



Transport for NSW

# Heathcote Road bridge widening

Review of Environmental Factors





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Prepared by Aurecon Australasia Pty Ltd (Aurecon) and Transport for NSW

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Transport for NSW Heathcote Road bridge widening Review of Environmental Factors report

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# Document controls

## Approval and authorisation

<b>Title</b>	Heathcote Road bridge widening - Review of Environmental Factors
<b>Accepted on behalf of Transport for NSW by:</b>	Cameron Jordan Project Development Manager
<b>Signed:</b>	
<b>Dated:</b>	4 December 2020

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# Executive summary

## The proposal

Transport for NSW proposes to widen Bridge 152 over the Woronora River (referred to as the Heathcote Road bridge) and its approaches (the proposal). The proposal is located about halfway along Heathcote Road between New Illawarra Road in Lucas Heights and Princes Highway in Heathcote, New South Wales (NSW) within the Sutherland Shire local government area (LGA).

Key features of the proposal include:

- widening of the bridge by about 1.4 metres on each side to provide one wide 3.5 metre lane in each direction with 1.2 metre shoulders
- widening and adjustments to the northern and southern bridge approaches about 250 metres either side of the bridge to improve the road alignment, increase lane and shoulder widths and reinstate the existing breakdown bays either side of the bridge
- new bored-pile retaining walls to support the slope along both bridge approaches, which would be up to two metres high and range in length up to 100 metres
- slope stabilisation measures including rock scaling, shotcreting, rock bolting, rock netting, and vegetation removal
- new and modified drainage infrastructure including replacement and extension of existing cross culvert pipes on the approaches for the widened road pavement, improved drainage gutter along the base of the rock cuttings, new longitudinal drainage outlet at each abutment and scour protection at all discharge points
- adjustments to optical fibre conduits for the length of the proposal area
- repair and maintenance work to the existing bridge structure including:
  - repairs to cracks
  - replacement of all bearings
  - joint replacement
  - application of an anti-carbonation coating on the bridge structure including piers
  - installation of new steel maintenance staircase for side access to the bridge for bridge inspections
- other ancillary work required to support construction of the proposal including two off site construction compounds and establishment of a temporary access track, waterway crossing and crane pads

The proposal would require the full closure of Heathcote Road between New Illawarra Road and the Princes Highway for up to six months during construction due to the constraints of the location including the steep terrain of the surrounding area and narrow width of existing roadway. Construction is proposed to be carried out 24 hours per day, seven days per week to minimise the duration of full road closures required.

It is anticipated that construction would start in late 2021 and take up to two years to complete, subject to weather.

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## Need for the proposal

The Heathcote Road bridge was built during World War II by the military to provide a basic east-west transport route over the Woronora River. The bridge was built with narrow lane widths and steep curved approaches that do not meet current road design standards and provide little room for motorist error, which increases the risk of road incidents. The risk of road incidents is supported by the crash history statistics within 500 metres of the bridge, which include two fatalities and six serious injuries between 2009 and 2019. In 2018, the Minister for Roads, Maritime and Freight announced a commitment to improve the safety of the Heathcote Road bridge due to a history of community concern for motorist safety when crossing the bridge.

The section of Heathcote Road between New Illawarra Road and the Princes Highway is part of the 'A6' road corridor, which is a major arterial road that services north–south journeys for freight and general traffic in Sydney. The strategic phase of the proposal was funded by Transport for NSW's 'Gateway to the South Pinch Point Program', which focuses on short to medium term solutions to improve reliability for road traffic, as the A6 section of Heathcote Road was identified as a key pinch point for traffic within southern Sydney. The proposal has since secured \$73 million funding for development and delivery.

The need for upgrades to the section of Heathcote Road within the A6 road corridor has been identified in several NSW and local government strategic plans and policies. This includes *Future Transport Strategy 2056* (NSW Government, 2018), which specifically lists Heathcote Road improvements as an initiative for investigation. The proposal would contribute to achieving the 'safety and performance' outcome of this strategy as well as form part of the 'safe roads' component of the *Road Safety Plan 2021* (a supporting plan of the *Future Transport Strategy 2056*), which is aimed at reducing fatalities on NSW roads by 30 percent by 2021 (Transport for NSW, 2018a).

## Proposal objectives

The objectives of the proposal are to:

- improve road safety by increasing the road and shoulder lane widths on the Heathcote Road bridge and approaches
- improve network reliability
- deliver a design solution that has the ability to be implemented in the short-term

## Options considered

Transport for NSW identified two strategic options, Heathcote Road bridge duplication (single lane each bridge) or Heathcote Road bridge widening, and a baseline 'do nothing' option. These options were investigated and assessed with respect to development criteria which included property acquisition, environmental impacts, Commonwealth issues, value for money, constructability and whether they could meet the proposal objectives. The Heathcote Road bridge widening option was selected as the preferred option. Despite the bridge duplication option providing slightly greater safety benefits due to the separation of opposing traffic flows, it would result in far more substantial environmental impacts as well as a longer and substantially more complex approval, land acquisition and construction duration compared to the Heathcote Road bridge widening option. The 'do nothing' option would not meet the proposal objectives.

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Following this, Transport for NSW developed three sub-options for the proposal related to different ways to widen the Heathcote Road bridge: widening on one side only supported by new piers, widening on both sides with steel brackets or widening on both sides through headstock expansion. The preferred sub-option was to widen the Heathcote Road bridge on both sides using headstock expansion as it would result in the lowest environmental impacts, property acquisitions, constructability issues and ongoing maintenance needs.

## Statutory and planning framework

The proposal is for the purpose of a road and road infrastructure facilities and is to be carried out by Transport for NSW. In accordance with Clause 94 of the State Environmental Planning Policy (Infrastructure) 2007 (ISEPP), the proposal can therefore be assessed under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). Development consent from council is not required. This REF fulfils Transport for NSW's obligation under Section 5.5 of the EP&A Act including to examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the activity.

An assessment of the proposal concluded that it would not significantly impact on the matters of national environmental significance protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) or significantly affect threatened species or ecological communities and their habitats under the *Biodiversity Conservation Act 2016* (BC Act). Therefore, the proposal is a valid development to be taken forward under Division 5.1 of the EP&A Act and no further planning approval requirements would be triggered under the EPBC Act or BC Act.

## Community and stakeholder consultation

Transport for NSW carried out a targeted community consultation campaign in May and June 2020 for the proposal, which provided an opportunity for early community and stakeholder feedback on the proposal. The campaign involved a letterbox drop, a Facebook video advertisement and live event, posters, an online questionnaire, a media release, dedicated email inbox, and variable message signs. It is noted that the consultation approach for the proposal to date has largely avoided face-to-face consultation activities due to the COVID-19 restrictions and social distancing requirements.

Various government agencies and key stakeholders have been consulted about the proposal via email and phone calls including consultation with (but not limited to):

- National Parks and Wildlife Service in accordance with the ISEPP due to the proposal being located directly adjacent to Heathcote National Park
- DPI Fisheries with regards to the proposed temporary waterway crossing structure
- Heritage NSW due to potential impacts on an item listed on a s170 heritage register
- Aboriginal stakeholders in accordance with the *Procedure for Cultural Heritage Consultation and Investigation* (Roads and Maritime, 2011)

The key issues raised related to the need for measures to protect fauna and flora and their habitat, the proposed road closure during construction and options considered for the proposal design. The issues raised were considered in the proposal design, options assessment and/or addressed in the REF. In particular, Transport for NSW acknowledges the concern regarding the proposed full road closure and are investigating innovations and alternative construction methodologies to minimise the duration and/or eliminate the need for daytime road closures, where possible. Transport for NSW will continue to seek feedback from the local community, Sutherland Shire Council, ANSTO, National Parks and Wildlife, Emergency Services organisations, Heritage NSW and other key stakeholders as the design progresses.

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## Environmental impacts

### Traffic and transport

During construction, the proposal would require the full closure of Heathcote Road between New Illawarra Road and the Princes Highway for up to six months. Most of the traffic that would normally use the Heathcote Road bridge would use the proposed detour route, which would increase traffic volumes on the proposed detour route and increase travel times between New Illawarra Road and the Princes Highway by an average of 29 minutes compared to normal conditions without the road closure.

Transport for NSW would continue to consult with the Transport Management Centre, Emergency Services and other key stakeholders to minimise potential traffic impacts associated with implementation of the proposed detour route as well as any cumulative traffic impacts with the planned Linden Street upgrade. Transport for NSW are also investigating ways to modify the construction methodology to eliminate the need for continuous daytime road closures during certain construction activities, where possible.

During operation, the proposal is expected to result in benefits to road users including:

- increased road safety on the Heathcote Road bridge and its approaches due to the provision of wider traffic lanes and shoulders that meet current road design standards
- improved reliability along the A6 section of Heathcote Road due to the increased lane and shoulder width that would allow vehicles to pass broken-down vehicles or road incidents and minimise the need for larger vehicles to slow on approach to the bridge
- a potential decrease in the frequency of incidents and their associated traffic delays

### Noise and vibration

The potential noise impact of key construction activities was assessed using Transport for NSW's Noise Estimator Tool and based on conservative scenarios. The assessment results indicated that during night time scenarios, the proposal may exceed noise management levels for surrounding residential receivers. However, actual construction noise levels may be lower than predicted due to the topography and dense vegetation. Construction noise would be managed in accordance with the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016), which specifies several standard mitigation measures as well as the need to consider additional mitigation measures for sensitive receivers who are predicted to experience noise levels that would exceed the adopted criteria. Construction verification monitoring would be carried out to confirm accurate construction noise levels and assess the performance of the implemented mitigation measures.

The predicted vibration levels during the construction of the proposal show that during some construction scenarios, larger vibration intensive construction equipment may exceed the adopted vibration criteria for heritage structures at distances of less than 10 metres as well as the maximum night-time levels for residences within 390 metres of construction activities. A Vibration Risk Assessment would evaluate feasible and reasonable mitigation measures to be implemented during construction, such as validation monitoring, specific notifications and equipment substitution to minimise the potential for vibration impacts.

The proposal is not expected to result in any noticeable change in noise or vibration during operation.

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## Biodiversity

The proposal would involve the removal of up to 3.08 hectares of native vegetation, of which 0.05 hectares is consistent with an Endangered Ecological Community (EEC) listed under the *Biodiversity Conservation Act 2016* (BC Act) (Sydney Freshwater Wetlands in the Sydney Basin Bioregion), which could lead to a reduction of threatened fauna habitat within the proposal area. There may also be a risk of fauna injury and mortality from construction movements and disturbance to aquatic habitat during the establishment and use of the temporary waterway crossing. However, it is unlikely that any threatened fauna species would be reliant on the habitat within the proposal area considering the extensive high-quality habitat nearby within Heathcote National Park and Holsworthy Military Reserve.

The proposal has the potential to impact the roosting habitat of Southern Myotis (*Myotis macropus*), which is listed as vulnerable under the BC Act and was recorded within the proposal area during field surveys. A Microbat Management Plan is proposed to manage potential construction impacts on this species. Opportunities to incorporate microbat roosting provisions into the bridge structure would also be investigated during detailed design.

An analysis of relevant literature and koala records indicates that the proposal area is used as a north-south movement corridor for koalas. The proposal provides an opportunity to provide fauna connectivity features under the bridge such as fauna furniture to facilitate Koala crossing beneath the bridge. The final design solution would be confirmed during detailed design in consultation with specialist ecologists.

Overall, the proposal is not likely to significantly impact threatened species, populations, ecological communities or their habitats.

## Water quality and soil

Construction of the proposal has the potential to result in water quality and soil impacts from earthworks, which can result in soil erosion as well as sedimentation of local waterways. The risk of water quality and soil impacts from the establishment of the new temporary access track, crane pads and waterway crossing is particularly notable, as this would involve the disturbance of soil close to the Woronora River and high potential for soil erosion due to the steep gradient and soil erodibility in this area. The inadequate containment of fuels, chemicals, materials and litter from construction activities could result in spills, leaks or localised accumulation of potentially contaminated materials into the surrounding environment. This would need to be carefully managed during activities such as (but not limited to) the operation of plant and equipment above waterways, the application of the anti-carbonation coating for bridge piers, hydro-demolition on the bridge, rock drilling and shotcreting. These potential impacts would be managed in accordance with a Soil and Water Management Plan (SWMP). The SWMP would include site-specific Erosion and Sedimentation Control plans, an emergency spill plan, a stabilisation plan, a surface water quality monitoring program as well as other safeguards and management measures to minimise potential water quality and soil impacts.

Potential impacts on water quality and soil during the operation of the proposal would be minor, and minimised through provision of scour protection at the outlets of stormwater drains and slope stabilisation measures as well as Water Sensitive Urban Design (WSUD) measures to capture and treat runoff from the road corridor, which would be confirmed during detailed design.

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## Hydrology and flooding

Construction of the proposal has the potential to impact hydrology and flooding due to:

- the establishment and use of the new temporary waterway crossing, which would directly alter flow conditions within the Woronora River and has potential to cause:
  - changes in channel velocity and flooding conditions
  - localised erosion and scouring
  - deposition of fine and coarse sediments
  - degradation and/or changes to aquatic habitat
- changes to ground surface levels associated with the temporary access track and laydown area, which may change the flow paths of surface water runoff and drainage
- new areas of hardstand within laydown areas, which may increase surface water runoff

These potential impacts would be temporary, as the waterway crossing structure would be removed and the access track and laydown area would be rehabilitated after construction to return the disturbed areas to pre-existing conditions. In addition, potential impacts associated with the establishment and use of the new temporary waterway crossing have been minimised by designing the waterway crossing to include appropriate pipe outlets, scour protection and flood immunity.

Impacts on hydrology and flooding during operation of the proposal would be negligible, as the headstock expansion methodology would avoid the need for new bridge piers in the waterway.

## Non-Aboriginal heritage

The existing bridge structure is listed on the Roads and Maritime Services s170 heritage register and is recognised as having state significance though not formally listed on the state heritage register. One of the heritage criteria which contributes to heritage significance of the bridge is its aesthetic value. Potential impacts on the aesthetic value of the bridge were minimised through sympathetic bridge design based on heritage advice. The heritage assessment concluded that although the aesthetics of the bridge would be impacted, the adoption of heritage recommendations in the detailed design of the bridge would mitigate the impacts to an acceptable level and would not prevent the bridge from being formally listed in the future. Further safeguards and management measures would be implemented to minimise potential non-Aboriginal heritage impacts, including the preparation of a Conservation Management Plan and carrying out archival recording of the bridge prior to construction.

The assessment also identified a potential minor impact on a small portion of the Commonwealth listed Cubbitch Barta National Estate heritage place, which has both non-Aboriginal and Aboriginal heritage significance, associated with the cutting back of the rock slope.

## Aboriginal cultural heritage

One known Aboriginal cultural heritage site is located in the proposal area, however this site would be avoided during construction through the implementation of a five metre exclusion zone. Additionally, a vibration risk assessment and a Ground Vibration Management Plan will be prepared to manage any indirect risk from vibration generating activities on this site. Therefore, the proposal is not expected to result in any direct or indirect impacts on this site.

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## Other impacts

Other notable impacts associated with the proposal include:

- property impacts from the acquisition of up to 1.5 hectares of land, including partial acquisition of one Crown Land lot and one Crown Waterway from the NSW Government
- landscape character and visual changes associated with the removal of vegetation and the widened bridge structure and approaches
- socio-economic impacts from restricted access to the A6 section of Heathcote Road during construction, which may lead to short-term inconvenience and feelings of severance for the local community, surrounding businesses and stakeholders

## Justification and conclusion

The proposal would involve widening the Heathcote Road bridge and its approaches to achieve compliance with current road safety standards.

