment be required for the above listed heritage items, this may result in impacts to the fabric of these items. Treatment would be sympathetic to the heritage values of each item and would be undertaken in accordance with the Burra Charter, which stipulates that changes which reduce cultural significance should be reversible.

## 8.3 Assessment of potential impacts

For the purposes of comparative assessment, the criteria in **Table 6** have been established for ranking the degree of impact from the construction and operation of the project.

**Table 6** Non-Aboriginal heritage impact criteria

Impact assessment	Criteria
Negligible	- Impacts to the heritage item in question would be negligible and would not affect the overall heritage significance of the item.
Minor impact	- Minor impacts may occur to the listed item, typically with respect to its reported curtilage as opposed to the listed item itself. - These impacts would be minimal in nature and would not affect the overall heritage significance of the item.
Significant impact	- Impacts to the heritage item are unavoidable with the current project design. - The heritage value of the item would be impacted.

## 8.4 Identified impacts to listed heritage items

Identified impacts to heritage items, both direct and indirect, are detailed in

**Table 7.**

In summary, 62 heritage items would be directly or indirectly impacted by the project. In some instances, an item would be directly and indirectly impacted by the project. Of the 62 heritage items:

- One item would be fully and directly impacted with the removal of two Canary Island Palms (Hornsby LEP reference: I762) located within a property that would be partially acquired. Feasible and reasonable options would be investigated during detailed design to relocate the two Canary Island Palms, however, the impacts to this item are likely to be significant
- Two items would be partially and directly impacted with
  - The demolition of structures associated with the Thornleigh Maltworks site (Hornsby LEP reference: A66). Feasible and reasonable options have been investigated during design of the project to date with the aim of retaining the original industrial structure associated with this site, however, the impacts to the overall site complex are likely to be significant.
  - Impacts to the curtilage of heritage listed street trees at Woonona Avenue, Wahroonga (Hornsby LEP reference: I769). Feasible and reasonable options would be investigated to avoid or minimise the impact. If it is necessary to remove the trees, this would have some impact to the heritage value of the item. This impact could be mitigated through sympathetic plantings of similar species through revegetation efforts.
- Two heritage conservation areas would be partially and directly impacted, being the North Wahroonga heritage conservation area (Hornsby LEP reference: C2), and the Beecroft-Cheltenham heritage conservation area (Hornsby LEP reference: C8). Landscaping of the project within these areas would minimise the potential impacts. The overall heritage value of the heritage conservation areas would not be significantly impacted by the project.
- Eleven items would be potentially directly impacted due to construction vibration from surface works. These impacts are anticipated to have a negligible to minor risk of affecting the value of the heritage items (*Ku-ring-gai Planning Scheme Ordinance 1971* reference: I897, I898, I900, I901 and I902<sup>2</sup>, *Draft Ku-ring-gai Local Environmental Plan 2013* reference: I855, and Hornsby LEP reference: I767, I750, I770, I771, and I791). The degree of impact to these items is anticipated to be minor to negligible. The overall heritage value of the heritage items would not be significantly impacted by the project.
- Forty-four items would be potentially directly impacted due to vibration, settlement and groundwater drawdown as a result of tunnelling works. These items are primarily located within the preferred project corridor. Impacts to these items are anticipated to be minor to negligible. Two of these items would also be potentially directly impacted by construction vibration due to surface works. The overall heritage value of the heritage items would not be significantly impacted by the project.

Of the 62 heritage items, 21 items may also be indirectly impacted by the project, due to temporary and / or permanent visual impacts. Of the 21 items, 19 items would also be directly impacted as outlined above. Impacts to the heritage items as a result of visual effects are anticipated to be minor to negligible. The overall heritage value of the heritage items would not be significantly impacted by the project.

As noted in **Section 8.2.2**, at-property acoustic treatment may also be required for three items listed above, which would be confirmed during detailed design.

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<sup>2</sup> For the purpose of this report, heritage item identification numbers for listed items in Ku-ring-gai local government area have been referred to using the identification numbers assigned to the items under *Draft Ku-ring-gai Local Environmental Plan 2013* because the *Ku-ring-gai Planning Scheme Ordinance 1971* does not include equivalent identification numbers.

It is noted that some heritage items identified through the registry search results have multiple listings as the item has been identified for its built and archaeological significance. For the purposes of this report, the following items have been counted as one item in this section and subsequent sections of the report:

- Loretto (sic) Convent group – grounds, gates and cemetery (listed under the Hornsby LEP as I607 and A60).
- Blackwood Memorial Sanctuary (listed under the Hornsby LEP (Hornsby LEP reference: A61) and under the National Trust register).
- Observatory Park (listed under the Hornsby LEP as I654 and A62).

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Table 7 Potential impact summary

Impact area	LEP / Ordinance	LEP no.	Item	Impact type	Comment	Degree of impact
Windsor Road compound (C1)	The Hills LEP	I28	Windsor Road from Baulkham Hills to Box Hill	No impact	<p>The Windsor Road compound (C1) would be located within a previously disturbed site that was used as a construction compound during the M2 Upgrade.</p> <p>The sections of road that have heritage value do not extend into the study area. This section of road was also recently widened to cater for additional motorway ramps at the Windsor Road interchange.</p>	No impact.
<p>Wilson Road compound (C6)</p> <p>Wilson Road tunnel support facility</p> <p>Main alignment tunnels</p>	Hornsby LEP	C2	Beecroft - Cheltenham Conservation Heritage Area	Change in heritage conservation area values	<p>Impacts on heritage values within the conservation area would be localised to specific areas already associated with major transport network infrastructure.</p> <p>Potential visual impacts due to the presence of the Wilson Road compound (C6) and Wilson Road tunnel support facility. Landscaping of the tunnel support facility, once established, would reduce the potential visual impacts within the conservation area.</p>	Minor impact.

Impact area	LEP / Ordinance	LEP no.	Item	Impact type	Comment	Degree of impact
<p>Trelawney Street compound (C7)</p> <p>Trelawney Street tunnel support facility</p> <p>Main alignment tunnels</p>	Hornsby LEP	I710	Street trees	Vibration and settlement (tunnelling)	<p>A part of Loch Maree Avenue would be located within the preferred project corridor.</p> <p>Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement during and after construction, however this would be less than five millimetres, which is considered to be negligible.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures. A program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> </ul> <p>The main alignment tunnels would be around 25 metres below ground level at this point and would be unlikely to impact on tree roots.</p> <p>Access to the Trelawney Street compound (C7) would be via Loch Maree Avenue. Impacts to street trees would be avoided during construction.</p>	Potential negligible impact.
Pioneer Avenue compound (C8)	Hornsby LEP	A66	Remains of Maltworks	Demolition of structures	Direct impact will occur through the demolition of some structures within the curtilage of this item. One of the original structures on the site would be retained.	Direct impact.