The proposal would meet the proposal objectives and need to improve the safety and reliability associated with the use of the Heathcote Road bridge in the short-term. The need for the proposal has been driven by existing community concern for motorist safety and the poor crash history record on the Heathcote Road bridge and its approaches. The proposal is also aligned with several strategic policies and government strategies, such as *Future Transport Strategy 2056* (TfNSW, 2018a) and *Road Safety Plan 2021 – Towards Zero* (NSW Government, 2018a).

Several potential environmental impacts from the proposal have been avoided or reduced during the concept design development and options assessment. However, the proposal would still result in some short-term impacts on traffic, noise and vibration, water quality, hydrology and flooding during construction as well as some longer-term minor biodiversity, non-Aboriginal heritage, property and visual impacts. Environmental safeguards and management measures as detailed in this REF would minimise these expected impacts.

Overall, the proposal is justified on the basis that it best meets the proposal objectives and results in long-term benefits on safety and reliability that would outweigh the potential adverse impacts, which would mainly occur during construction. Moreover, the proposal would not result in any significant negative long-term impacts on society, the biophysical environment or the local economy.

## Display of the review of environmental factors

This REF is on display for comment between Wednesday 9 December 2020 and Wednesday 17 February 2021.

You can access the documents as pdf files on the Transport for NSW website at [nswroads.work/Heathcote](https://nswroads.work/Heathcote).

## How can I make a submission

To make a submission about this proposal, please:

- visit the Heathcote Road Bridge Virtual Information Centre at [nswroads.work/Heathcote](https://nswroads.work/Heathcote)
- email us at [HeathcoteRoadBridge@transport.nsw.gov.au](mailto:HeathcoteRoadBridge@transport.nsw.gov.au)

All submissions must be received by Wednesday 17 February 2021.

Submissions will be managed in accordance with the [Transport for NSW Privacy Statement](#).

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## What happens next

Transport for NSW will collate and consider the submissions received during public display of the REF.

After this consideration, Transport for NSW will determine whether or not the proposal should proceed as proposed and will inform the community and stakeholders of this decision.

If the proposal is determined to proceed, Transport for NSW will continue to consult with the community and stakeholders prior to and during construction.

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# 1 Introduction

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## 1.1 Proposal identification

Transport for NSW proposes to widen Bridge 152 over the Woronora River (referred to as the Heathcote Road bridge) and its approaches (the proposal).

The proposal is located about halfway along a 5.4 kilometre long section of Heathcote Road between New Illawarra Road in Lucas Heights and Princes Highway in Heathcote, New South Wales (NSW) within the Sutherland Shire local government area (LGA). This section of Heathcote Road is located within the 'A6 road corridor', which is a major arterial route that extends from Carlingford in the north to Heathcote in the south and services north–south journeys for freight and general traffic in Sydney. This section of Heathcote Road also currently serves as the main connection for the residential and commercial areas of Heathcote, Engadine and Lucas Heights. Key land uses surrounding the proposal include Heathcote National Park, Commonwealth Defence land associated with Holsworthy Military Barracks, the Australian Nuclear Science and Technology Organisation (ANSTO) at Lucas Heights and Crown Land.

Figure 1-1 shows the location of the proposal.

The proposal is required to improve safety on the bridge and approaches as the existing narrow road lanes and shoulders do not meet current road design standards. The need for the proposal has also been driven by the poor crash history record on the bridge and its approaches (refer to Section 2.1.1).

Key features of the proposal include:

- widening of the bridge by about 1.4 metres on each side to provide one wide 3.5 metre lane in each direction with 1.2 metre shoulders
- widening and adjustments to the northern and southern bridge approaches about 250 metres either side of the bridge to improve the road alignment, increase lane and shoulder widths and reinstate the existing breakdown bays either side of the bridge
- new bored-pile retaining walls to support the slope along both bridge approaches, which would be up to two metres high and range in length up to 100 metres
- slope stabilisation measures including rock scaling, shotcreting, rock bolting, rock netting, and vegetation removal
- new and modified drainage infrastructure including replacement and extension of existing cross culvert pipes on the approaches for the widened road pavement, improved drainage gutter along the base of the rock cuttings, new longitudinal drainage outlet at each abutment and scour protection at all discharge points
- adjustments to optical fibre conduits for the length of the proposal area
- repair and maintenance work to the existing bridge structure including:
  - repairs to cracks
  - replacement of all bearings
  - joint replacement
  - application of an anti-carbonation coating on the bridge structure including piers
  - installation of new steel maintenance staircase for side access to the bridge for bridge inspections

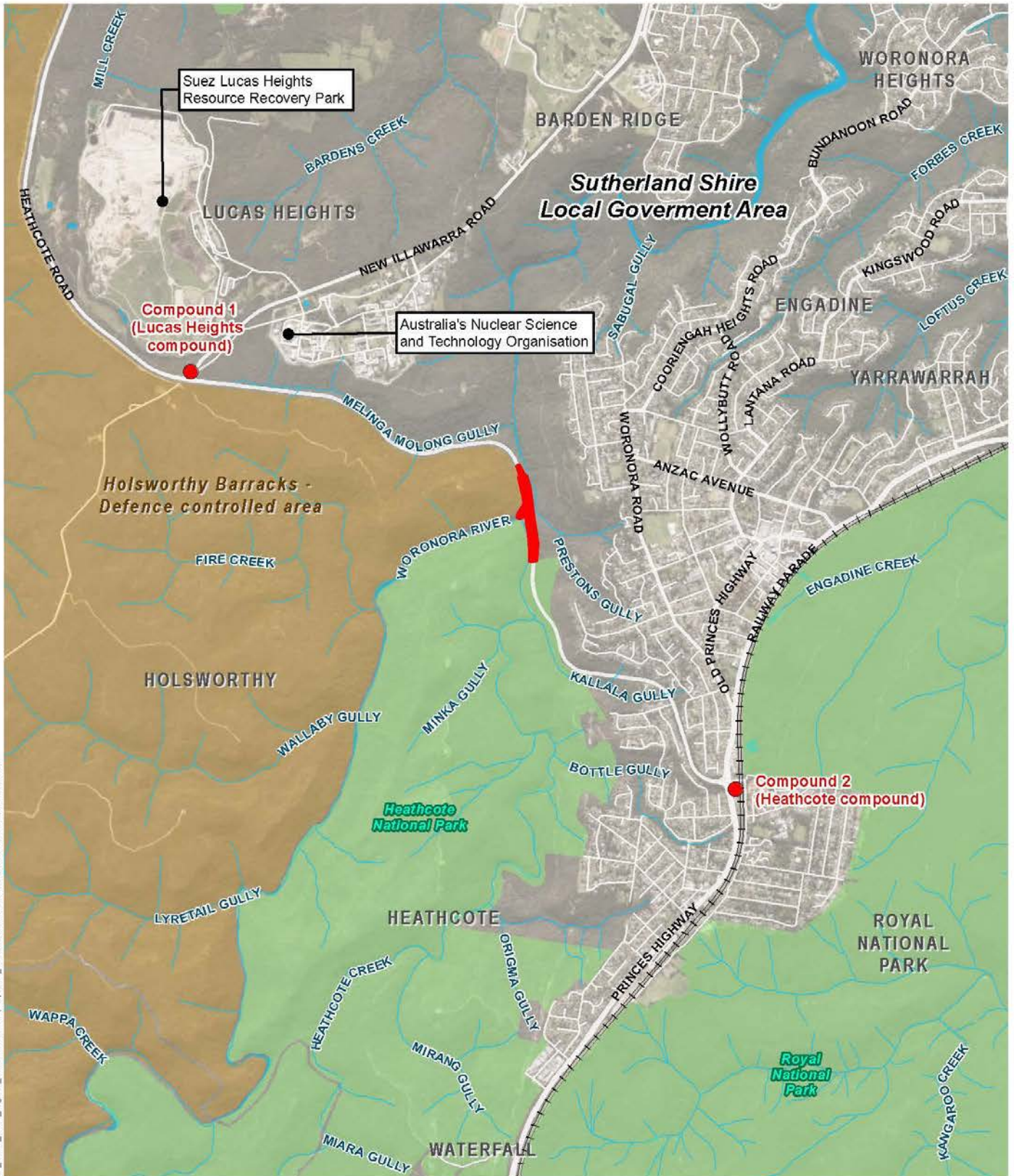
- other ancillary work required to support construction of the proposal including two off site construction compounds and establishment of a temporary access track, waterway crossing and crane pads

Construction of the proposal is expected to start in late 2021 and be completed by mid 2023.

An overview of the key features of the proposal is provided in Figure 1-2. Chapter 3 (Description of the proposal) describes the proposal in more detail.

The Heathcote Road bridge is surrounded by steep cliffs, due to its location within the Woronora River valley, and has limited visibility to the surrounding residential areas, which are a few hundred metres away and at higher elevations.



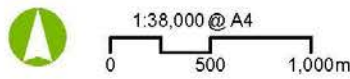


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- Proposal area
- Holsworthy Barracks - Defence controlled area
- National park
- Watercourses



Source: Aurecon, TfNSW, Spatial Services, Esri

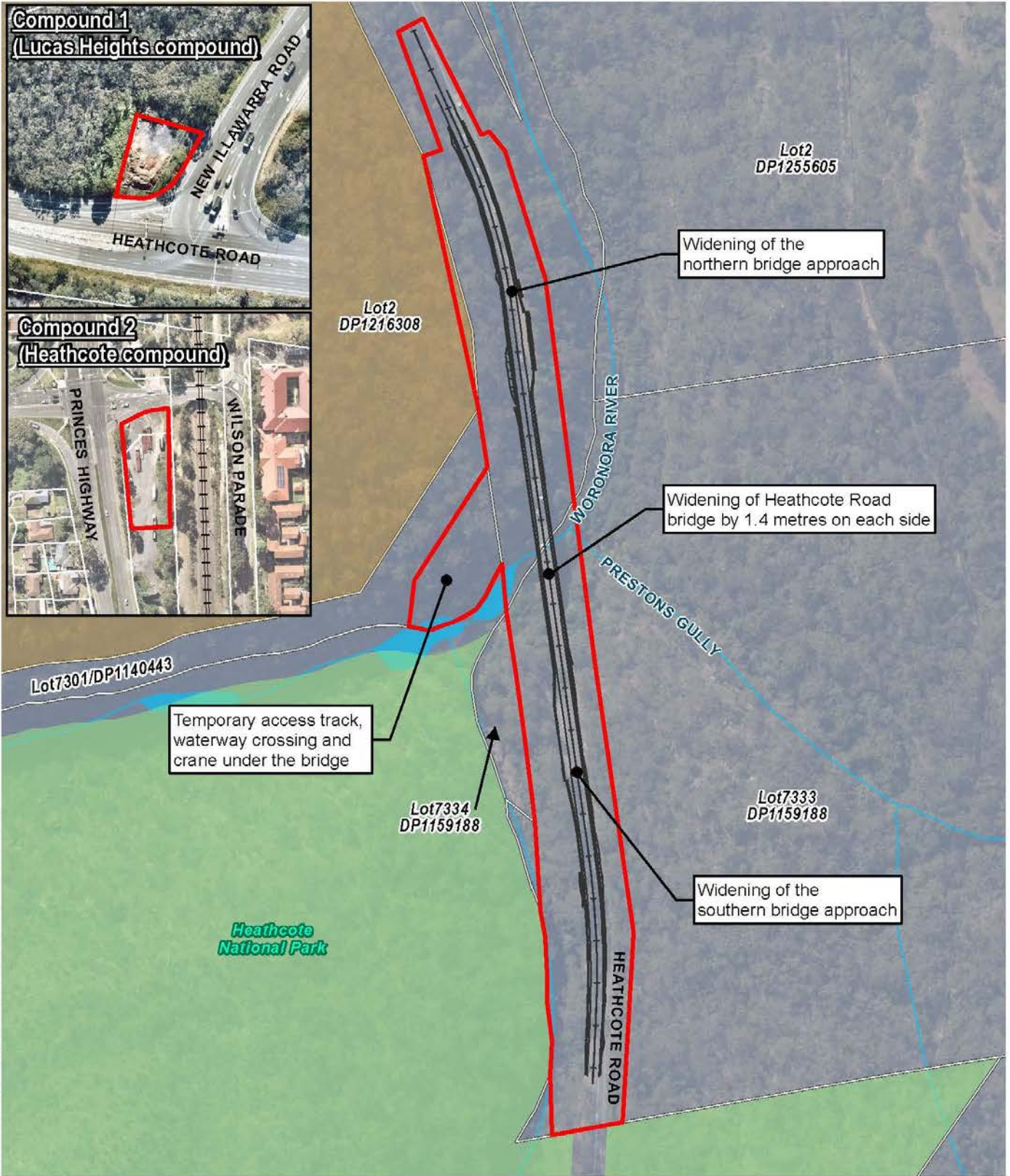


Projection: GDA 1994 MGA Zone 56

**Heathcote Road bridge widening REF**

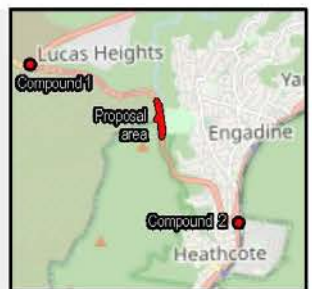
**FIGURE 1-1:** Location of the proposal



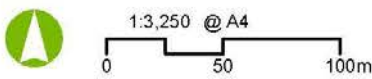


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- Proposal area
- Indicative design (subject to detailed design)
- Holsworthy Barracks - Defence controlled area
- National park
- Lot
- Watercourses
- Water bodies



Source: Aurecon, TfNSW, Spatial Services, Esri



Projection: GDA 1994 MGA Zone 58

**Heathcote Road bridge widening REF**

**FIGURE 1-2: The proposal**

## 1.2 Purpose of the report

This review of environmental factors (REF) has been prepared by Aurecon Australasia Pty Ltd (Aurecon) on behalf of Transport for NSW. For the purposes of these works, Transport for NSW is the proponent and the determining authority under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The purpose of the REF is to describe the proposal, to document the likely impacts of the proposal on the environment, and to detail mitigation and management measures to be implemented.

The description of the proposed work and assessment of associated environmental impacts has been undertaken in the context of clause 228 of the Environmental Planning and Assessment Regulation 2000, the factors in *Is an EIS Required? Best Practice Guidelines for Part 5 of the Environmental Planning and Assessment Act 1979 (Is an EIS required? guidelines)* (DUAP, 1995/1996), *Roads and Related Facilities EIS Guideline* (DUAP 1996), the *Biodiversity Conservation Act 2016* (BC Act), the *Fisheries Management Act 1994* (FM Act), and the Australian Government's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

In doing so, the REF helps to fulfil the requirements of Section 5.5 of the EP&A Act including that Transport for NSW examine and take into account to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the activity.

The findings of the REF would be considered when assessing:

- whether the proposal is likely to have a significant impact on the environment and therefore the necessity for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning and Public Spaces under Division 5.2 of the EP&A Act
- the significance of any impact on threatened species as defined by the BC Act and/or FM Act, in section 1.7 of the EP&A Act and therefore the requirement for a Species Impact Statement or a Biodiversity Development Assessment Report
- the significance of any impact on nationally listed biodiversity matters under the EPBC Act, including whether there is a real possibility that the activity may threaten long-term survival of these matters, and whether offsets are required and able to be secured
- the potential for the proposal to significantly impact any other matters of national environmental significance or the environment of Commonwealth land and the need, subject to the EPBC Act strategic assessment approval, to make a referral to the Australian Government Department of Agriculture, Water and the Environment for a decision by the Commonwealth Minister for the Environment on whether assessment and approval is required under the EPBC Act

### 1.3 Terms used in this report

The following terms definitions have been used in this report:

- The 'proposal area' refers to the area that may be directly impacted by construction and operation of the proposal (shown in Figures 1-1 and 1-2). The proposal area includes both the:
  - construction footprint, which is the area where construction activities would occur for the proposal and includes land that would be temporarily impacted for the construction compound sites, temporary access track, waterway crossing and crane pads
  - operational footprint, which includes the areas that would be permanently impacted by the proposal including the widened bridge and approaches and supporting infrastructure.
- The 'study area' consists of land in the vicinity of, and including, the proposal area. The study area is the wider area surrounding the proposal area, including land that has the potential to be indirectly impacted by the proposal beyond the immediate works area (for example, as a result of any noise or traffic diversions). The scope of the study area varies depending on the environmental factor being assessed.



## 2 Need and options considered

### 2.1 Strategic need for the proposal

#### 2.1.1 Need for the proposal

##### Improve road network safety and reliability and address community concern

The existing Heathcote Road bridge was built over 75 years ago during World War II to provide a basic east-west transport route over the Woronora River for movement of troops and supplies to and from the Holsworthy military area. The space available for the bridge was limited by its location within a steeply sided river valley, so the bridge was built with narrow lane widths and steep curved approaches that were cut into the landscape. This narrow and steep road corridor provides little room for motorist error and increases the risk of road incidents.

The risk of road incidents for motorists using the Heathcote Road bridge and its approaches is supported by the crash history statistics within 500 metres of the bridge, which comprise data from 25 crashes including two fatalities and six serious injuries between 2009 and 2019 (refer to Figure 2-1) (Transport for NSW, 2020a). Most of these crashes (72 per cent) involved more than one vehicle with 84 per cent of crashes involving at least one car, 40 per cent of crashes involving a light truck and 12 per cent of crashes involving a heavy vehicle. This data shows that head-on crashes generally led to more serious injuries compared to rear-end crashes. The narrow width of the bridge and the steep curved approaches were identified as a key factor in several of these road incidents as well as speeding (contributed to 36 per cent of incidents).

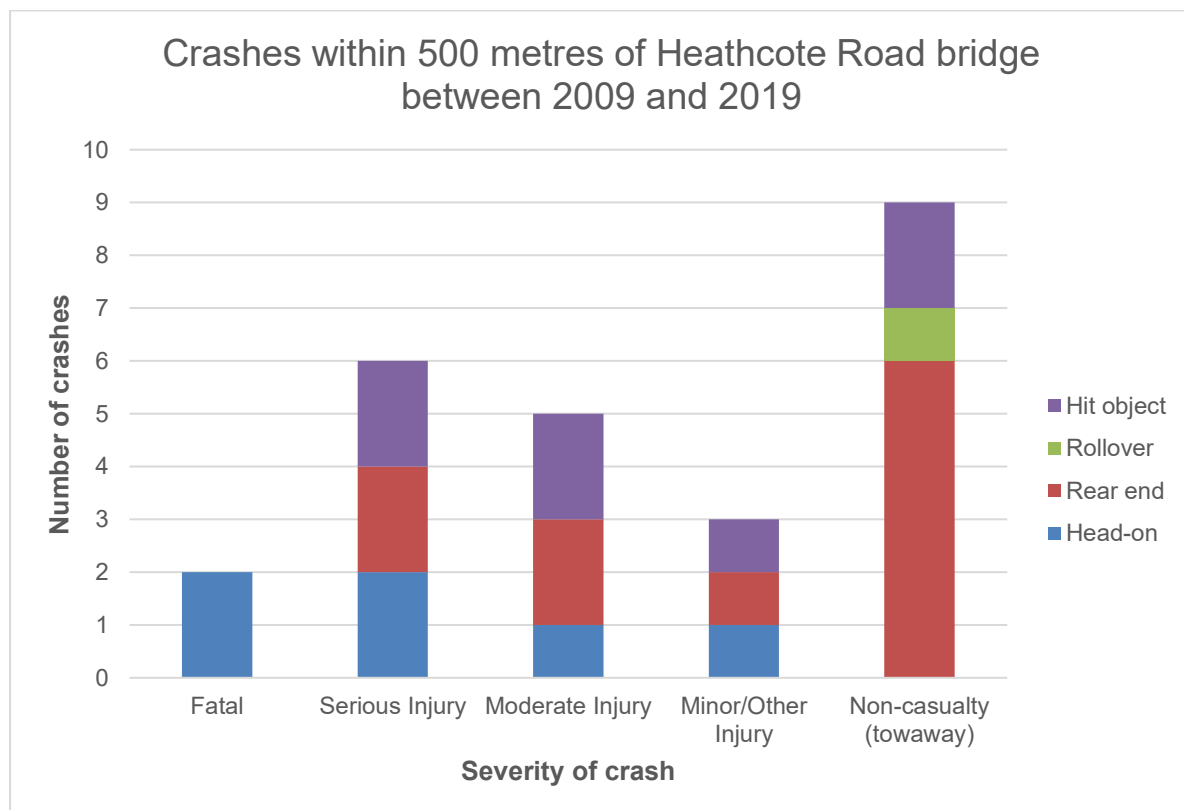


Figure 2-1 Crashes within 500 metres of Heathcote Road bridge between 2009 and 2019

It is noted that some safety improvements were made to Heathcote Road bridge in 1990, which included installation of a new jersey kerb and rectangular steel rails to replace the original bridge railing system and Armco guardrailing to protect the approaches. However, as shown in Figure 2-1, the risk of road incidents using the Heathcote Road bridge and its approaches is still relatively high and further upgrades are required to ensure the continued function of the road assets and achieve compliance with the current road safety standards.

In 2018, the Minister for Roads, Maritime and Freight announced a commitment to improve the safety of the Heathcote Road bridge due to a history of community concern for motorist safety when crossing the bridge. This community concern is evident in the results of the community consultation carried out by Transport for NSW in May and June 2020, which identified that over 80 per cent of people were concerned with the traffic safety of the Heathcote Road bridge (refer to Chapter 5 (Consultation)).

Predicted population increase and increased freight movement across the Sydney Metropolitan area over the coming decades is also anticipated to increase the traffic volumes on the A6 section of Heathcote Road. This also leads to associated increased risk of the potential occurrence and severity of incidents. This would correspond to reduced travel time reliability on Heathcote Road, as incidents are often associated with unplanned road closures and large traffic delays.

### **Contribute to achieving future transport planning goals for Greater Sydney**

The section of Heathcote Road between New Illawarra Road and the Princes Highway is part of the 'A6' road corridor, which is a major arterial road that services north–south journeys for freight and general traffic in Sydney (refer to Figure 1-1). This section of Heathcote Road currently serves as the main connection for the residential and commercial areas of Heathcote, Engadine and Lucas Heights and also provides access to infrastructure of regional significance including ANSTO at Lucas Heights and the Holsworthy Military Reserve located next to the Heathcote National Park. The narrow lanes along this section of Heathcote Road can restrict traffic flow, particularly when larger vehicles slow down to safely navigate the Heathcote Road bridge.

The current congestion along the greater A6 corridor is identified in the *Australian Infrastructure Audit 2015*, which confirms that the A6 road corridor between Sutherland and Ryde as Sydney's fifth worst route for congestion, as measured by delays per lane kilometre (Infrastructure Australia, 2015). This congestion impacts on the efficiency of traffic and freight movements to and from Sydney's south.

To address this inefficiency, the NSW Government committed \$300 million in 2015 to address critical pinch points along the A1, A3 and A6 routes south of the M5 Motorway, which was used to fund Transport for NSW's 'Gateway to the South Pinch Point program'. The Gateway to the South Pinch Point program focuses on short to medium term solutions to improve travel time and reliability for all road traffic including buses and freight. The strategic phase of the project was funded by this program, as the section of Heathcote Road between the Princes Highway and New Illawarra Road was identified as a key pinch point along the A6 road corridor. The proposal complements other pinch point projects that have been delivered under this program, including upgrades to the major intersections with New Illawarra Road and the Princes Highway, as well as future improvements proposed as part of the upgrade of Heathcote Road between Holsworthy and Voyager Point. Since progressing into concept design, the proposal has secured additional funding of \$73 million for the development and delivery of the proposal.



The need for upgrades to the section of Heathcote Road within the A6 road corridor has also been identified in several other strategic plans including:

- *Future Transport Strategy 2056* (NSW Government, 2018) (refer to Section 2.1.2), which includes Heathcote Road improvements as an initiative for investigation over the next 0 to 10 years
- the *Infrastructure Priority List* (Infrastructure Australia, 2020), which lists the 'A3 and A6 corridor capacity' as a priority initiative and states that these capacity constraints could be resolved through a range of initiatives such as intersection upgrades and road widening
- the *Sutherland Shire Local Strategic Planning Statement* (Sutherland Shire Council, 2020) (refer to Section 2.1.3), which includes upgrades to Heathcote Road to improve safety on the road network surrounding the ANSTO Innovation Precinct as a planning priority

The proposal would directly contribute to the realisation of these planned upgrades for the A6 road corridor and the associated future transport planning goals by improving the safety, network reliability and traffic efficiency of the A6 Heathcote Road corridor at the bridge over Woronora River.

## 2.1.2 NSW policy context

### Future Transport Strategy 2056

The *Future Transport Strategy 2056* is NSW Government's vision for the next 40 years of transport in NSW (TfNSW, 2018a). The vision is based on the following six outcomes:

- customer focused
- successful places
- a strong economy
- safety and performance
- accessible services
- sustainability

The purpose of the Strategy is to guide integrated transport and land use planning across regional NSW and Greater Sydney. Transport and customer outcomes to be achieved over the short, medium and long-term to provide better and safer journeys for all transport customers are set out in the Strategy.

The Strategy is supported by a suite of issue-specific and place-based plans that focus on the role transport plays in the land use, tourism and economic development of towns and cities. Plans under the Strategy include the *Greater Sydney Services and Infrastructure Plan*, *Regional NSW Services and Infrastructure Plan* and *Road Safety Plan*. These plans build upon the preceding 2012 Long Term Transport Master Plan, which laid out framework to deliver better infrastructure and services, create safer communities, reduce road fatalities by more than 30 per cent by 2021 and improve road travel reliability and on time running.

A key priority and direction under the Strategy relates to movement and place; balancing the efficient movement of people and goods with the liveability of places on the transport network. A part of the vision for Greater Sydney is that of a 30-minute city where anyone can reach their nearest Metropolitan and Strategic centre within 30 minutes by public transport seven days a week.

The proposal is aligned with this Strategy as it specifically mentions Heathcote Road improvements as a Greater Sydney initiative for investigation within 0 to 10 years and would contribute to achieving the 'safety and performance' outcome, by improving the safety of the Heathcote Road bridge and its approaches.

### **Road Safety Plan 2021 – Towards Zero**

The *Road Safety Plan 2021 – Towards Zero* (NSW Government, 2018a) is a supporting plan of the *Future Transport Strategy 2056*. The Plan sets out a framework with six priority targets to achieve the NSW Government's State Priority Target/s to reduce fatalities by 30 percent by 2021 and to achieve zero harm by 2056.

The six priority areas are:

- saving lives on country roads
- liveable and safe urban communities
- using the roads safely
- building a safer community culture
- new and proven vehicle technology
- building a safe future

The Plan establishes the need for a 'safe system approach' to achieve the ultimate goal of zero deaths and serious injuries on NSW roads, which has four key components: safe roads, safe people, safe speeds and safe vehicles. The 'safe roads' component states that if a driver or rider makes a mistake, upgrades to road infrastructure and design can significantly reduce the chance that it will result in a fatality or serious injury. The proposal would form part of the 'safe roads' component and be aligned with the aims of this plan as it would involve road upgrades to improve the safety of Heathcote Road bridge and its approaches for road users and ultimately reduce the risk of serious road incidents.

### **Greater Sydney Services and Infrastructure Plan**

The *Greater Sydney Services and Infrastructure Plan* (TfNSW, 2018b) is a supporting plan of the *Future Transport Strategy 2056* (TfNSW, 2018a), which establishes a 40-year plan for transport in Sydney with a key focus on enabling people and goods to move safely, efficiently and reliably around Greater Sydney.

The Plan establishes several specific outcomes that transport customers in Greater Sydney can expect over the life of the Plan including Customer Outcome 9: "a safe transport system for every customer with the aim for zero deaths or serious injuries on the network by 2056" (TfNSW, 2018b, p.41). The proposal would help realise this outcome by improving the safety of the Heathcote Road bridge and its approaches, which would reduce the risk of serious injuries along this road corridor.

### **NSW Freight and Ports Plan 2018-2023**

The *NSW Freight and Ports Plan 2018-2023* (NSW Government, 2018b) is a supporting plan for *Future Transport Strategy 2056*. It sets the State government's objectives on the long-term investment in the freight and logistics network, with the aim to provide assurance to the industry that these investments will not only benefit the industry but support the state economy. The primary intent of the *NSW Freight and Ports Plan 2018-2021* is to provide a transport network that allows the efficient flow of goods to their market. It aims to provide a network that minimises or eliminates congestion, supports economic growth and productivity and encourages regional development. It also aims to deliver a freight network that efficiently supports the projected growth of the NSW economy and provides a balance of freight needs with those of the broader community and environment.

The Plan details 70 initiatives to be delivered by 2023, with a focus on achieving five key objectives. These are:

- economic growth
- efficiency, connectivity and access
- capacity
- safety
- sustainability

The Plan states that most freight movement across NSW is by road, with 80 per cent of the Greater Sydney freight task being carried out by road. The Greater Sydney freight network not only supports the demands of a growing population but also plays a role in connecting the State and Australia to global markets. It is projected that a 50 per cent freight task increase by 2036 will occur within the Greater Sydney area (TfNSW, 2018b).

The proposal falls within the Greater Sydney region and the A6 section of Heathcote Road is identified as a major state road and secondary freight route that links the Princes Highway and M5, which are part of the National Land Transport Network. The proposal would be aligned with “Objective 4: Safety” by increasing the road safety on a section of Heathcote Road, particularly for larger vehicles, and therefore reducing the risk of fatalities and serious injuries from crashes involving heavy vehicles or light trucks. It would also indirectly support “Objective 3: Capacity”, by improving the existing road network and connectivity between freight routes.

### **NSW State Infrastructure Strategy 2018-2038**

The *State Infrastructure Strategy 2018 – 2038 – Building Momentum* (Infrastructure NSW, 2018) is a 20-year strategy that makes recommendations on policies and projects for NSW’s key infrastructure sectors to provide a positive impact on the future of the State. The Strategy states that Infrastructure NSW recommends investments in the transport sector for Greater Sydney that reduce the incidence of accident trauma on the metropolitan transport network, which supports the need for the proposal. It also recognises the importance of careful management of State-owned existing assets and ensuring appropriate maintenance, repurposing and upgrading. This involves addressing existing inefficiencies and focusing on asset management. The proposal is aligned with this as it would improve an existing road asset.