Impact area	LEP / Ordinance	LEP no.	Item	Impact type	Comment	Degree of impact
Main alignment tunnels	Hornsby LEP	A61	Blackwood Memorial Sanctuary, including North Road culvert	Vibration and settlement (tunnelling)	<p>Blackwood Memorial Sanctuary would be located within the preferred project corridor. Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement during and after construction, however this would be less than five millimetres, which is considered to be negligible.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures.</li> </ul> <p>The tunnel would be around 85 metres below ground at this point and would be unlikely to impact on tree roots.</p>	Potential negligible impact.
		I68	Street trees	Vibration and settlement (tunnelling)	<p>A part of Cardinal Avenue would be located within the preferred project corridor. Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement during and after construction, however this would be less than five millimetres, which is considered to be negligible.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures.</li> </ul> <p>The main alignment tunnels would be around 85 metres below ground at this point and would be unlikely to impact on tree roots.</p>	Potential negligible impact.
		I98	Street trees	Vibration and settlement (tunnelling)	<p>A part of Hannah Street would be located within the preferred project corridor. Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement during and after construction, however this would be 10 millimetres or less, which is considered to be negligible.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures.</li> </ul> <p>The main alignment tunnels would be around 55 metres below ground at this point and would be unlikely to impact on tree roots.</p>	Potential negligible impact.



Impact area	LEP / Ordinance	LEP no.	Item	Impact type	Comment	Degree of impact
		I111	Street trees	Vibration and settlement (tunnelling)	<p>A part of Hull Road would be located within the preferred project corridor. Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement during and after construction, however this would be less than five millimetres, which is considered to be negligible.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures.</li> </ul> <p>The main alignment tunnels would be around 85 metres below ground at this point and would be unlikely to impact on tree roots.</p>	Potential negligible impact.
		I590	Street trees	Vibration and settlement (tunnelling)	<p>A part of Campbell Avenue would be located within the preferred project corridor. Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement during and after construction, however this would be less than five millimetres, which is considered to be negligible.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures.</li> </ul> <p>No impact to tree roots is anticipated given the depth of the main alignment tunnels at this location (around 20 to 30 metres).</p>	Potential negligible impact.
		I603	House	Vibration and settlement (tunnelling)	<p>The property would be located within the preferred project corridor. Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement during and after construction, however this would be less than five millimetres, which is considered to be negligible.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> </ul>	Potential negligible impact.

Impact area	LEP / Ordinance	LEP no.	Item	Impact type	Comment	Degree of impact
		I607 / A60	Loretto [sic] Convent group—grounds, gates and cemetery	Vibration and settlement (tunnelling)	<p>The property would be located within the preferred project corridor. Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement during and after construction, however this would be less than five millimetres, which is considered to be negligible.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> </ul>	Potential negligible impact.
		I618	St. Agatha's Primary School—grounds (excluding buildings)	Vibration and settlement (tunnelling)	<p>The property would be located within the preferred project corridor. Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement during and after construction, however this would be less than five millimetres, which is considered to be negligible.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> </ul>	Potential negligible impact.
		I619	"Cheddington" and stables (formerly "Niara")	Vibration and settlement (tunnelling)	<p>The property would be located within the preferred project corridor. Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement during and after construction, however this would be less than five millimetres, which is considered to be negligible.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> </ul>	Potential negligible impact.

Impact area	LEP / Ordinance	LEP no.	Item	Impact type	Comment	Degree of impact
		I626	House	Vibration and settlement (tunnelling)	<p>The property would be located within the preferred project corridor. Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement during and after construction, however this would be less than five millimetres, which is considered to be negligible.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> </ul>	Potential negligible impact.
		I630	House	Vibration and settlement (tunnelling)	<p>The property would be located within the preferred project corridor. Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement during and after construction, however this would be less than five millimetres, which is considered to be negligible.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> </ul>	Potential negligible impact.
		I652	"Camira"	Vibration and settlement (tunnelling)	<p>The property would be located within the preferred project corridor. Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement during and after construction, however this would be less than five millimetres, which is considered to be negligible.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> </ul>	Potential negligible impact.

Impact area	LEP / Ordinance	LEP no.	Item	Impact type	Comment	Degree of impact
		I653	Mount St. Benedict's Convent and grounds	Vibration and settlement (tunnelling)	<p>The property would be located within the preferred project corridor. Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement during and after construction, however this would be less than five millimetres, which is considered to be negligible.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> </ul>	Potential negligible impact.
		I654 / A62	Observatory Park — Observatory site and park	Vibration and settlement (tunnelling)	<p>A part of Observatory Park would be located within the preferred project corridor. Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement during and after construction, however this would be less than five millimetres, which is considered to be negligible.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> </ul> <p>The main alignment tunnels would be around 85 metres below ground at this point would unlikely have an impact on tree roots.</p>	Potential negligible impact.

Impact area	LEP / Ordinance	LEP no.	Item	Impact type	Comment	Degree of impact
		I660	Fence	Vibration and settlement (tunnelling)	<p>The property would be located within the preferred project corridor. Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement during and after construction, however this would be less than five millimetres, which is considered to be negligible.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> </ul>	Potential negligible impact.
		I661	Fence	Vibration and settlement (tunnelling)	<p>The property would be located within the preferred project corridor. Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement during and after construction, however this would be less than five millimetres, which is considered to be negligible.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> </ul>	Potential negligible impact.
		I662	House and fence	Vibration and settlement (tunnelling)	<p>The property would be located within the preferred project corridor. Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement during and after construction, however this would be less than five millimetres, which is considered to be negligible.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> </ul>	Potential negligible impact.

Impact area	LEP / Ordinance	LEP no.	Item	Impact type	Comment	Degree of impact
		I666	"Bushloe"	Vibration and settlement (tunnelling)	<p>The property would be located within the preferred project corridor. Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement during and after construction, however this would be less than five millimetres, which is considered to be negligible.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> </ul>	Potential negligible impact.
		I680	House	Vibration and settlement (tunnelling)	<p>The property would be located within the preferred project corridor. Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement during and after construction, however this would be less than five millimetres, which is considered to be negligible.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> </ul>	Potential negligible impact.
		I681	House	Vibration and settlement (tunnelling)	<p>The property would be located within the preferred project corridor. Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement during and after construction, however this would be less than five millimetres, which is considered to be negligible.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> </ul>	Potential negligible impact.

Impact area	LEP / Ordinance	LEP no.	Item	Impact type	Comment	Degree of impact
		I682	House	Vibration and settlement (tunnelling)	<p>The property would be located within the preferred project corridor. Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement during and after construction, however this would be less than five millimetres, which is considered to be negligible.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> </ul>	Potential negligible impact.
		I683	"Hillcourt"	Vibration and settlement (tunnelling)	<p>The property would be located within the preferred project corridor. Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement during and after construction, however this would be less than five millimetres, which is considered to be negligible.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> </ul>	Potential negligible impact.
		I684	"Karoola"	Vibration and settlement (tunnelling)	<p>The property would be located within the preferred project corridor. Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement during and after construction, however this would be less than five millimetres, which is considered to be negligible.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> </ul>	Potential negligible impact.

Impact area	LEP / Ordinance	LEP no.	Item	Impact type	Comment	Degree of impact
		I689	House	Vibration and settlement (tunnelling)	<p>The property would be located within the preferred project corridor. Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement during and after construction, however this would be less than five millimetres, which is considered to be negligible.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> </ul>	Potential negligible impact.
		I690	House	Vibration and settlement (tunnelling)	<p>The property would be located within the preferred project corridor. Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement during and after construction, however this would be less than five millimetres, which is considered to be negligible.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> </ul>	Potential negligible impact.
		I691	The Maze	Vibration and settlement (tunnelling)	<p>The property would be located within the preferred project corridor. Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement during and after construction, however this would be less than five millimetres, which is considered to be negligible.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> </ul>	Potential negligible impact.



Impact area	LEP / Ordinance	LEP no.	Item	Impact type	Comment	Degree of impact
		I714	"Loch Maree House" and garden	Vibration and settlement (tunnelling)	<p>The property would be located within the preferred project corridor. Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement during and after construction, however this would be less than five millimetres, which is considered to be negligible.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> </ul>	Potential negligible impact.
		I716	House	Vibration and settlement (tunnelling)	<p>The property would be located within the preferred project corridor. Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement during and after construction, however this would be less than five millimetres, which is considered to be negligible.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> </ul>	Potential negligible impact.
		I723	House	Vibration and settlement (tunnelling)	<p>The property would be located within the preferred project corridor. Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement during and after construction, however this would be less than five millimetres, which is considered to be negligible.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> </ul>	Potential negligible impact.

Impact area	LEP / Ordinance	LEP no.	Item	Impact type	Comment	Degree of impact
		1724	Gardens	Vibration and settlement (tunnelling)	<p>The property would be located within the preferred project corridor. Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement during and after construction, however this would be less than five millimetres, which is considered to be negligible.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> </ul>	Potential negligible impact.
		1725	House	Vibration and settlement (tunnelling)	<p>The property would be located within the preferred project corridor. Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement during and after construction, however this would be less than five millimetres, which is considered to be negligible.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> </ul>	Potential negligible impact.
		1731	Garden	Vibration and settlement (tunnelling)	<p>The property would be located within the preferred project corridor. Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement during and after construction, however this would be less than five millimetres, which is considered to be negligible.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> </ul>	Potential negligible impact.

Impact area	LEP / Ordinance	LEP no.	Item	Impact type	Comment	Degree of impact
		I755	House	Vibration and settlement (tunnelling)	<p>The property would be located within the preferred project corridor. Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement during and after construction, however this would be less than five millimetres, which is considered to be negligible.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> </ul>	Potential negligible impact - vibration.
Northern interchange	Hornsby LEP	C7	Wahroonga Heritage Conservation Area	Visual	There would be no above ground works within the heritage conservation area. The preferred project corridor passes under the eastern edge of the conservation area, and widening works at the intersection of Pennant Hills Road and Pacific Highway would be undertaken adjacent to this conservation area.	Negligible impact.
		C8	Wahroonga North Heritage Conservation Area	Change in heritage conservation area values	<p>Impacts to heritage values within the conservation area would be localised to specific areas already associated with major transport network infrastructure.</p> <p>The M1 Pacific Motorway would be widened to cater for the northern portal and associated ancillary facilities. This would extend to the eastern edge of the heritage conservation area and would include the acquisition of a property on the corner of Bareena Avenue and Woronora Avenue, Wahroonga. Visual impacts due to changes to noise walls and the northern ventilation facility which would be visible above the noise walls may affect certain properties.</p> <p>Landscaping would provide screening of the project from the heritage conservation area, once established.</p> <p>Temporary visual impacts may also occur while the Bareena Road compound (C10) is operational during construction.</p>	Minor impact.

Impact area	LEP / Ordinance	LEP no.	Item	Impact type	Comment	Degree of impact
		I475	Street trees	No impact	Construction activities would be undertaken in proximity to, but not directly affecting this heritage item. There would be no construction activities undertaken along Edgeworth David Avenue west of the M1 Pacific Motorway.	No impact.
		I596	Garden	No impact	Construction activities would be undertaken in proximity to, but not directly affecting this heritage item. The construction activities would be undertaken within the Pennant Hills Road reserve and would not require the removal of street trees.	No impact
		I743	Street trees	No impact	Construction activities would be undertaken in proximity to, but not directly affecting this heritage item. There would be no construction activities undertaken directly adjacent to the heritage item, with works limited to the road reserve.	No impact.
		I750	Street trees	Vibration (surface works)  Visual	<p>This site would be located adjacent to the construction footprint and has the potential to be directly and/ or indirectly impacted. Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Vibration impacts during surface construction, however surface works would adhere to safe working distances. A program of monitoring would be undertaken to identify early potential risks to the heritage item.</li> <li>- Visual impacts during construction and operation however this would be reduced in part by distance and the screening effect of surrounding residential developments. Existing vistas and view lines from the property would be considered during detailed design, including rehabilitation strategies that are sympathetic to the heritage item.</li> </ul> <p>It is unlikely that vibration during construction works would diminish the heritage value of this item.</p> <p>As the item is on the corner of two major roads, any visual change to surrounding landscape of the road caused by the widening of the Pacific Highway as part of the project is unlikely to be significant given the existing landscape.</p>	<p>Potential negligible impact – vibration.</p> <p>Negligible impact – visual.</p>

Impact area	LEP / Ordinance	LEP no.	Item	Impact type	Comment	Degree of impact
		I762	Garden	Acquisition  Heritage vegetation removal	Partial land acquisition would be required at the front of the property to cater for the widening of Pennant Hills Road northbound carriageway at Pearces Corner to create a permanent additional right-turn lane onto the Pacific Highway. The two heritage listed trees (Canary Island Palms) would be removed during construction of the project, resulting in a direct loss of heritage value for this item.	Significant impact – heritage vegetation removal.

Impact area	LEP / Ordinance	LEP no.	Item	Impact type	Comment	Degree of impact
		1767	St Pauls Church - Pearces Corner	Vibration (surface works)	This site would be located in adjacent to the construction footprint and has a potential for direct and indirect impacts.	Potential negligible impact – vibration.
				Visual	Potential impacts may include:	Negligible impact – visual.
				At-property acoustic treatment	<ul style="list-style-type: none"> <li>- Vibration impacts during surface construction, however surface works would adhere to safe working distances. An existing condition survey and a program of monitoring would be undertaken to identify early potential risks to the heritage item.</li> <li>- Visual impacts during construction and operation however this would be reduced in part by distance and the screening effect of surrounding residential developments. Existing vistas and view lines from the property would be considered during detailed design, including rehabilitation strategies that are sympathetic to the heritage item.</li> <li>- Potential direct impacts due to eligibility for at-property acoustic treatment. As the typical hours of use of this property differ to residential dwellings, a different set of treatment criteria apply. As such, this property has been flagged for further investigation, including an internal investigation. The need for acoustic treatment at this property would be confirmed during detailed design, in consultation with the landowner, and with consideration of potential impacts to heritage values.</li> </ul> <p>It is unlikely that vibration during construction works would diminish the heritage value of this item.</p> <p>As the item is on the corner of two major roads, any visual change to surrounding landscape of the road caused by the widening of the Pacific Highway as part of the project is unlikely to be significant given the existing landscape.</p>	Potential impact depending on required treatment – At-property acoustic treatment.

Impact area	LEP / Ordinance	LEP no.	Item	Impact type	Comment	Degree of impact
		1768	Street trees	No impact	Construction activities would be undertaken in proximity to, but not directly affecting this heritage item. The construction activities would be undertaken within the Pennant Hills Road reserve and would not require the removal of street trees..	No impact.
		1769	Street trees	Heritage vegetation removal	<p>Potential tree clearance would be required at southern end of heritage item to cater for site access to the Bareena Road compound (C10) and the northern ventilation facility.</p> <p>Measures to avoid direct impacts to the specific listed vegetation "Blue Gum High Forest" would be investigated during the detailed design phase.</p> <p>If avoidance is not feasible or reasonable, some impact to the overall heritage value of this item would occur.</p>	Minor impact.