### **Greater Sydney Region Plan: A Metropolis of Three Cities**

The *Greater Sydney Region Plan: A Metropolis of Three Cities* (Greater Sydney Commission, 2018) is a 20-year plan that has been prepared along with *Future Transport 2056* and the *State Infrastructure Strategy 2018-2038* (NSW Government, 2018c), to align land use, transport and infrastructure outcomes for Greater Sydney region. The Plan has developed 10 directions (made up of 40 objectives) to manage social, economic and environmental changes. To address these changes, the objectives encourage the transformation of the Greater Sydney region into three self-sustaining, connected cities:

- the Eastern Harbour City
- the Central River City
- the Western Parkland City

The proposal aligns with two directions of the Greater Sydney Region Plan, which are ‘A city supported by infrastructure’ and ‘A city for people’ as it would improve the infrastructure and safety for people within the Greater Sydney Region by improving the road safety and reliability on the Heathcote Road bridge, which is existing road infrastructure within the Eastern Harbour City.

### 2.1.3 Local policy context

#### South District Plan

The *South District Plan* (Greater Sydney Commission, 2018) has been prepared to support the Greater Sydney Region Plan: A Metropolis of Three Cities and outlines the future vision of the South District. The South District is within the Eastern Harbour City and includes the Sutherland Shire, Georges River and Canterbury-Bankstown LGAs. The plan states several short to medium term initiatives that have been identified to provide people in the South District with better transport connections between districts and strategic centres and journey times. The proposal directly aligns with one of these initiatives 'Heathcote Road improvements', as the proposal would improve safety along the Heathcote Road bridge and its approaches.

#### Sutherland Shire Local Strategic Planning Statement

In September 2020, the Sutherland Shire Council released the *Sutherland Shire Local Strategic Planning Statement* (LSPS). The aim of the LSPS is to set the vision for the Sutherland Shire and the actions required to achieve this vision, and also considers the values and priorities of the community.

The proposal is aligned to two of the planning priorities outlined in the LSPS:

- **Planning Priority 2: Managing Traffic Congestion and Parking**, which includes an action for Sutherland Shire Council to “advocate to Transport for NSW on behalf of the community to address congestion and safety issues on classified roads”. The proposal is aligned with this as it would address the safety issues on Heathcote Road bridge (a Classified Road managed by Transport for NSW) that have been identified in community and stakeholder consultation.
- **Planning Priority 14: ANSTO Innovation Precinct**, which includes an action to “collaborate on upgrades to New Illawarra Road and Heathcote Road to improve safety” on the road network surrounding the ANSTO Innovation Precinct. The proposal would assist in achieving this action by improving safety on Heathcote Road bridge.

## 2.2 Limitations of existing infrastructure

The existing Heathcote Road bridge is a single lane undivided bridge that spans the Woronora River within a steeply sided river valley. It is about 126 metres long with four piers.

The existing lane widths on the bridge are narrow at 3.05 metres each, with limited usable shoulders (0.3 metres wide) and no physical separation of opposing traffic lanes (refer to Figure 2-2). These narrow lane and shoulder widths do not meet current Austroads engineering and safety standards. In addition, the approaches to the bridge are on a curve and sloping gradient, which do not conform to current road design guidelines.



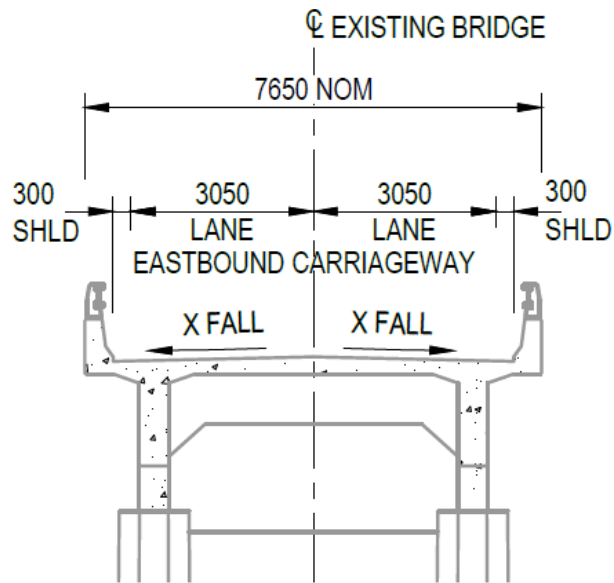


Figure 2-2 Typical cross section of existing Heathcote Road bridge structure



Figure 2-3 Photo showing narrow lanes and shoulders on Heathcote Road bridge



In addition, the approaches to the bridge are on a curve and sloping gradient, which do not conform to current road design guidelines. These narrow lanes are particularly challenging for larger vehicles, as there is little room for error given a standard truck is about 2.5 metres wide plus the width of mirrors and other attachments. As a result, large vehicles have been observed to:

- cross over into the oncoming lane when using the bridge (refer to Figure 2-4), which increases the risk of head on collisions
- slow down when approaching the bridge or waiting for other vehicles to pass, in an attempt to navigate the bridge safely, which can slow down traffic and has been linked to vehicles stalling on the incline after crossing the bridge, therefore impacting the reliability along this section of Heathcote Road.



**Figure 2-4 Photo of large vehicle using the existing narrow Heathcote Road bridge**

Drainage on the bridge approaches consists of seven cross culvert drainage pipes beneath the road ranging from 0.45 metres to 0.75 metres in diameter. These drainage pipes are fed by an informal shallow drainage channel at the interface of the road and the rock cutting, and inflow from the rock cuttings. The drainage infrastructure on the bridge comprises simple pipe drainage (scuppers) that drain directly to the area below. Scouring is evident in some areas around the bridge abutments. The proposal seeks to improve the drainage conditions within the proposal area including by formalising the drainage channel and discharge points as well as providing improved scour protection and cross-fall on the road and bridge sections.

In addition, the Heathcote Road bridge was built over 75 years ago, which means that some parts of the bridge have deteriorated, including cracking (shown in Figure 2-5) and concrete spalling), which require repairs and maintenance.



Figure 2-5 Photo of fine cracks (marked with U59, U60 and U61) under the bridge

## 2.3 Proposal objectives and development criteria

### 2.3.1 Proposal objectives

The key objectives of the proposal are to:

- improve road safety by increasing the road and shoulder lane widths on the bridge and approaches
- improve network reliability
- deliver a design solution that has the ability to be implemented in the short-term

### 2.3.2 Development criteria

The development criteria for the proposal are to:

- minimise property acquisitions
- minimise environmental impacts, including encroachment into Heathcote National Park
- avoid impact to Commonwealth issues including Defence Land and Commonwealth heritage area
- achieve value for money
- achieve constructability



### **2.3.3 Urban design objectives**

Urban design objectives for the proposal include:

- developing a design that minimises impacts to the surrounding bushland environment to demonstrate a sensitive construction methodology
- retaining the integrity of the existing structure to contribute to the heritage and identity of the area
- enhancing journey experience by improving the bridge width and create a safer and more pleasant journey experience
- providing a design that limits visual impacts and allows the structure to recede/integrate with the surrounding setting
- developing a design that minimises maintenance and provides ease of access to key components
- fitting sensitively within the natural bushland setting
- designing built form elements that fit sensitively in the natural bushland setting and steep topography

## **2.4 Alternatives and options considered**

This section summarises the strategic options and design options that were considered for the proposal and explains why the preferred option was chosen.

### **2.4.1 Methodology for selection of the preferred option**

#### **Stage 1: Strategic options development**

In 2018, the Minister for Roads, Maritime and Freight announced a commitment to improve the safety of the Heathcote Road bridge due to its poor crash history and a recent fatal crash at the site. Initially a strategic investigation was completed to identify possible high-level solutions to improve safety and which could be developed and delivered in a short timeframe.

Two strategic options were identified for further investigation. These strategic options and a 'do nothing' option are identified in section 2.4.2 below and were evaluated against the proposal objectives and development criteria to determine a preferred strategic option.

#### **Stage 2: Development of sub-options for the proposal**

On selection of a preferred strategic option, three sub-options were developed. Each sub-option was evaluated against specific proposal criteria to determine the final preferred safety improvement sub-option for the proposal, refer to section 2.4.3. This stage also included a detailed investigation of the existing bridge condition which, informed the 'feasibility' criteria used in this assessment of sub-options.

## 2.4.2 Strategic options considered

### Background to strategic options development

#### *Constraints to options development*

There are limited feasible options for the upgrade of the Heathcote Road bridge due to the narrow existing road corridor and steep terrain surrounding the Woronora River as well as the surrounding National Park and Commonwealth Defence land (refer to Section 3.2.2). These constraints significantly increased the complexity involved with identifying suitable bridge engineering and constructability options that would also minimise potential environmental and property impacts.

#### *Upgrade to dual carriageway*

It is noted that this proposal is required to improve road safety and network reliability in the short-term (refer to Section 2.3.1), as road safety and reliability issues are currently being experienced due to operation of the Heathcote Road bridge, and as such are the priority concerns to be addressed. This is aligned with the focus of Transport for NSW's Gateway to the South Pinch Point program on short to medium solution, which has funded the development of the proposal.

Further strategic upgrades to the A6 section of Heathcote Road have been investigated separately to this proposal, including the potential for future upgrades of the full section of the road from New Illawarra Road to the Princes Highway to a two-lane separated dual carriageway. However, a review of traffic data collected from the proposal area indicates that additional lanes are not required in the short-term as:

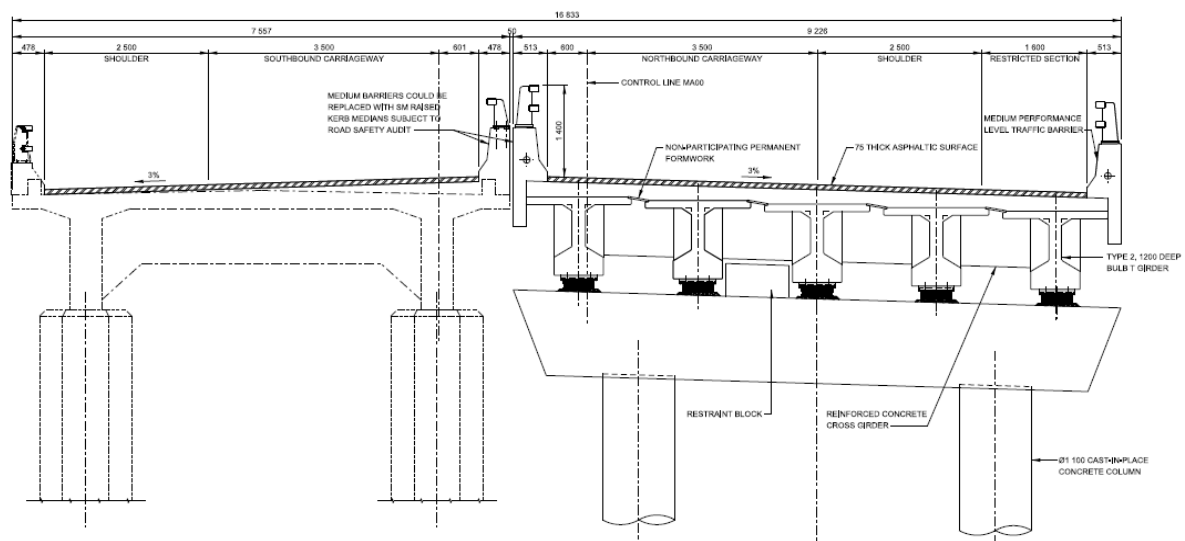
- traffic is currently travelling at or above the speed limit throughout the corridor on average, suggesting that there are no general issues with congestion
- the main reduction in speed within the A6 section of the Heathcote Road corridor appeared to be as a result of vehicles slowing to navigate the narrow lanes of the Heathcote Road bridge, which would be addressed by a bridge widening
- the population of the Sutherland Shire has a relatively slow rate of change, with an annual increase of 0.7 per cent between 2006 and 2016 compared to the population of Greater Sydney, which is growing at a rate of 1.8 per cent per annum (Sutherland Shire Council, 2020)

Providing additional lanes would also cost significantly more money, be more challenging to design, take longer to construct and would have greater potential environmental impacts. Therefore, the provision of additional lanes along the A6 section of Heathcote Road is considered out of the scope of this proposal and would be a longer-term investment, if required due to a significant growth in traffic volumes. However, the options assessment for the proposal has considered whether the design would allow for the Heathcote Road bridge to be further upgraded to an 'ultimate' option with two lanes in each direction in the future, so as not to preclude this opportunity.

## Identified strategic options

### Heathcote Road – bridge duplication (single lane each bridge)

This option would involve construction of a new bridge next to the existing Heathcote Road bridge. The opposing traffic would be separated as each bridge would accommodate a single wide lane with shoulder in one direction. The existing Heathcote Road bridge would be converted to a single wide lane in a southbound direction. The new bridge would accommodate a new single wide lane in a northbound direction. Substantial modifications (high rock cuttings and high retaining walls) would be required on both northern and southern approaches to construct the two separate bridge approaches. Both bridge structures would require minor re-configuration works in the future to accommodate dual lanes, if required due to significantly increased traffic volumes.



**Figure 2-6 Example cross section of Heathcote Road bridge duplication (single lane each bridge) strategic option**

### Heathcote Road – bridge widening

This option would involve widening the Heathcote Road bridge structure so that one wider lane (at least 3.5 metres wide) and shoulder is provided in each direction. The traffic lanes would be separated by a painted median.

The widened bridge would likely look similar to the Deadmans Creek bridge, which is located on Heathcote Road at Sandy Point, surrounded by similar challenging topography and was widened by Roads and Maritime Services in 2015 to improve road safety (refer to Figure 2-7).



**Figure 2-7 Example of a similar bridge structure at Deadmans Creek bridge**

This strategic option does not include a physical median barrier separating the traffic lanes on the bridge. This is because several sub-options were investigated for the installation of a median barrier on the existing bridge structure, however no barrier options were considered viable due to engineering, safety and maintenance issues. These issues include:

- load limits for the structural engineering capacity of the existing bridge structure, which ruled out some barrier types (e.g. concrete F type barriers) due to weight
- lack of space due to limits on the width that the existing bridge structure could be widened to (about 9.6 metres), which would not provide enough room for barrier deflection for some barrier types (e.g. back-to-back three beam barriers would require a two metre wide median area) and maintain narrow lane widths
- an ongoing need to maintain the barrier, which would likely require frequent lane or road closures for maintenance workers to fix the barrier, if hit by vehicles
- lack of access for incident management, as a fixed median barrier may prevent emergency vehicles from accessing the incident site from the adjacent lane

Similarly, a strategic option to include a physical median barrier on the Heathcote Road bridge without widening the bridge was not considered, as it would make the narrow lanes on the bridge even narrower and introduce an additional hazard for motorists.

#### ***Do nothing***

No change to the current configuration of the Heathcote Road bridge or its approaches (refer to Section 2.2).

#### **Analysis of options**

Table 2-1 summarises the initial high-level analysis of the strategic options identified.

**Table 2-1 Evaluation of strategic options against the proposal objectives and criteria**

Criteria	Strategic option		
	Option 1) Heathcote Road – bridge duplication	Option 2) Heathcote Road – bridge widening	Option 3) Do nothing
<b>Proposal objectives (refer to Section 2.3.1)</b>			
<b>Improve safety</b>	<p>This option would result in the most positive safety outcome as it provides physical separation of the opposing traffic flows and the lane and shoulder widths would be in accordance with current design standards. This would reduce the risk of road incidents including head-on and rear-end collisions and out-of-control vehicles.</p> <p>During the upgrade, there may be additional safety benefits as a result of the opportunity to improve road drainage, the stability and safety of the adjacent rock cuttings and maintenance of the existing bridge structure.</p>	<p>This option would result in a positive safety outcome as it would increase the lane and shoulder widths on the bridge as well as the width and alignment of the northern and southern bridge approaches. However, there would not be any physical separation of the opposing traffic flows.</p> <p>During the upgrade, there may be additional safety benefits as a result of the opportunity to improve road drainage, the stability and safety of the adjacent rock cuttings and maintenance of the existing bridge structure.</p>	<p>No improvement to safety.</p> <p>The safety risk would increase over time with increased traffic volumes and freight use.</p>
<b>Improve network reliability</b>	<p>The reduced risk of road incidents would reduce the frequency of unplanned road closures and their associated impacts on the reliability on the A6 road corridor and the surrounding road network.</p> <p>The wider lane widths and shoulders would also provide extra room for vehicles to navigate around incidents on the Heathcote Road bridge and its approaches, such as vehicle breakdowns, which would minimise traffic delays.</p> <p>The separate bridge structure would also improve network reliability as traffic could be temporarily diverted on to the existing bridge structure during repairs and maintenance, instead of requiring road closures.</p>	<p>The reduced risk of road incidents would reduce the frequency of unplanned road closures and their associated impacts on the reliability on the A6 road corridor and the surrounding road network.</p> <p>The wider lane widths and shoulders would also provide extra room for vehicles to navigate around incidents on the Heathcote Road bridge and its approaches, such as vehicle breakdowns, which would minimise traffic delays.</p>	<p>No improvement to network reliability.</p> <p>The frequency of road incidents would likely increase over time, which would further reduce network reliability during unplanned incident closures.</p>

Criteria	Strategic option		
	Option 1) Heathcote Road – bridge duplication	Option 2) Heathcote Road – bridge widening	Option 3) Do nothing
<b>Ability to be delivered in the short-term</b>	<p>This option would take the most time to deliver as:</p> <ul style="list-style-type: none"> <li>it would require acquisitions of Commonwealth and National Park land, which is a complex process that would require substantial lead times and an act of parliament</li> <li>the greater environmental impacts (including to a Commonwealth listed place recognised for outstanding Aboriginal Cultural Heritage significance and potential significant biodiversity impacts) would likely require longer and more complex environmental assessment and approval processes (such as preparation of an environmental impact statement)</li> <li>preliminary cost estimates indicate that due to the scale of the work, this option would exceed the allocated project budget, so additional funding would need to be secured</li> </ul>	<p>This option would take less time to deliver than the bridge duplication option, which is largely due to its smaller scale and associated lesser property, environmental assessment and funding requirements.</p>	<p>Not applicable.</p>
<b>Development criteria (refer to Section 2.3.2)</b>			
<b>Minimise property acquisition</b>	<p>This option would require substantial property acquisition including areas of National Park land, Commonwealth land and Crown Land.</p>	<p>This option would require some property acquisition, including areas of Crown Land, however substantially less area and cost than the bridge duplication option. Due to its smaller footprint, this option can also avoid acquisition of National Park land and Commonwealth lands.</p>	<p>No property acquisition.</p>

Criteria	Strategic option		
	Option 1) Heathcote Road – bridge duplication	Option 2) Heathcote Road – bridge widening	Option 3) Do nothing
<b>Minimise environmental impacts including encroachment into Heathcote National Park</b>	<ul style="list-style-type: none"> <li>substantial vegetation clearing within National Park and along Heathcote Creek would be required, which may result in significant biodiversity impacts</li> <li>likely direct impact on known Aboriginal cultural heritage items and places, which cannot be avoided through design</li> <li>less change to the existing Heathcote Road bridge structure would result in reduced impacts on its heritage significance compared to the bridge widening option</li> <li>substantially longer construction timeframe and associated road closures would be required compared to the bridge widening option, which would notably increase the duration of traffic impacts</li> <li>substantial change to the visual setting, particularly from motorist viewpoint, due to new bridge structure, widened carriageway, new viaducts on approaches, benched rock cuttings and more vegetation removal</li> </ul>	<ul style="list-style-type: none"> <li>less vegetation clearing required than bridge duplication option and avoids direct impacts to Heathcote National Park</li> <li>ability to avoid impacts to known Aboriginal cultural heritage item and limit impacts on the cultural heritage place to the edge of the item curtilage</li> <li>major modification to the existing Heathcote Road bridge structure, which would result in heritage impacts</li> <li>shorter construction timeframe and road closures compared to the bridge duplication option</li> <li>visual changes from the addition of the new structural elements to the existing bridge and rock cutting, however less visual impact than the bridge duplication option for motorists as the bulk of the structural changes would be below the bridge deck</li> </ul>	No direct environmental impacts.
<b>Avoid impact to Commonwealth issues including Defence land and Commonwealth heritage area</b>	The option would have a direct and permanent impact on Commonwealth defence land and the Commonwealth listed heritage place in north-west area of the proposal due to the substantial excavation required to form a new northern approach carriageway for the new bridge structure.	The option would avoid impact to Commonwealth Defence Lands and minimise impacts on the Commonwealth heritage item curtilage by limiting work to the edge of the curtilage.	No impact to Commonwealth issues.



Criteria	Strategic option		
	Option 1) Heathcote Road – bridge duplication	Option 2) Heathcote Road – bridge widening	Option 3) Do nothing
<b>Value for money</b>	<p>This option would cost substantially more than the widening option due to greater property acquisition, biodiversity offset, construction and maintenance costs, which are likely to exceed the allocated project funding.</p> <p>This option provides the most projected long-term benefits in the form of improved road safety and network reliability.</p>	<p>This option is likely to cost substantially less than the bridge duplication option and could be delivered within the allocated funding.</p> <p>Similar to the duplication option, this option provides projected long-term benefits in the form of improved road safety and network reliability, however slightly less benefit due to the lack of physical separation of opposing traffic.</p>	<p>This option would have no direct cost, however there may be long-term indirect costs associated with poor reliability, freight inefficiencies and cost of road crash/trauma.</p>
<b>Constructability</b>	<p>This option would be the most complex to construct, due to the greater scope and construction footprint within a highly constrained and challenging environment. This would require longer road closures, substantially more earthwork and more difficult temporary access arrangements due to the greater extent of the rock cutting and work over the Woronora River.</p>	<p>This option would be much simpler to construct than the bridge duplication option, however would still be challenging due to the difficult topography, need for road closures and work over the Woronora River.</p>	<p>Not applicable.</p>

### Preferred strategic option

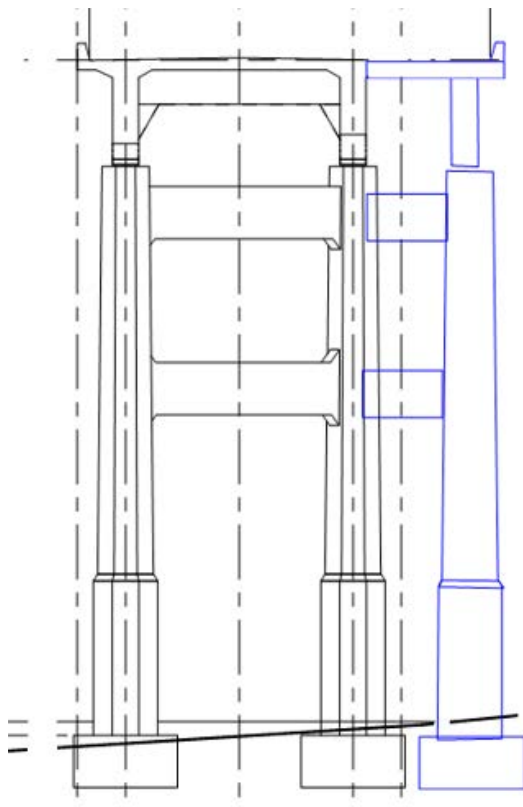
The Heathcote Road bridge widening option was selected as the preferred option as it best satisfied the proposal objectives and development criteria. This is because although the bridge duplication option provided slightly greater safety benefits due to the separation of opposing traffic flows, it resulted in far more substantial environmental and property impacts, including direct impacts to Aboriginal cultural heritage, Heathcote National Park, Commonwealth Land as well as greater vegetation clearance. It would also be more difficult to construct and would be associated with longer and substantially more complex approval, land acquisition and construction durations.

#### 2.4.3 Identified sub-options for the proposal

Three sub-options were developed for the proposal, which are as described below.

##### Option 2A: Widening Heathcote Road bridge on one side only supported by new piers

This option would involve widening the bridge structure by three metres on the upstream side. The widened deck structure would be supported by multiple new piers. An example cross section is provided below in Figure 2-8. Some of the new pier construction would be within Woronora River waterway. This option would also require widening on both northern and southern approaches. The northern approach would require substantial widening into the rock cutting with a large footprint to be able to accommodate multiple benches in the rock face for safety. Widening on the southern approach side would require construction of high retaining walls in difficult terrain above Heathcote Creek.



**Figure 2-8 Example cross section sketch of bridge widening to one side with the addition of new supporting piers**

### Option 2B Widening Heathcote Road bridge on 1.5 metres on both sides supported by steel brackets

This option would widen the bridge by 1.5 metres on both sides. The widened bridge deck would be supported by about 58 steel brackets (29 on each side), which would be attached to the existing bridge girder by means of coring and bolting through the girder at eight locations for each of the brackets. The brackets then support the additional load of the widened bridge deck. An example cross section of this option is provided below in Figure 2-9.

The proposal would require widening on both northern and southern approaches. Widening can be achieved by retaining wall structures to support the widened road pavement in combination with modifications to the rock cuttings to trim back the face of the cutting.

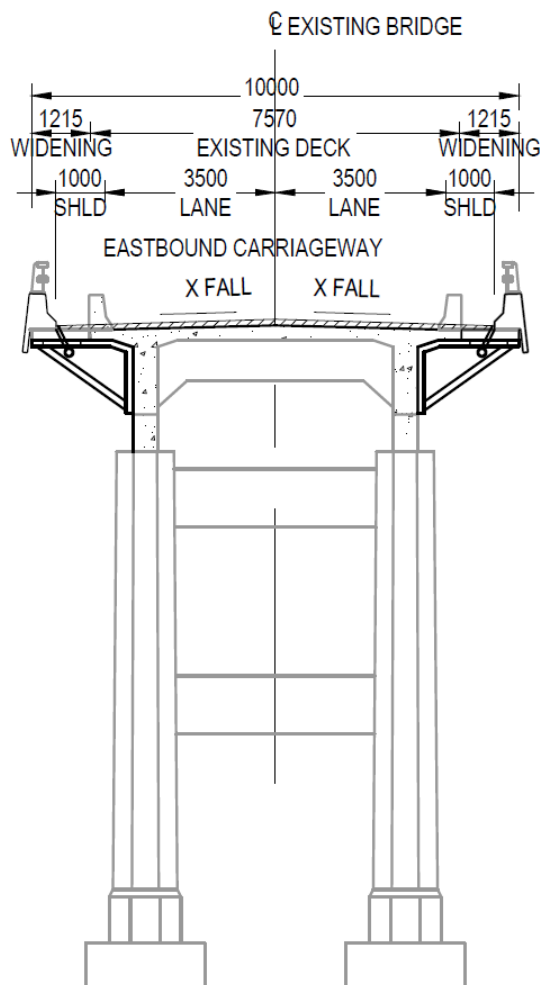


Figure 2-9 Example cross section of bridge widening with steel bracket support

### Option 2C Widening by ~1.5 metres on both sides using headstock expansion

This option would widen the bridge on both sides by widening the bridge headstocks through clamping a new structure onto the existing piers, which would carry the load of the new girders and support the widened bridge deck.

The proposal would require widening on both northern and southern approaches. Widening can be achieved by retaining wall structures to support the widened road pavement in combination with modifications to the rock cuttings to trim back the face of the cutting.

Figure 2-10 shows an example of bridge widening through headstock expansion and steel bracket widening methods on the Market Street viaduct in Darling Harbour.



**Figure 2-10 Example of bridge widening where a combination of headstock extension and steel bracket widening methods have been used from Market Street viaduct widening in Darling Harbour**

### **Analysis of options**

The three identified sub-options were assessed against the following criteria:

- avoid/minimise environmental impacts
- constructability and engineering issues
- value for money
- maintenance needs.

A summary of the options analysis is provided below in Table 2-2.

**Table 2-2 Summary of assessment of sub-options for the proposal**

<b>Criteria</b>	<b>Option 2A – Widen to one side</b>	<b>Option 2B – Widen to both sides using steel brackets</b>	<b>Option 2C – Widen to both sides using headstock expansion</b>
<b>Avoid/minimise environmental impacts</b>	<ul style="list-style-type: none"> <li>• greater area of vegetation clearing due to the eastern side widening</li> <li>• potential water quality and hydrology impacts to Woronora River due to the alignment of the viaducts directly over the river and construction of new piers in the waterway</li> <li>• temporary waterway crossing would be required for construction access, which may impact on key fish habitat</li> <li>• the retaining walls would have an impact on the Aboriginal rock shelter in the vicinity of the southern extent of the project</li> <li>• larger property impact due to need for greater acquisition for approaches, which would require substantial lead times and may delay construction</li> </ul>	<ul style="list-style-type: none"> <li>• less impact on Woronora River than Option 2A due to no new structures in waterway</li> <li>• less vegetation clearing required than Option 2A</li> <li>• temporary waterway crossing would be required for construction access, which may impact on key fish habitat</li> <li>• requires substantial work over Woronora River during drilling of about 500 core holes in the bridge structure, which may result in water quality impacts and non-Aboriginal heritage impacts associated with drilling through a heritage significant structure</li> <li>• ranked first preference by urban design as widening both sides provides symmetry and rock cutting work would be visible but substantially less than Option 2A</li> </ul>	<ul style="list-style-type: none"> <li>• less impact on Woronora River than Option 2A due to no new structures in waterway</li> <li>• less vegetation clearing required than Option 2A</li> <li>• temporary waterway crossing would be required for construction access, which may impact on key fish habitat</li> <li>• less work required above the waterway than the other options</li> <li>• ranked second preference by urban design as widening both sides provides symmetry and rock cutting work is visible but substantially less than Option 2A</li> <li>• potentially less non-Aboriginal heritage impacts due to less visual change than Option 2A and less impact on the existing bridge structure than Option 2B</li> </ul>

Criteria	Option 2A – Widen to one side	Option 2B – Widen to both sides using steel brackets	Option 2C – Widen to both sides using headstock expansion
	<ul style="list-style-type: none"> <li>ranked third preference by urban design/heritage due to greater magnitude of visual change from new piers and viaducts, large benched rock cutting and larger area of vegetation clearance than the other options</li> </ul>		
<b>Constructability and engineering issues</b>	<ul style="list-style-type: none"> <li>full road closures would be required for substantially longer than the other options due to the complexity of construction</li> <li>construction required within Woronora River for the new piers, which would be complex due to the difficult terrain and potential for flooding</li> <li>significant earthworks required on the south east to excavate the rock cutting and bench the cutting</li> <li>temporary waterway crossing required for construction</li> <li>construction of the high retaining walls would be very difficult because of the limited access and steep topography above Heathcote Creek where they are required</li> </ul>	<ul style="list-style-type: none"> <li>significant risk associated with the requirement to core through existing bridge girders at about 500 locations without compromising existing steel reinforcement and causing structural issues to the existing bridge structure. Problems have been encountered with this method on other bridge assets</li> <li>full road closures estimated at 6 months though could possibly be reduced with refinements to equipment and methodologies</li> <li>temporary waterway crossing required for construction</li> <li>construction access can use former track on northern side</li> </ul>	<ul style="list-style-type: none"> <li>dull road closures estimated at 6 months though could possibly be reduced with refinements to equipment and methodologies</li> <li>temporary waterway crossing required for construction</li> <li>construction access can use former track on northern side</li> <li>minimises need for rock cutting and retaining walls compared to Option 2B</li> <li>avoids inherent risk associated with the modification of the existing structure that the steel bracket option does and would be simpler to construct than Option 2B</li> <li></li> </ul>

Criteria	Option 2A – Widen to one side	Option 2B – Widen to both sides using steel brackets	Option 2C – Widen to both sides using headstock expansion
	<ul style="list-style-type: none"> <li>• construction of the benched rock cutting would require substantial program of earthworks. Major earthworks and potential constructability safety issues because of the difficult terrain. Significant issues in creating access for heavy machinery to top of cut.</li> <li>• added complexity due to need to relocate the section of the AARNet optic fibre which is currently located in a shallow underbored underneath the Woronora River due to a clash with the required pier foundations.</li> <li>• the creation of a joint between the old and new structures within the westbound lane would require vehicles travelling in the westbound lane to use both structures, which is undesirable from a bridge engineering perspective</li> </ul>	<ul style="list-style-type: none"> <li>• widening each side of the existing alignment minimises the need for rock cutting and retaining walls due to the opposite cut/fill embankment reflected on opposite side either side of the bridge</li> <li>• the engineering feasibility assessment strongly recommended against this option because of the structural risks.</li> </ul>	
<b>Value for money</b>	Substantially greater cost than the other options due to the additional infrastructure required, including construction of viaducts and new piers. Additional costs are also associated with the substantially greater areas of acquisition.	This option would have a similar cost to Option 2C and substantially less cost than Option 2A.	This option would have a similar cost to Option 2B and substantially less cost than Option 2A.