Impact area	LEP / Ordinance	LEP no.	Item	Impact type	Comment	Degree of impact
		I770	"Cherrygarth" and garden	Vibration and settlement (tunnelling)  Vibration (surface works)  Visual  At-property acoustic treatment	<p>This item would be located opposite the northern ventilation facility. Noise walls and landscaping would provide some visual screening, once established. However, the taller components of the northern ventilation facility are located further north and may be visible above the noise walls.</p> <p>Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement during and after construction, however this would be less than five millimetres, which would be negligible.</li> <li>- Vibration impacts during tunnelling and surface construction, however:               <ul style="list-style-type: none"> <li>• Vibration levels from tunnelling are anticipated to be below potential damage levels relevant to heritage structures.</li> <li>• Surface works would adhere to safe working distances.</li> </ul> </li> <li>- An existing condition survey and a program of monitoring would be undertaken to identify early potential risks to the heritage item.</li> <li>- Visual impacts during construction and operation. Existing vistas and view lines from the property would be considered during detailed design, including rehabilitation strategies that are sympathetic to the heritage item.</li> <li>- Potential direct impacts due to eligibility for at-property acoustic treatment. The need for acoustic treatment at this property would be confirmed during detailed design, in consultation with the landowner, and with consideration of potential impacts to heritage values.</li> </ul>	<p>Potential minor impact – vibration and settlement</p> <p>Minor impact – visual</p> <p>Potential impact depending on required treatment – At-property acoustic treatment.</p>



Impact area	LEP / Ordinance	LEP no.	Item	Impact type	Comment	Degree of impact
		I771	"Neringala" and garden	Vibration (surface works)  Visual	<p>This heritage item would be located directly opposite the northern ventilation facility. Noise walls and landscaping would provide some visual screening, once established. However, the taller components of the northern ventilation facility may be visible above the noise walls.</p> <p>Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Vibration impacts during surface construction, however surface works would adhere to safe working distances. An existing condition survey and a program of monitoring would be undertaken to identify early potential risks to the heritage item.</li> <li>- Visual impacts during construction and operation. Existing vistas and view lines from the property would be considered during detailed design, including rehabilitation strategies that are sympathetic to the heritage item.</li> </ul>	<p>Potential minor impact –vibration</p> <p>Minor impact – visual.</p>
		I772	Street trees and bushland	Vibration and settlement (tunnelling)	<p>The eastern end of Alexandria Parade within the Hornsby local government area would be located within the preferred project corridor. However, impacts would be unlikely given that the main alignment tunnels would be located within the M1 Pacific Motorway corridor at this location.</p> <p>Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement during and after construction, however this would be less than five millimetres, which is considered to be negligible.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures.</li> </ul>	Potential negligible impact.

Impact area	LEP / Ordinance	LEP no.	Item	Impact type	Comment	Degree of impact
	Ku-ring-gai Planning Ordinance	C1	Wahroonga Heritage Conservation Area	Visual	<p>The heritage conservation area is located to the east of the M1 Pacific Motorway. Properties that are directly adjacent to but not within the conservation area would be subject to full or partial acquisition due to the widening of the motorway at this location to accommodate the integration of the southbound portal. This would locate road infrastructure closer to the western edge of the heritage conservation area that is currently the case.</p> <p>Visual impacts would be associated with construction (short-term) and operation. For operation, the impacts would be associated with changes to noise walls and loss of screening vegetation. Landscaping would provide screening of the project from the conservation area, once established.</p>	Negligible impact.
		I897	Timber Cottages Group	Vibration (surface works)  Visual	<p>This heritage item would be located near the northern portal of the project with surface works required immediately adjacent to the item on the M1 Pacific Motorway.</p> <p>Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Vibration impacts during surface construction, however surface works would adhere to safe working distances. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> <li>- Visual impacts during construction and operation. Existing vistas and view lines from the property would be considered during detailed design, including rehabilitation strategies that are sympathetic to the heritage item.</li> </ul>	Potential minor impact – vibration.  Minor impact – visual.

Impact area	LEP / Ordinance	LEP no.	Item	Impact type	Comment	Degree of impact
		1898	Timber Cottages Group	Vibration (surface works)  Visual	<p>This item would be located near the northern portal of the project with surface works required immediately adjacent to the item on the M1 Pacific Motorway.</p> <p>Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Vibration impacts during surface construction, however surface works would adhere to safe working distances. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> <li>- Visual impacts during construction and operation. Existing vistas and view lines from the property would be considered during detailed design, including rehabilitation strategies that are sympathetic to the heritage item.</li> </ul>	<p>Potential minor impact – vibration.</p> <p>Minor impact – visual.</p>
		1900	Timber Cottages Group	Vibration (surface works)  Visual	<p>This heritage item would be located near the northern portal of the project with surface works required immediately adjacent to the item on the M1 Pacific Motorway.</p> <p>Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Vibration impacts during surface construction, however surface works would adhere to safe working distances. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> <li>- Visual impacts during construction and operation. Existing vistas and view lines from the property would be considered during detailed design, including rehabilitation strategies that are sympathetic to the heritage item.</li> </ul>	<p>Potential minor impact – vibration.</p> <p>Minor impact – visual.</p>

Impact area	LEP / Ordinance	LEP no.	Item	Impact type	Comment	Degree of impact
		I901	Timber Cottages Group	Vibration (surface works)  Visual	<p>This heritage item would be located near the northern portal of the project with surface works required immediately adjacent to the item on the M1 Pacific Motorway.</p> <p>Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Vibration impacts during surface construction, however surface works would adhere to safe working distances. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> <li>- Visual impacts during construction and operation. Existing vistas and view lines from the property would be considered during detailed design, including rehabilitation strategies that are sympathetic to the heritage item.</li> </ul>	<p>Potential minor impact – vibration.</p> <p>Minor impact – visual.</p>
		I902	Timber Cottages Group	Vibration (surface works)  Visual	<p>Despite being listed on the current Ku-ring-gai Planning Scheme Ordinance, the current state of the property is not consistent with the listed heritage item description. Ku-ring-gai Municipal Council has resolved to recommend its removal from Schedule 5 of the Draft Ku-ring-gai LEP to the Department of Planning and Infrastructure.</p>	Negligible impact.

Impact area	LEP / Ordinance	LEP no.	Item	Impact type	Comment	Degree of impact
		I953	"Bolton Grange" Dwelling House	Vibration and settlement (tunnelling)  Visual	<p>This item would be located above the on-ramp and off-ramp portals on the M1 Pacific Motorway / Pennant Hills Road connector and would lie directly above the on-ramp and off-ramp tunnels. The northern interchange compound (C9) would also be located directly adjacent to the property boundary.</p> <p>Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement during and after construction, however this would be 10 millimetres or less, which may result in cosmetic damage only.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> <li>- Visual impacts from vegetation clearance and the introduction of new infrastructure. Re-vegetation of the area would occur following construction which would limit potential long-term visual impacts. Existing vistas and view lines from the property would be considered during detailed design, including rehabilitation strategies that are sympathetic to the heritage item.</li> </ul>	<p>Potential minor impact – vibration and settlement.</p> <p>Minor impact – visual.</p>