Criteria	Option 2A – Widen to one side	Option 2B – Widen to both sides using steel brackets	Option 2C – Widen to both sides using headstock expansion
<b>Maintenance needs</b>	Substantially greater maintenance needs compared to other sub-options, mainly due to the large number of new structures.	Large amount of additional steel infrastructure (brackets) would greatly add to the bridge maintenance needs.	Adds to the maintenance, though has the lowest maintenance needs of all options.

## **Preferred sub-option**

Option 2C was selected as the preferred sub-option as it best met the proposal and additional assessment criteria. This is because Option 2C would result in similar environmental impacts, property acquisition needs and value for money compared to Option 2B, however would be beneficial as it would require less construction work above the Woronora River and would have the lowest ongoing maintenance needs. It also avoided the prohibitive engineering issues encountered with Option 2B. Option 2A was not preferred as it had the greatest environmental impacts, constructability issues and cost.

## **2.5 Design refinements**

During early concept design, several design refinements have been captured within the proposal scope to minimise environmental impacts and add value, as described below.

### **2.5.1 Inclusion of bridge repair/maintenance work and slope maintenance work**

It was proposed to add important bridge repair/maintenance and slope maintenance works to the scope of the proposal to take advantage of the limited opportunity of a long duration full road closure. This would minimise the need for additional separate instances of full road closure and the nuisance caused to motorists to carry out this maintenance work in the future. This also makes the most out of the opportunity to access areas beneath the bridge. Some of the activities can also take advantage of the plant/equipment required for other components of the proposal (such as scaffolding, lifting equipment etc).

### **2.5.2 Road widening method refinement – bored piling**

A bored piling technique has been proposed to further minimise the construction footprint on the north-east and south-west areas of the proposal. With this technique, the piling equipment would operate from the existing road. Alternative methods such as the original reinforced earth wall construction would have required a larger construction footprint, more vegetation clearing, and greater earthworks and ground disturbance in a high risk area on the steep batter slope above Heathcote Creek alignment (which also forms the boundary of Heathcote National Park).

### **2.5.3 Inclusion of fauna connectivity and habitat features**

Early investigation is underway to evaluate feasible design measures to maintain fauna connectivity under the bridge and also minimise risk of fauna roadkill. This includes investigation of opportunities to re-use cleared vegetation to construct arboreal fauna connectivity furniture or waterway snags as appropriate. An example of where this has been applied on other projects is shown in Figure 2-11. Early investigation is also underway to evaluate the feasibility of incorporating microbat habitat into the new design elements of the widened bridge structure. The final design solution/s would be confirmed during detailed design and subject to specialist ecologist advice and further consultation with key stakeholders including DPI Fisheries.



**Figure 2-11 Example of fauna furniture installed under a bridge to facilitate the movement of koalas (Roads and Maritime, 2019)**

#### **2.5.4 Construction methodology review to minimise road closure durations**

The REF has assessed the impacts of the proposal based on a potential worst case scenario of an estimated six months full road closure. A construction methodology review has been proposed as part of detailed design phase to highlight alternate opportunities in construction methodologies and sequencing that would reduce the duration of full road closure. Some activities may be able to be completed under night road closures in order to maintain access during the day.

#### **2.5.5 Localised refinement to the proposal area and construction methodology to avoid potential indirect impact to an item of Aboriginal cultural heritage**

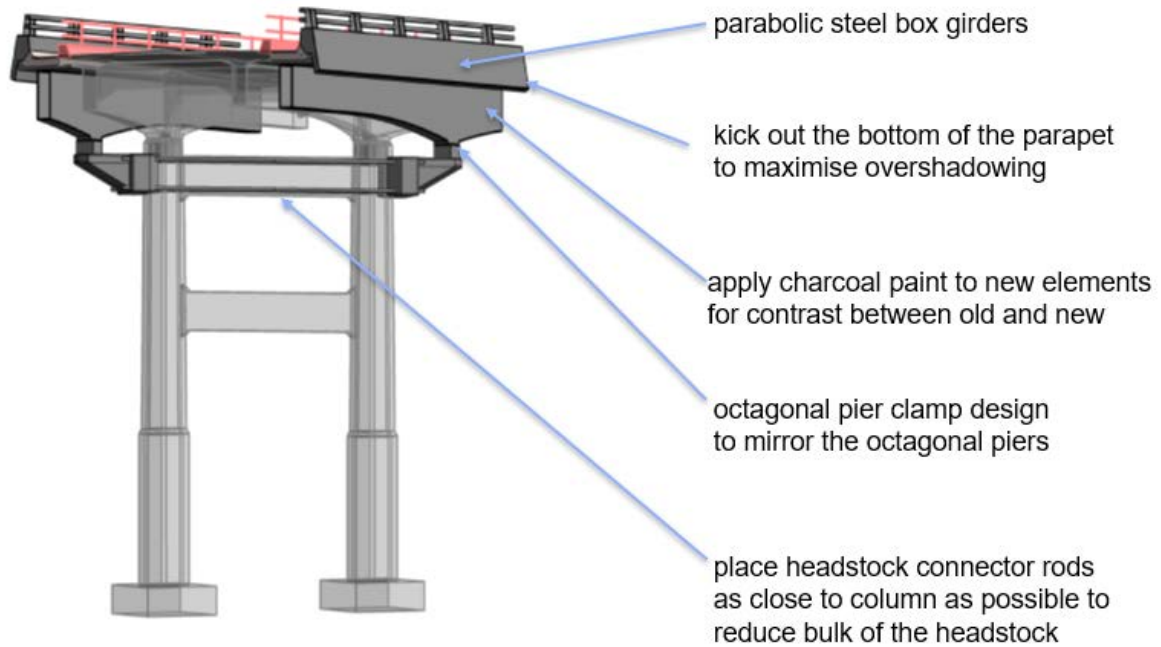
An Aboriginal cultural heritage survey identified the presence of a heritage site ‘Scouters Mountain Engadine’ alongside an area of proposed widening. This site had previously been shown to be at other coordinates about 300 metres away. The updated coordinates of the site were recorded and would be demarcated through an exclusion zone around this site. The noise and vibration assessment identified the potential for vibration related impacts to this heritage item due to its location close to construction activities that may use a 20 tonne excavator. However, feasible and reasonable mitigation measures would be implemented to minimise the potential for indirect vibration related impacts to this item in accordance with the findings of a Vibration Risk Assessment. These mitigation measures may include consideration of less vibration intensive equipment, limiting vibration intensive works close to the site and carrying out vibration monitoring during construction (refer to Section 6.2.5).

#### **2.5.6 Refinements to optic fibre adjustment**

Through the development of the concept design the proposal was able to avoid triggering the requirement to carry out works on the AARNet (fibre optic cable) Woronora River under bore. It is anticipated works of relatively low complexity would be required to carry out relocation of the optic fibre on at least one of the bridge approaches.

### 2.5.7 Heritage design refinements

Through the development of the concept design the proposal was able to refine the design to limit impacts to the heritage structures of the bridge. Figure 2-12 details the key design refinements which were made at the heritage and urban design workshop.



**Figure 2-12 Key heritage design refinements**

Additional safeguards and management measures to be considered during detailed design to retain and protect the heritage features of the bridge are provided in Section 6.7.4.

## 3 Description of the proposal

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This chapter describes the proposal and provides descriptions of existing conditions, the design parameters including major design features, the construction method and associated infrastructure and activities.

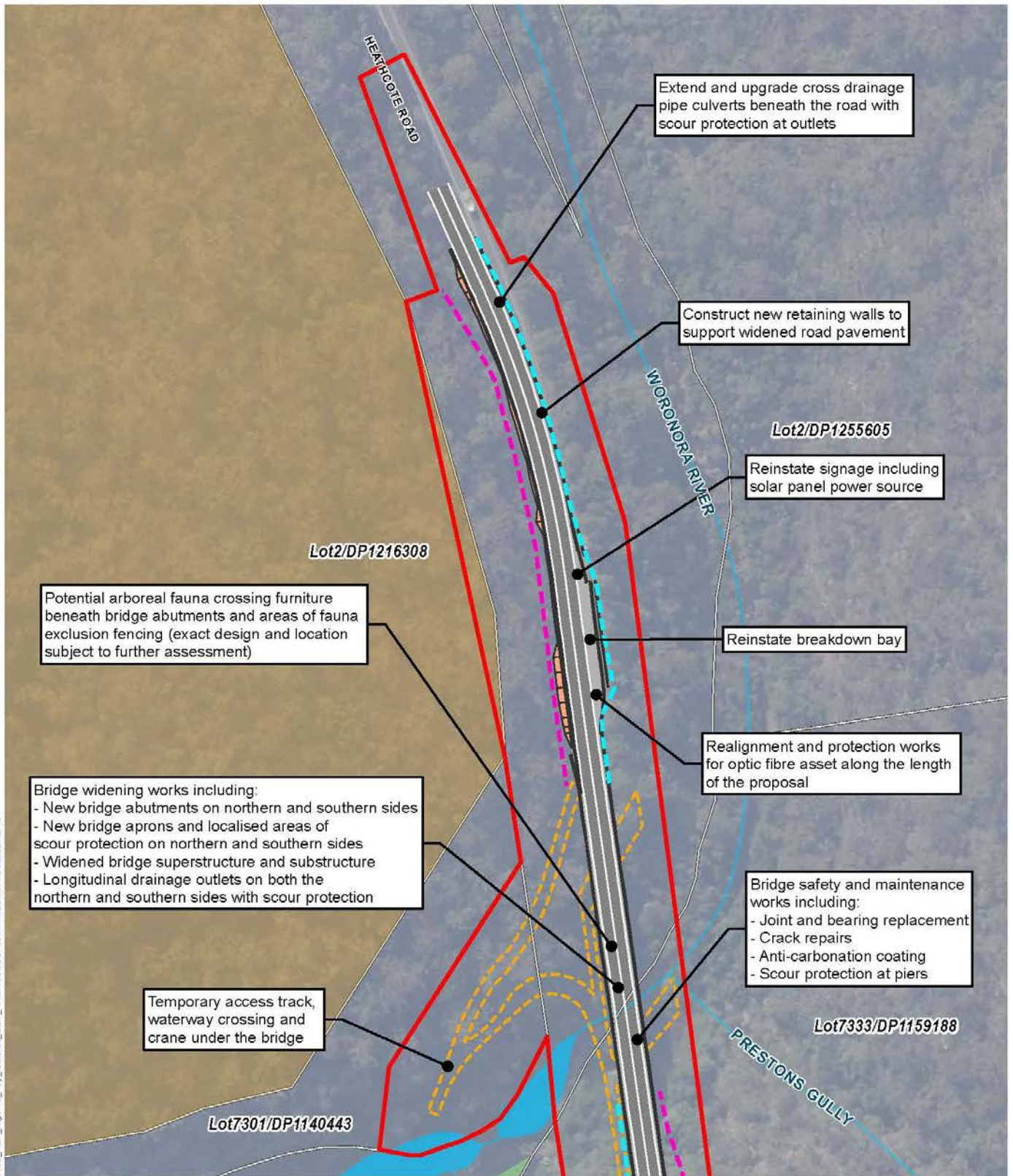
### 3.1 The proposal

The proposal involves widening the bridge by headstock widening with supports using the existing bridge piers. Both northern and southern approaches to the bridge are proposed to be widened through a combination of minor scaling back areas of the rock face and construction of retaining walls. The full proposal length is about 630 metres including the upgrade to the bridge approaches. The proposal includes associated enabling works such as utility relocation and vegetation removal. Ancillary facilities required include site compounds, vehicle access tracks and laydown areas.