Impact area	LEP / Ordinance	LEP no.	Item	Impact type	Comment	Degree of impact
		1955	"Matakana" Dwelling House	Vibration and settlement (tunnelling)  Visual	<p>The property would be located within the preferred project corridor.</p> <p>Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement during and after construction, however this would be less than five millimetres, which is considered to be negligible.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> <li>- Permanent visual impacts associated with surface works at the northern interchange are unlikely given the distance to these areas (over 250 metres) and presence of surrounding residential properties and vegetation. Temporary visual impacts would also unlikely be significant for the same reasons.</li> </ul>	<p>Potential negligible impact – vibration and settlement.</p> <p>Negligible impact – visual.</p>

Impact area	LEP / Ordinance	LEP no.	Item	Impact type	Comment	Degree of impact
		I956	"Cullingral" Dwelling House	Vibration and settlement (tunnelling)  Visual	<p>This item would be located above the on-ramp and off-ramp portals on the M1 Pacific Motorway connector and would lie directly above the ramps to the main alignment tunnels. The northern interchange compound (C9) would also be located near item.</p> <p>Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement during and after construction, however this would be 10 millimetres or less, which may result in cosmetic damage only.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> <li>- Visual impacts however adjacent properties are likely to screen views to the project from this property. Existing vistas and view lines from the property would be considered during detailed design, including rehabilitation strategies that are sympathetic to the heritage item.</li> </ul>	<p>Potential minor impact – vibration and settlement.</p> <p>Minor impact – visual.</p>
		I1012	"Poole House" Dwelling House	Vibration and settlement (tunnelling)	<p>The property would be located within the preferred project corridor. Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement during and after construction, however this would be less than five millimetres, which is considered to be negligible.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> </ul>	Potential negligible impact.

Impact area	LEP / Ordinance	LEP no.	Item	Impact type	Comment	Degree of impact
	Draft Ku-ring-gai LEP	I855	Dwelling House	Vibration (surface works)	Part of the property would be located within 50 metres of cut-and-cover sections of the northern portal.	Potential minor impact – vibration.
				Visual	<p>Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Vibration impacts during surface construction, however surface works would adhere to safe working distances. Vibration levels are anticipated to be below potential damage levels relevant to heritage structures. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> <li>- Visual impacts during construction and operation primarily due to the widening of the existing M1 Pacific Motorway corridor at this location and changes to noise walls. However, this impact would be minimised due to the screening effect from surrounding residential developments.</li> </ul>	Minor impact – visual.



Impact area	LEP / Ordinance	LEP no.	Item	Impact type	Comment	Degree of impact
		I954	Dwelling House	Vibration and settlement (tunnelling)  Visual	<p>The property would be located within the preferred project corridor.</p> <p>Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement during and after construction, however this would be less than five millimetres, which is considered to be negligible.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> <li>- Permanent visual impacts associated with surface works at the northern interchange are unlikely given the distance to these areas (over 250 metres) and presence of surrounding residential properties and vegetation. Existing properties would also likely obscure temporary visual impacts associated the northern interchange compound (C9).</li> </ul>	<p>Potential negligible – vibration and settlement.</p> <p>Negligible – visual.</p>

Impact area	LEP / Ordinance	LEP no.	Item	Impact type	Comment	Degree of impact
		I957	"Mansfield" Dwelling House	Vibration and settlement (tunnelling)  Visual	<p>This heritage item would be located near the on and off-ramp portals on the M1 Pacific Motorway / Pennant Hills Road connector and would lie directly above the on and off-ramp tunnels. The northern interchange compound (C9) would also be located near item.</p> <p>Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement impacts during and after construction, however this would be five millimetres or less, which is considered to be negligible.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> <li>- Visual impacts during construction and operation. However this would be reduced in part due the screening effect of surrounding residential developments. Existing vistas and view lines from the property would be considered during detailed design, including rehabilitation strategies that are sympathetic to the heritage item.</li> </ul>	<p>Potential minor impact – vibration and settlement.</p> <p>Minor impact – visual.</p>

Impact area	LEP / Ordinance	LEP no.	Item	Impact type	Comment	Degree of impact
		1959	"Hindfell" Dwelling House	Vibration and settlement (tunnelling)	The property would be located within the preferred project corridor.	Potential negligible impact – vibration and settlement.
				Visual	Potential impacts may include:	
				At-property Acoustic treatment	<ul style="list-style-type: none"> <li>- Settlement during and after construction, however this would be less than five millimetres, which is considered to be negligible.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> <li>- No significant permanent change to visual context given the presence of the existing motorway. Potential for temporary visual impacts while construction works are undertaken within the existing motorway corridor.</li> <li>- Potential direct impacts due to eligibility for at-property acoustic treatment. The need for acoustic treatment at this property would be confirmed during detailed design, in consultation with the landowner, and with consideration of potential impacts to heritage values.</li> </ul>	<p>Negligible impact – visual.</p> <p>Potential impact depending on required treatment – At-property acoustic treatment.</p>

Impact area	LEP / Ordinance	LEP no.	Item	Impact type	Comment	Degree of impact
		I960	Dwelling House	Vibration and settlement (tunnelling)  Visual	<p>This heritage item would be located above the on and off-ramp portals on the M1 Pacific Motorway / Pennant Hills Road connector and would lie directly above the on and off-ramp tunnels. The northern interchange compound (C9) would also be located near item.</p> <p>Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement during and after construction, however this would be 10 millimetres or less, which may result in cosmetic damage only.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> <li>- Visual impacts during and after construction, however this would be reduced in part by distance and the screening effect of surrounding residential developments. Existing vistas and view lines from the property would be considered during detailed design, including rehabilitation strategies that are sympathetic to the heritage item.</li> </ul>	<p>Potential minor impact – vibration and settlement.</p> <p>Minor impact – visual.</p>

Impact area	LEP / Ordinance	LEP no.	Item	Impact type	Comment	Degree of impact
Southern interchange	Hornsby LEP	I791	House	Vibration and settlement (tunnelling)	This heritage item would be located near the southern interchange and would lie directly above the northbound on-ramp tunnel from Pennant Hills Road.	Potential minor impact – vibration and settlement.
				Vibration (surface works)	Potential impacts may include:	Minor impact – visual.
				Visual	<ul style="list-style-type: none"> <li>- Settlement during or after construction, however this would be five millimetres or less, which is considered to be negligible.</li> <li>- Vibration impacts during tunnelling and surface construction, however: <ul style="list-style-type: none"> <li>• Vibration levels from tunnelling are anticipated to be below potential damage levels relevant to heritage structures.</li> <li>• Surface works would adhere to safe working distances</li> </ul> </li> <li>- An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> <li>- Visual impact during construction and operation. This would be reduced in part, due to the large brick wall surrounding the property.</li> </ul>	

Impact area	LEP / Ordinance	LEP no.	Item	Impact type	Comment	Degree of impact
		I138	Pennant Hills Golf Club—grounds	Vibration and settlement (tunnelling)  Visual	<p>The main alignment tunnels would pass directly underneath the golf course. Potential impacts to heritage values would be largely avoided as the project would not be located near the golf club house or club entry.</p> <p>Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement within the western fairways during and after construction, however this would be 10 millimetres or less, which may result in cosmetic changes only.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures.</li> <li>- Visual impact during construction and operation. However existing vegetation along the perimeter of the golf course would not be impacted and would effectively screen construction activities and operational buildings from the golf course.</li> </ul>	<p>Potential minor impact – vibration and settlement.</p> <p>Minor impact – visual.</p>

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## 9.0 Mitigation and management

Mitigation and management measures have been recommended for where there is the potential for loss of heritage value. The recommended measures are presented in **Table 8** and would be developed further on a case by case basis during detailed design with consideration to the final areas of disturbance. The final suite of mitigation and management measures would be documented within a construction environmental management plan(s) for the project.