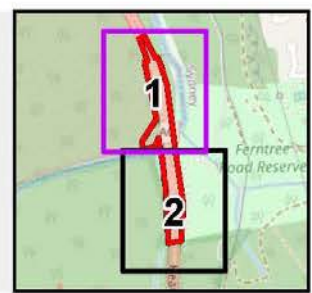
Key features of the proposal would include (shown on Figure 3-1):

- widening of the bridge by about 1.4 metres on each side to provide one wide 3.5 metre lane in each direction with 1.2 metre shoulders
- widening and adjustments to the northern and southern bridge approaches about 250 metres either side of the bridge to improve the road alignment, increase lane and shoulder widths and reinstate the existing breakdown bays either side of the bridge
- new bored-pile retaining walls to support the slope along both bridge approaches, which would be up to two metres high and range in length up to 100 metres
- slope stabilisation measures including rock scaling, shotcreting, rock bolting, rock netting, and vegetation removal
- new and modified drainage infrastructure including replacement and extension of existing cross culvert pipes on the approaches for the widened road pavement, improved drainage gutter along the base of the rock cuttings, new longitudinal drainage outlet at each abutment and scour protection at all discharge points
- adjustments to optical fibre conduits for the length of the proposal area
- repair and maintenance work to the existing bridge structure including:
  - repairs to cracks
  - replacement of all bearings
  - joint replacement
  - application of an anti-carbonation coating on the bridge structure including piers
  - installation of new steel maintenance staircase for side access to the bridge for bridge inspections
- other ancillary work required to support construction of the proposal including two off site construction compounds and establishment of a temporary access track, waterway crossing and crane pads

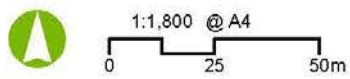




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Source: Aurecon, TNSW, Spatial Services, Esri

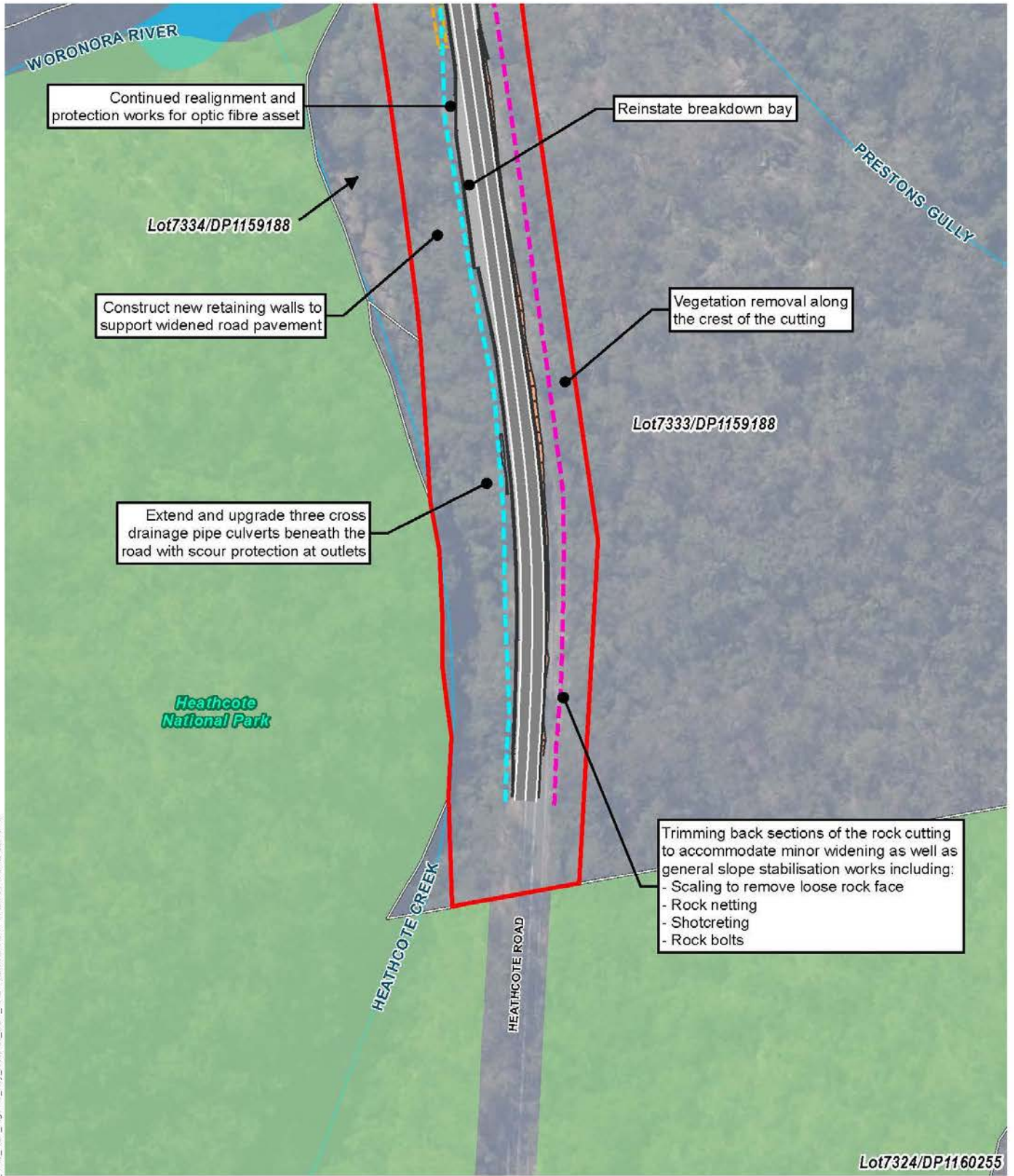


Projection: GDA 1994 MGA Zone 56

Heathcote Road bridge widening REF

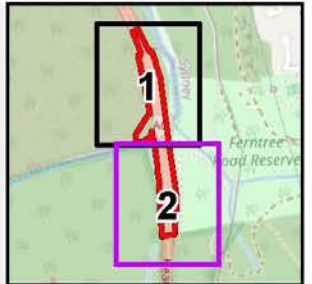
FIGURE 3-1a: Key features of the proposal



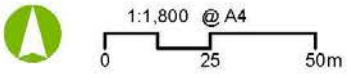


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- |  |                        |
|--|------------------------|
| Proposal area                                  | Rock trimming          |
| Indicative design (subject to detailed design) | Temporary access track |
| Road   | National park          |
| Shoulder                                       | Lot                    |
| Cut  | Watercourses           |
| Retaining wall                                 | Water bodies           |



Source: Aurecon, TfNSW, Spatial Services, Esri



Projection: GDA 1994 MGA Zone 56

Heathcote Road bridge widening REF

FIGURE 3-1b: Key features of the proposal



## 3.2 Design

The concept design for the proposal is described below and would be further refined during detailed design as result of ongoing design investigation and consideration of the environmental safeguards discussed in Chapter 6 (Environmental assessment).

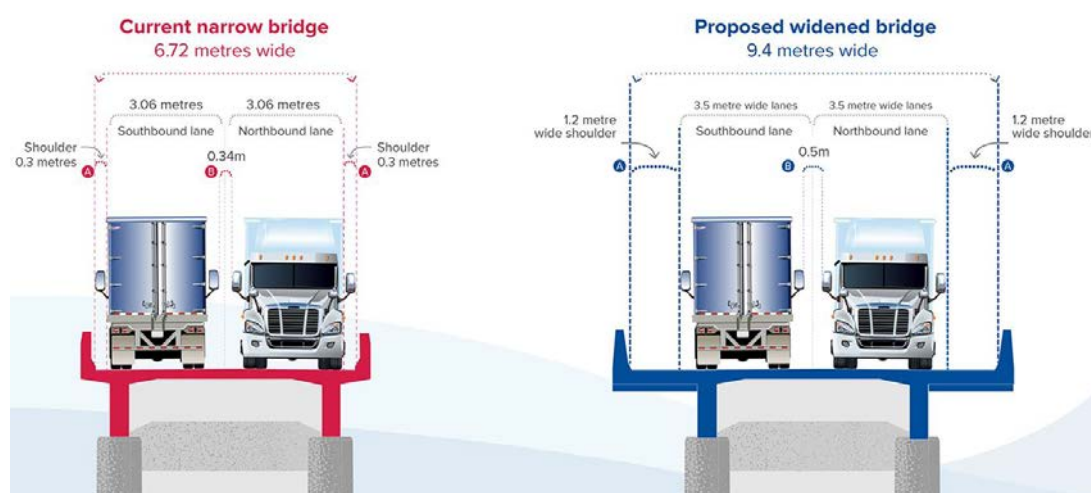
### 3.2.1 Design criteria

The proposal has been designed to NSW and Australian engineering, road safety, environmental and transport planning standards developed by Transport for NSW and Austroads. These standards describe the criteria that should be adopted for specific road classifications and conditions. The criteria have been developed to ensure all roads are designed to be safe, effective, well-planned and easily maintained.

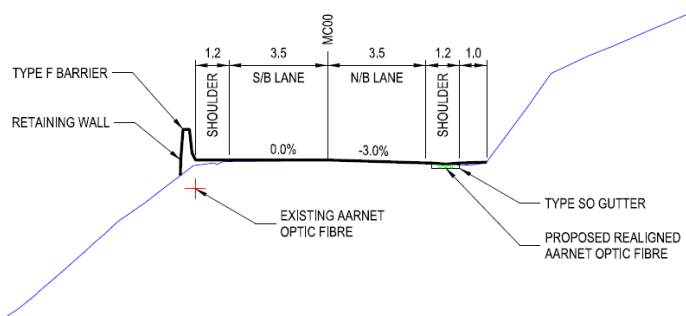
Table 3-1 shows the design criteria that has been adopted for the proposal. Figure 3-2 shows typical cross sections of the existing Heathcote Road bridge and the widened bridge as part of this proposal.

**Table 3-1 Summary of design criteria for the proposal**

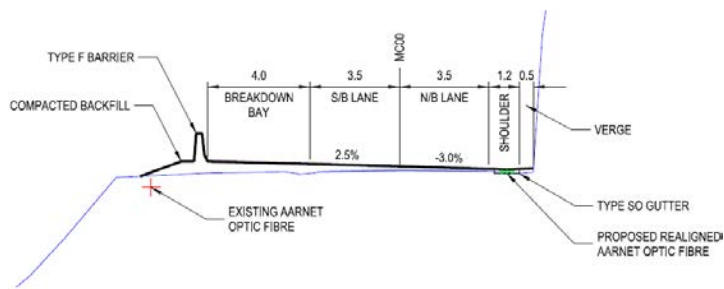
Criteria	Description
Speed limit	70 kilometres per hour (posted) 80km/hr design speed
Cross section (as shown on Figure 3-2 and Figure 3-3)	The widened bridge would be 9.4 metres wide with one general traffic lane in each direction and a minimum: <ul style="list-style-type: none"> <li>lane width of 3.5 metres</li> <li>shoulder width of 1.2 metres</li> </ul>
Design vehicle	<ul style="list-style-type: none"> <li>stopping sight distance and acceleration/deceleration requirements design vehicle: car</li> <li>turning path design vehicle: semi-trailer</li> <li>lane widening for curves design vehicle: B-doubles up to 26 metres in length</li> </ul>
Grade	Maximum of 7.5 per cent grade
Road surface type	Asphalt
Safety barriers	F type concrete safety barrier



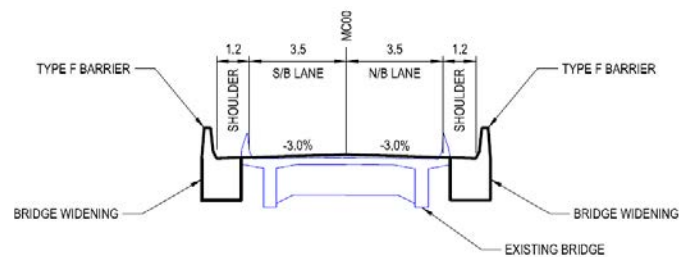
**Figure 3-2 Cross sections of the Heathcote Road bridge with and without the proposed widening**



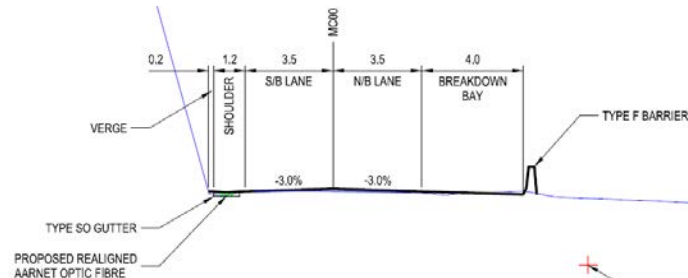
Typical cross section at northern approach



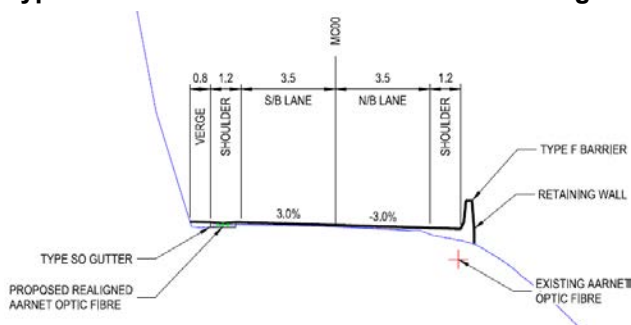
Typical cross section at northern approach near bridge



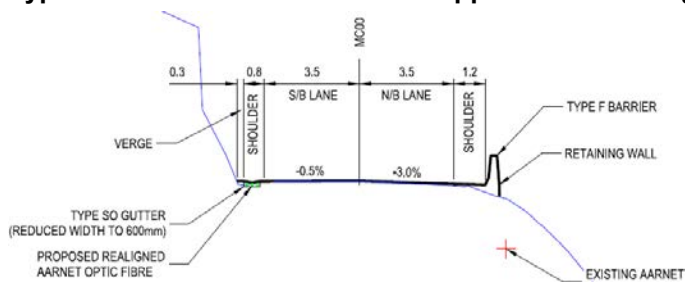
Typical cross section at Heathcote Road bridge



Typical cross section at southern approach near bridge



Typical cross section at southern approach



Typical cross section southern approach near tie-in

Figure 3-3 Typical cross sections of the proposal at various along the alignment (north to south)

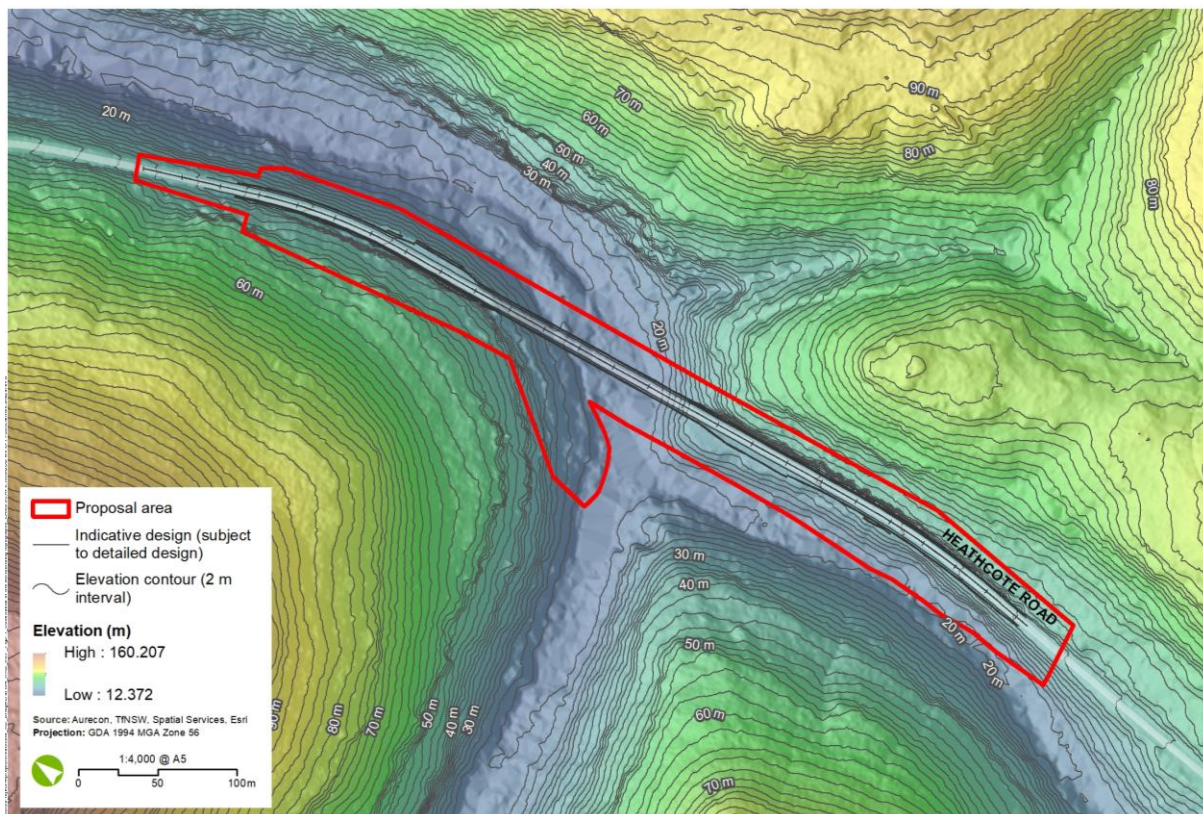
### 3.2.2 Engineering constraints

Table 3-2 lists the main engineering constraints and how they have been addressed in the proposal design.