**Table 8 Recommended mitigation and management measures**

Potential impact	Mitigation and management measures
General construction impacts	<p>In the event of an unexpected cultural heritage find, the Standard Management Procedure – Unexpected Archaeological Finds (Roads and Maritime, 2012) would be followed. This would include notification to the NSW Heritage Division.</p> <p>Construction personnel would be made aware of non-Aboriginal heritage sites as part site inductions.</p>
Demolition of listed items	<p>Demolition of late 20<sup>th</sup> century items associated with the Thornleigh Maltworks (A66) would be undertaken. The original germination structure would be maintained.</p> <p>Prior to demolition:</p> <ul style="list-style-type: none"> <li>- A structural assessment of the germination structure would be conducted to ascertain the possible impact of the demolition of adjacent structures to identify suitable mitigation methods to ensure the germination structure remains intact. Additional measures would be identified and implemented, if required, to treat the newly exposed surfaces of the germination structure to protect it from the elements as a result of the demolition of adjacent structures.</li> <li>- Archival recording of the industrial site would be undertaken to record the connection of the original structures to the modern upgraded structures.</li> <li>- A program of archaeological test excavation would also be undertaken to assess the archaeological potential of identifying evidence of the early malting industry in this area, the relationship of the industrial site to the urban site and evidence of the occupation of the Manager's House by the Chilvers family.</li> </ul>
Removal of heritage listed vegetation	<p>Feasible and reasonable options for the relocation of the two mature Canary Island Palms (I762) would be investigated during detailed design.</p> <p>If the trees cannot be relocated:</p> <ul style="list-style-type: none"> <li>- Archival samples would be collected in accordance with NSW Royal Botanic Gardens collection procedures.</li> <li>- Options would be investigated to collect seed samples for later propagation.</li> <li>- Oral histories (if relevant) would be obtained.</li> </ul> <p>Feasible and reasonable options to avoid direct impacts to identified heritage listed vegetation along Woonona Ave, Wahroonga (I769) would be investigated during detailed design.</p> <p>If impacts cannot be avoided:</p> <ul style="list-style-type: none"> <li>- The street frontage would be revegetated in consultation with the landowner (Hornsby Shire Council).</li> <li>- Plantings that are representative species of the Blue Gum High Forest ecological community would be considered.</li> </ul>



Potential impact	Mitigation and management measures
Construction vibration and / or ground settlement	<p>Where non-Aboriginal heritage items have been identified as having the potential to be impacted by construction vibration or ground settlement, the following would be implemented:</p> <ul style="list-style-type: none"> <li>- A ground settlement assessment would be undertaken during detailed design to confirm predicted impacts on heritage structures.</li> <li>- Completion of existing condition surveys prior to the commencement of construction for heritage items within the project corridor or that have been identified during detailed design to be within recommended safe working distances to surface works. A post-construction condition survey would also be undertaken of these items to identify if impacts have occurred.</li> </ul> <p>Additional feasible and reasonable mitigation and management measures to be implemented would be identified based on the above assessments. This would include the use of vibration monitoring where recommended maximum levels are predicted to be exceeded. The placement of vibration monitors would consider the heritage fabric of the item.</p>
Impacts to North Wahroonga heritage conservation area and Beecroft-Cheltenham heritage conservation area	Landscaping of ancillary infrastructure sites would be undertaken with consideration of the heritage values of the Wahroonga North heritage conservation area and Beecroft Cheltenham heritage conservation area.
Impacts to heritage values due to changes in views (construction)	The heritage values of items I771, I953, I956 and I957 (including views and vistas from the items) would be considered during the detailed design of built elements of the project and the development of the landscaping plan.
Impacts to heritage values due to changes in views (operation)	The heritage values of items I771, I953, I956 and I957 (including views and vistas from the items) would be considered during the detailed design of built elements of the project and the development of the landscaping plan.

## 10.0 Statement of heritage impact

Statements of heritage impact (refer to **Table 9**) have been prepared for the following:

- Directly impacted items.
- Potentially directly impacted items with an impact rating of minor or significant.
- Indirectly impacted items with an impact rating of minor or significant.

For the three items that may be eligible for at-property acoustic treatment, the need and type of treatment would be confirmed during detailed design. Consideration of the potential impacts on the heritage values of the property as a result of acoustic treatment, if required, would be considered during detailed design. Any such treatment would be sympathetic to the heritage values and would need to be undertaken in accordance with the Burra Charter.

**Table 9 Statement of Heritage Impacts**

LEP / Ordinance	LEP no.	Item	Impact area	Impact type	Statement of heritage impact
Hornsby LEP	C2	Beecroft-Cheltenham heritage conservation area	Wilson Road compound (C6)  Wilson Road tunnel support facility  Main alignment tunnels	Change in heritage conservation area values	Impacts to heritage values within the conservation area would be localised to specific areas already associated with major transport network infrastructure.  The overall heritage value of the conservation heritage area would not be significantly impacted by the project and associated works.
Hornsby LEP	C8	Wahroonga North heritage conservation area	Northern interchange	Change in heritage conservation area values	Impacts to heritage values within the conservation area would be localised to specific areas already associated with major transport network infrastructure.  The overall heritage value of the conservation heritage area would not be significantly impacted by the project and associated works.

LEP / Ordinance	LEP no.	Item	Impact area	Impact type	Statement of heritage impact
Hornsby LEP	I138	Pennant Hills Golf Course – grounds	Southern interchange	Vibration and settlement (tunnelling)  Visual	<p>Pennant Hills Golf Course would be located across from the southern interchange area. The main alignment tunnels would pass directly underneath the golf course. Potential impacts to heritage values would be largely avoided as the project would not be located near the golf club house or club entry.</p> <p>Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement within the western fairways during and after construction, however this would be 10 millimetres or less, which may result in cosmetic changes only.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures.</li> <li>- Visual impact during construction and operation, however existing vegetation along the perimeter of the golf course would not be impacted and would effectively screen construction activities and operational buildings from the golf course.</li> </ul> <p>The overall heritage value of the listed item would not be affected by the project and associated works.</p>
Hornsby LEP	A66	Remains of Maltworks	Thornleigh Maltworks compound (C8)	Demolition of Structures	<p>Overall, there would be a moderate impact to the heritage significance of the item. Direct impact would occur through the demolition of some structures within the curtilage of this item which would change the context of the original use of the site. Although, except for the Manager's House, the remaining structures to be demolished have no intrinsic heritage value apart from their connection to the site as a whole. This would change the context of the original use of the site. The retention of one of the original structures (the germination building) on site would have a minor positive outcome.</p>
Hornsby LEP	I762	Garden	Northern interchange	Acquisition  Heritage vegetation removal	<p>The two heritage listed trees would be removed during construction of the project, resulting in a direct loss of heritage value for this item.</p> <p>Options to avoid direct impacts or identify appropriate areas for potential relocation would be investigated during the detailed design phase. In the event that a feasible and reasonable option to relocate the trees cannot be identified, there would be a direct loss of the heritage item. In this event seed collection and archival samples would be undertaken.</p>

LEP / Ordinance	LEP no.	Item	Impact area	Impact type	Statement of heritage impact
Hornsby LEP	1769	Street trees	Northern interchange	Heritage vegetation removal	<p>The trees identified in this streetscape are reflective of the original floral biota of this area. The identified impacts to this area as a result of the project would be restricted to the southern portion (around 100 square metres or one per cent of the total area) of the listed curtilage for this streetscape.</p> <p>Measures to avoid direct impacts to the specific listed vegetation would be investigated during the detailed design phase in order to minimise potential impacts to the item's heritage value. If avoidance is not feasible or reasonable, some impact to the overall heritage value of this item would occur. However this would be mitigated through sympathetic plantings of similar species as part of landscaping / revegetation of the site following completion of construction.</p>
Hornsby LEP	1770	"Cherrygarth" and garden	Northern interchange and northern ventilation facility	Vibration and settlement (tunnelling)  Vibration (surface works)  Visual	<p>This heritage item would be located opposite the northern ventilation facility.</p> <p>Noise walls and landscaping would provide some visual screening between the project and the heritage item, once established. However, the taller components of the northern ventilation facility would be located further north and may be visible above the noise walls.</p> <p>Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement during and after construction, however this would be less than five millimetres, which would be negligible.</li> <li>- Vibration impacts during tunnelling and surface construction, however:               <ul style="list-style-type: none"> <li>• Vibration levels from tunnelling are anticipated to be below potential damage levels relevant to heritage structures.</li> <li>• Surface works would adhere to safe working distances.</li> </ul> </li> <li>- An existing condition survey and a program of monitoring would be undertaken to identify early potential risks to the heritage item.</li> <li>- Visual impacts during construction and operation. Existing vistas and view lines from the property would be considered during detailed design, including rehabilitation strategies that are sympathetic to the heritage item.</li> </ul> <p>The overall heritage value of the listed item would not be affected by the project and associated works.</p>

LEP / Ordinance	LEP no.	Item	Impact area	Impact type	Statement of heritage impact
Hornsby LEP	I771	"Neringala" and garden. Dwelling house	Northern interchange and northern ventilation facility	Vibration (surface works)  Visual	<p>This heritage item would be located directly opposite the northern ventilation facility.</p> <p>Noise walls and landscaping would provide some visual screening between the project and the heritage item, once established. However, the taller components of the northern ventilation facility would be located further north and may be visible above the noise walls.</p> <p>Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Vibration impacts during surface construction, however surface works would adhere to safe working distances. An existing condition survey and a program of monitoring would be undertaken to identify early potential risks to the heritage item.</li> <li>- Visual impacts during construction and operation. Existing vistas and view lines from the property would be considered during detailed design, including rehabilitation strategies that are sympathetic to the heritage item.</li> </ul> <p>The overall heritage value of the listed item would not be affected by the project and associated works.</p>

LEP / Ordinance	LEP no.	Item	Impact area	Impact type	Statement of heritage impact
Hornsby LEP	1791	House	Southern interchange	Vibration and settlement (tunnelling)  Vibration (surface works)  Visual	<p>This heritage item would be located near the southern interchange and would be located directly above the northbound on-ramp tunnel from Pennant Hills Road.</p> <p>Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement during or after construction, however this would be five millimetres or less, which would be negligible.</li> <li>- Vibration impacts during tunnelling and surface construction, however:               <ul style="list-style-type: none"> <li>• Vibration levels from tunnelling are anticipated to be below potential damage levels relevant to heritage structures.</li> <li>• Surface works would adhere to safe working distances</li> </ul> </li> <li>- An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> <li>- Visual impact during construction and operation. This would be reduced, in part, due to the large brick wall surrounding the property.</li> </ul> <p>The overall heritage value of the listed item would not be affected by the project and associated works.</p>
Ku-ring-gai Planning Ordinance	1897	Timber Cottages Group	Northern interchange	Vibration (surface works)  Visual	<p>This heritage item would be located near the northern portals of the project with surface works required immediately adjacent to the item on the M1 Pacific Motorway.</p> <p>Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Vibration impacts during surface construction, however surface works would adhere to safe working distances. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> <li>- Visual impacts during construction and operation. Existing vistas and view lines from the property would be considered during detailed design, including rehabilitation strategies that are sympathetic to the heritage item.</li> </ul> <p>The overall heritage value of the listed item would not be affected by the project and associated works.</p>

LEP / Ordinance	LEP no.	Item	Impact area	Impact type	Statement of heritage impact
Ku-ring-gai Planning Ordinance	1898	Timber Cottages Group	Northern interchange	Vibration (surface works)  Visual	<p>This heritage item would be located near the northern portals of the project with surface works required immediately adjacent to the item on the M1 Pacific Motorway.</p> <p>Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Vibration impacts during surface construction, however surface works would adhere to safe working distances. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> <li>- Visual impacts during construction and operation. Existing vistas and view lines from the property would be considered during detailed design, including rehabilitation strategies that are sympathetic to the heritage item.</li> </ul> <p>The overall heritage value of the listed item would not be affected by the project and associated works.</p>
Ku-ring-gai Planning Ordinance	1900	Timber Cottages Group	Northern interchange	Vibration (surface works)  Visual	<p>This heritage item would be located near the northern portals of the project with surface works required immediately adjacent to the item on the M1 Pacific Motorway.</p> <p>Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Vibration impacts during surface construction, however surface works would adhere to safe working distances. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> <li>- Visual impacts during construction and operation. Existing vistas and view lines from the property would be considered during detailed design, including rehabilitation strategies that are sympathetic to the heritage item.</li> </ul> <p>The overall heritage value of the listed item would not be affected by the project and associated works.</p>

LEP / Ordinance	LEP no.	Item	Impact area	Impact type	Statement of heritage impact
Ku-ring-gai Planning Ordinance LEP	I901	Timber Cottages Group	Northern interchange	Vibration (surface works)  Visual	<p>This item would be located near the northern portals of the project with surface works required immediately adjacent to the item on the M1 Pacific Motorway.</p> <p>Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Vibration impacts during surface construction, however surface works would adhere to safe working distances. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> <li>- Visual impacts during construction and operation. Existing vistas and view lines from the property would be considered during detailed design, including rehabilitation strategies that are sympathetic to the heritage item.</li> </ul> <p>The overall heritage value of the listed item would not be affected by the project and associated works.</p>
Ku-ring-gai Planning Ordinance	I902	Timber Cottages Group	Northern interchange	Vibration (surface works)  Visual	<p>Despite being listed on the current Ku-ring-gai Planning Scheme Ordinance, the current state of the property is not consistent with the listed heritage item description. Ku-ring-gai Municipal Council has resolved to recommend its removal from Schedule 5 of the Draft Ku-ring-gai LEP to the Department of Planning and Infrastructure.</p>



LEP / Ordinance	LEP no.	Item	Impact area	Impact type	Statement of heritage impact
Ku-ring-gai Planning Ordinance	1953	"Bolton Grange" Dwelling House	Northern interchange	<p>Vibration and settlement (tunnelling)</p> <p>Visual</p>	<p>This item would be located above the on-ramp and off-ramp portals on the M1 Pacific Motorway / Pennant Hills Road connector and would lie directly above the on-ramp and off-ramp tunnels. The northern interchange compound would also be located directly adjacent to the property boundary.</p> <p>Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement during and after construction, however this would be 10 millimetres or less, which may result in cosmetic damage only.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> <li>- Visual impacts from vegetation clearance and the introduction of new infrastructure. Re-vegetation of the area would occur following construction which would limit potential long-term visual impacts. Existing vistas and view lines from the property would be considered during detailed design, including rehabilitation strategies that are sympathetic to the heritage item.</li> </ul> <p>The overall heritage value of the listed item would not be affected by the project and associated works.</p>

LEP / Ordinance	LEP no.	Item	Impact area	Impact type	Statement of heritage impact
Ku-ring-gai Planning Ordinance	1956	"Cullingral" Dwelling House	Northern interchange	Vibration and settlement (tunnelling)  Visual	<p>This heritage item would be located above the on-ramp and off ramp portals on the M1 Pacific Motorway connector and would lie directly above the ramps to the main alignment tunnels. The northern interchange compound (C9) would also be located near the item.</p> <p>Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement during and after construction, however this would be 10 millimetres or less, which may result in cosmetic damage only.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> <li>- Visual impacts however adjacent properties are likely to screen views to the project from this property. Existing vistas and view lines from the property would be considered during detailed design, including rehabilitation strategies that are sympathetic to the heritage item.</li> </ul> <p>The overall heritage value of the listed item would not be affected by the project and associated works.</p>
Draft Ku-ring-gai LEP	1855	Dwelling House	Northern interchange	Vibration (surface works)  Visual	<p>Part of the property would be located within 50 metres of cut-and-cover sections of the northern portal.</p> <p>Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Vibration impacts during surface construction, however surface works would adhere to safe working distances. Vibration levels are anticipated to be below potential damage levels relevant to heritage structures. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> <li>- Visual impacts during construction and operation primarily due to the widening of the existing M1 Pacific Motorway corridor at this location and changes to noise walls. However, this impact would be minimised due to the screening effect from surrounding residential developments.</li> </ul> <p>The overall heritage value of the listed item would not be affected by the project and associated works.</p>

LEP / Ordinance	LEP no.	Item	Impact area	Impact type	Statement of heritage impact
Draft Ku-ring-gai LEP	1957	"Mansfield" Dwelling House	Northern interchange	<p>Vibration and settlement (tunnelling)</p> <p>Visual</p>	<p>This heritage item would be located near the on and off-ramp portals on the M1 Pacific Motorway / Pennant Hills Road connector and would lie directly above the on-ramp and off-ramp tunnels. The northern interchange compound would also be located near the item.</p> <p>Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement impacts during and after construction, however this would be five millimetres or less, which is considered to be negligible.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> <li>- Visual impacts during construction and operation. However this would be reduced in part due the screening effect of surrounding residential developments. Existing vistas and view lines from the property would be considered during detailed design, including rehabilitation strategies that are sympathetic to the heritage item.</li> </ul> <p>The overall heritage value of the listed item would not be affected by the project and associated works.</p>

LEP / Ordinance	LEP no.	Item	Impact area	Impact type	Statement of heritage impact
Draft Ku-ring-gai LEP	1960	Dwelling House	Northern interchange	<p>Vibration and settlement (tunnelling)</p> <p>Visual</p>	<p>This heritage item would be located above the on-ramp and off-ramp portals on the M1 Pacific Motorway / Pennant Hills Road connector and would lie directly above the on-ramp and off-ramp tunnels. The northern interchange compound would also be located near item.</p> <p>Potential impacts may include:</p> <ul style="list-style-type: none"> <li>- Settlement during and after construction, however this would be 10 millimetres or less, which may result in cosmetic damage only.</li> <li>- Vibration impacts during tunnelling. However, vibration levels are anticipated to be below potential damage levels relevant to heritage structures. An existing condition survey and a program of monitoring would also be undertaken to identify early potential risks to the heritage item.</li> <li>- Visual impacts during and after construction, however this would be reduced in part by distance and the screening effect of surrounding residential developments. Existing vistas and view lines from the property would be considered during detailed design, including rehabilitation strategies that are sympathetic to the heritage item.</li> </ul> <p>The overall heritage value of the listed item would not be affected by the project and associated works.</p>

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## 11.0 Key findings and recommendations

Within the study area, 62 heritage items would be directly or indirectly impacted by the project. In some instances, an item would be directly and indirectly impacted by the project. Of the 62 heritage items:

- One item would be fully and directly impacted with the removal of two Canary Island Palms (Hornsby LEP reference: I762) located within a property that would be partially acquired. Feasible and reasonable options would be investigated during detailed design to relocate the two Canary Island Palms, however, the impacts to this item are likely to be significant.
- Two items would be partially and directly impacted with
  - The demolition of structures associated with the Thornleigh Maltworks site (Hornsby LEP reference: A66). Feasible and reasonable options have been investigated during design of the project to date with the aim of retaining the original industrial structure associated with this site, however, the impacts to the overall site complex are likely to be significant.
  - Impacts to the curtilage of heritage listed street trees at Woonona Avenue, Wahroonga (Hornsby LEP reference: I769). Feasible and reasonable options would be investigated to avoid or minimise the impact. If it is necessary to remove the trees, this would have some impact to the heritage value of the item. This impact could be mitigated through sympathetic plantings of similar species through revegetation efforts.
- Two heritage conservation areas would be partially and directly impacted, being the North Wahroonga heritage conservation area (Hornsby LEP reference: C2), and the Beecroft-Cheltenham heritage conservation area (Hornsby LEP reference: C8). Landscaping of the project within these areas would minimise the potential impacts. The overall heritage value of the heritage conservation areas would not be significantly impacted by the project.
- Eleven items would be potentially directly impacted due to construction vibration from surface works. These impacts are anticipated to have a negligible to minor risk of affecting the value of the heritage items (*Ku-ring-gai Planning Scheme Ordinance 1971* reference: I897, I898, I900, I901 and I902, *Draft Ku-ring-gai Local Environmental Plan 2013* reference: I855, and Hornsby LEP reference: I767, I750, I770, I771, and I791). The degree of impact to these items is anticipated to be minor to negligible. The overall heritage value of the heritage items would not be significantly impacted by the project.
- Forty-four items would be potentially directly impacted due to vibration, settlement and groundwater drawdown as a result of tunnelling works. These items are primarily located within the preferred project corridor. Impacts to these items are anticipated to be minor to negligible. Two of these items would also be potentially directly impacted by construction vibration due to surface works. The overall heritage value of the heritage items would not be significantly impacted by the project.

Of the 62 heritage items, 21 items may also be indirectly impacted by the project, due to temporary and / or permanent visual impacts. Of the 21 items, 19 items would also be directly impacted as outlined above. Impacts to the heritage items as a result of visual effects are anticipated to be minor to negligible. The overall heritage value of the heritage items would not be significantly impacted by the project.

There is also the potential for directly impacts due to potential eligibility for at-property acoustic treatment. This would be confirmed during detailed design, in consultation with landowners, and with consideration of potential impacts to heritage values.

The potential impacts to heritage items due to ground movement and construction vibration would be confirmed during detailed design. If required, mitigation and management measures to minimise impacts would be investigated, and monitoring undertaken at properties identified as being above recommended criteria. Property dilapidation surveys would also be undertaken for all items located within the preferred project corridor or properties within recommended safe working setbacks.

Mitigation measures are recommended to be developed for the loss of heritage value. It is recommended that these be clearly defined on an item by item basis once the final areas of level of disturbance have been defined during detailed design. The measures would be detailed with the construction management plan.

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