Figure 3-4, Figure 3-5 and Figure 3-6 show the challenging topography surrounding the proposal, including the steep slopes of the Woronora River valley, high rock cuttings on both approaches to the bridge, steep roadside batters and meandering alignment of the Woronora River and Heathcote Creek beneath the bridge.

**Table 3-2 Engineering constraints for the proposal**

Constraint	How it has been addressed in the proposal design
<p>Limited space and access available for construction activities due to steep terrain, narrow corridor and Woronora River below (refer to Figure 3-4, Figure 3-5 and Figure 3-6)</p>	<ul style="list-style-type: none"> <li>existing construction compounds owned by Transport for NSW near the construction footprint would be used</li> <li>full road closure of Heathcote Road would be required for safety during construction</li> <li>temporary access track and waterway crossing would be constructed under the bridge to provide additional room for construction activities and crane pad</li> <li>headstock expansion method of widening bridge structure minimises extent of construction activities required above Woronora River (refer to Section 2.4.3)</li> <li>the bridge would be widened on both sides to minimise the extent of earthwork and rock cuttings required on both approaches</li> </ul>
<p>Surrounding National Park and Commonwealth Defence Land</p>	<ul style="list-style-type: none"> <li>the design has been refined to avoid any acquisition or direct impacts to the nearby Heathcote National Park and Commonwealth Defence Land (Holsworthy Military Barracks)</li> </ul>
<p>Existing AARNET optical fibre conduit</p>	<ul style="list-style-type: none"> <li>the existing optical fibre conduit would be identified, relocated and protected in consultation with the relevant utility owner</li> </ul>



**Figure 3-4 Constraints of the surrounding topography**





**Figure 3-5 Photo showing high rock cutting and narrow lanes and shoulders on approach to the bridge**



**Figure 3-6 Photo showing existing Heathcote Road bridge structure from underneath and steep river valley surrounding Woronora River**

### 3.2.3 Major design features

#### Widened Heathcote Road bridge and approaches

The bridge structure would be widened from 6.72 metres to 9.4 metres (refer to Figure 3-2) by headstock widening with supports using the existing bridge piers. This would provide space for 3.5 metre wide traffic lanes and 1.2 metre shoulders on the bridge.

The bridge abutments, including the apron wall and wing walls, would be widened to match the width of the modified bridge structure to accommodate for the new girders being installed. The widened abutment would be constructed from steel reinforced concrete likely founded on bed rock near the surface.

The widened bridge would also feature:

- F type safety barriers on either side
- a new asphalt pavement
- drainage scuppers and improved crossfall for drainage
- a painted median visually separating the opposing traffic lanes
- new maintenance access staircase side access for bridge inspections

The northern and southern bridge approaches would also be widened up to three metres for about 250 metres either side of the bridge and realigned slightly to remove 'pinch points' and therefore minimise the potential for vehicles to hit the rock cutting or safety barriers. This would provide 3.5 metre wide traffic lanes and 1.2 metre shoulders, which is consistent with the cross section of the bridge (refer to Figure 3-3). In addition, four metre wide breakdown bays would also be provided for either side of the bridge, which would be about same width as the current maintenance bays next to the bridge approaches.

The existing guard rail along the bridge and approaches would be replaced with an F Type concrete barrier.

#### Retaining walls

Six new retaining walls are proposed to be built along the northern and southern approaches to the bridge to stabilise the slope or rock cutting. The locations of the proposed retaining walls are shown in Figure 3-1. These retaining walls would be soldier pile retaining walls, consisting of bored piles with concrete panels that slot into steel beams. The walls would range in length up to a maximum of about 100 metres and up to two metres in height. It is anticipated that about 130 piles will be required in total.

#### Rock cutting and slope stabilisation

The proposal would involve grinding back localised sections of the rock cuttings to remove pinch points, accommodate widening and improve the alignment (reduce the road curve on approach to the bridge) of the approaches. In addition, several slope stabilisation measures are also proposed to reduce the risk of rock fall or slope instability, including:

- rock scaling, which would involve removal of loose rock and material from the face of the rock cutting
- vegetation removal from the face of the rock cutting and up to three metres back from the crest of the cutting. This includes clearing accumulated vegetation and debris from crest drains
- application of shotcrete on an area up to 250 square metres on the southern side cut and up to 100 square metres on northern side cut



- installation of rock bolts, which would each be about four metres length and would be drilled into the rock face. It is estimated that about 20 rock bolts would be required on the southern side cut and ten on northern side cut
- installation of rock netting on an area of the rock cutting about 3000 square metres in size on the southern side cut (0 to 230 metres from the bridge) and 1500 square metres on the northern side cut (0 to 140 metres from the bridge)

### **New and modified drainage infrastructure**

The proposal would involve installation of new and realigned drainage infrastructure including:

- new scuppers on the bridge structure
- improved drainage gutter along the base of the rock cuttings
- new longitudinal drainage outlet at each abutment
- rock scour protection at discharge points, bridge abutments and slopes.

### **Bridge repairs and maintenance**

The repair and maintenance work proposed to the existing bridge structure would include:

- replacement of all bridge bearings and expansion joints with new bearings and expansion joints
- repair of areas of concrete cracking and spalling by injecting high strength grout into cracks
- application of an anti-carbonation coating on the entire bridge sub structure to improve concrete durability.

Workers would access the bridge structure to carry out this work by erecting temporary scaffolding.

### **Other features**

The design for the proposal would also feature:

- relocation of the existing optical fibre cable (refer to Section 3.5)
- arboreal fauna crossing furniture (such as that shown in Figure 2-11) at the bridge abutments in combination with tie-in fencing primarily targeted at maintaining Koala connectivity. The final design solution/s would be confirmed during detailed design and subject to specialist ecologist advice and further consultation with key stakeholders including DPI Fisheries.
- supporting roadside infrastructure, which would be confirmed during detailed design and may include CCTV signage and guideposts. The existing solar cell tower would also be reinstated.

### 3.3 Construction activities

The proposal would be built under Transport for NSW construction specifications and delivered by a construction contractor.

This section summarises the likely method, work hours, plant and equipment and associated activities for construction of the proposal. However, the actual work method may vary from the description provided in this section due to the identification of additional engineering constraints, ongoing design refinements, feedback from the community and stakeholder consultation and contractor requirements and limitations. As such, the construction activities and their sequencing would be finalised during detailed design and within the Construction Environmental Management Plan (CEMP). Any work outside the scope of activities as described in the approved REF would require additional assessment.

#### 3.3.1 Work methodology

Table 3-3 summarises the likely construction activities and their sequencing for the construction of the proposal.

**Table 3-3 Indicative construction activities and stages**

Construction activity	Associated work
<b>Design investigation</b>	<ul style="list-style-type: none"> <li>• confirm geotechnical assumptions at piers and at retaining walls through drilling up to 20 boreholes and carrying out ground survey within the proposal area</li> <li>• carry out a bridge condition assessment</li> </ul>
<b>Establish off site ancillary facilities</b>	<ul style="list-style-type: none"> <li>• setup construction compound sites at Heathcote and Lucas Heights</li> <li>• construct temporary driveway access from Wilson Parade to the Heathcote compound site</li> <li>• implement temporary perimeter fencing as required.</li> </ul>
<b>Early works</b> <b>Establish on site ancillary facilities (refer to Section 3.4) and site access</b>	<ul style="list-style-type: none"> <li>• implement full road closure traffic arrangements</li> <li>• demarcate and/or fence approved limits of work and property boundaries, as required</li> <li>• establish erosion and sediment controls</li> <li>• establish access track for vehicles and plant beneath the bridge, including associated vegetation removal</li> <li>• construct temporary waterway crossing across Woronora River</li> <li>• establish temporary laydown and storage areas including new hardstand areas either side of the bridge, a small storage area on the northern access track</li> <li>• construct crane platform areas</li> <li>• setup small on-site compound shed plus amenities block</li> <li>• construct scaffolding and containment</li> </ul>



<b>Construction activity</b>	<b>Associated work</b>
<b>Bridge repair and maintenance work</b>	<ul style="list-style-type: none"> <li>• remove existing guard rails on the bridge</li> <li>• install personnel protection screens and/or temporary concrete barriers on bridge</li> <li>• repair cracking and concrete spalling</li> <li>• replace expansion joints and bearings</li> <li>• apply anti-carbonation coating to all of the bridge surface including piers</li> </ul>
<b>Bridge widening</b>	<ul style="list-style-type: none"> <li>• install working platforms at abutments</li> <li>• test containment setup</li> <li>• use hydro-demolition on the concrete structure</li> <li>• construct widened bridge structure through headstock widening with supports using the existing bridge piers</li> <li>• modify bridge abutments and install new bridge aprons and parapets</li> <li>• install new bridge deck and permanent formwork using cranes</li> <li>• install new drainage infrastructure and scour protection</li> </ul>
<b>Utility adjustment</b>	<ul style="list-style-type: none"> <li>• excavate the existing optic fibre conduit bank</li> <li>• relocate the optical fibre</li> </ul>
<b>Upgrade to the northern and southern bridge approaches</b>	<ul style="list-style-type: none"> <li>• remove vegetation and excavate cuttings, as required</li> <li>• construct new road pavement</li> <li>• mill and resheet existing pavement</li> <li>• install new drainage infrastructure to replace drainage lines and reconstruct the existing drainage gutter</li> </ul>
<b>Retaining walls and slope stabilisation</b>	<ul style="list-style-type: none"> <li>• install bored piles for retaining walls using piling rig</li> <li>• construct retaining walls by installing concrete panels</li> <li>• stabilise the rock cutting through rock scaling, shotcreting, rock bolting and installation of rock netting, where required along approaches</li> </ul>
<b>Finishing works</b>	<ul style="list-style-type: none"> <li>• apply anti-carbonation coating to protect the concrete</li> <li>• install F type safety barriers on bridge and approaches</li> <li>• undertake permanent line-marking and tie-in the new widened road to existing road</li> <li>• install supporting roadside infrastructure including signage and CCTV</li> </ul>
<b>Demobilisation and restoration</b>	<ul style="list-style-type: none"> <li>• restore kerb to pre-existing conditions at Compound 2 (Heathcote compound)</li> <li>• remove temporary waterway crossing structure</li> <li>• remove and rehabilitate temporary access track similar to pre-existing conditions</li> </ul>

### 3.3.2 Construction workforce

Construction of the proposal is likely to require up to 65 construction workers during peak construction. However, the number of construction workers at any one time would vary depending on the stage of construction and the final methodology that would be identified during detailed design and within the CEMP.

### 3.3.3 Construction hours and duration

It is anticipated that construction would start in late 2021 and take up to two years to complete, subject to weather.

- Construction would be carried out where possible during standard construction working hours as defined by the *Interim Construction Noise Guideline* (DECC, 2009):
- Monday to Friday: 7 am to 6 pm
- Saturday: 8 am to 1 pm
- Sundays and public holidays: no work
- However, construction work for the proposal is generally proposed to be carried out 24 hours per day, seven days per week to minimise the duration of full road closures required for construction of the proposal (currently estimated to be up to six months in duration) and the associated traffic disruption to road users (refer to Section 3.3.7).

### 3.3.4 Plant and equipment

The plant and equipment needed to build the proposal would be typical to any road and bridge construction project. The use of plant and equipment would vary depending on the construction activity being carried out. Table 3-4 indicates the plant and equipment that is likely to be used during construction of the proposal, however this would be finalised during detailed design and outlined within the CEMP.

**Table 3-4 Indicative plant and equipment for the proposal**

Construction activity	Plant/equipment
<b>Design investigation</b>	<ul style="list-style-type: none"> <li>• small drill rig</li> <li>• small excavator</li> <li>• excavator mulch head</li> <li>• small tipper truck</li> </ul>
<b>Establishment of ancillary facilities and site access</b>  <b>Implementation of environmental and safety controls</b>	<ul style="list-style-type: none"> <li>• trucks and semi trailers</li> <li>• franna cranes</li> <li>• small and large excavators</li> <li>• small and large tipper trucks</li> <li>• concreting equipment</li> <li>• small vibratory roller</li> <li>• small front end tipper all terrain vehicle</li> <li>• truck with cantilever platform</li> <li>• generator and lighting towers</li> <li>• concreting pump, equipment and agitator</li> <li>• traffic control equipment including signage</li> </ul>

Construction activity	Plant/equipment
<b>Utility adjustment</b>	<ul style="list-style-type: none"> <li>• small hand-held tools</li> <li>• small and large excavators</li> <li>• offset boom excavator with rock saw, hammer and bucket attachments</li> <li>• concreting pump, equipment and agitator</li> <li>• dumper</li> </ul>
<b>Bridge repair and maintenance work</b>	<ul style="list-style-type: none"> <li>• small hand-held tools</li> <li>• hiab truck crane</li> <li>• small trucks and utes</li> </ul>
<b>Bridge widening</b>	<ul style="list-style-type: none"> <li>• small hand-held tools</li> <li>• excavators including a long reach excavator with rock hammer attachment and an excavator with a pile boring attachment</li> <li>• tipper truck</li> <li>• hiab truck crane</li> <li>• concrete pump</li> <li>• large cranes including franna crane</li> <li>• prime mover and jinker trailer</li> <li>• hydrodemolition equipment</li> </ul>
<b>Upgrade to the northern and southern approaches</b>	<ul style="list-style-type: none"> <li>• small hand-held tools</li> <li>• small and large excavators, including grinding head attachment</li> <li>• rock bolting rig</li> <li>• elevated work platform</li> <li>• dumper and tipper trucks</li> <li>• concreting pump, equipment and agitator</li> <li>• large cranes</li> <li>• rollers</li> <li>• hydrodemolition equipment</li> </ul>
<b>Finishing work</b>	<ul style="list-style-type: none"> <li>• asphalt plant and machinery</li> <li>• Franna crane</li> <li>• small excavator and tipper</li> <li>• elevated work platform and telehandler</li> <li>• road line marking truck</li> </ul>
<b>Demobilisation</b>	<ul style="list-style-type: none"> <li>• mid-size excavator</li> <li>• tipper trucks, small trucks and small crane</li> </ul>

### 3.3.5 Earthwork

The proposal would require substantial earthworks along the bridge approaches to construct the widened road pavement and supporting bored-pile retaining walls. Earthworks would also be required for

- drainage installation/ extensions

- utility adjustments
- installation of scour protection
- installation of bridge aprons
- construction of crane pads
- construction of temporary waterway crossing.

Movement of materials between work sites may also be required from cutting to fill locations and embankment areas. Overall, the proposal is expected to generate about 5530 cubic metres of excavated material (spoil) comprising about:

- 2000 cubic metres from rock grinding
- 2942 cubic metres from road work (drainage, new pavement, removal of pavement, utilities)
- 143 cubic metres from pavement milling
- 445 cubic metres from retaining wall piling

The earthworks cut for the new road pavement would be about 612 cubic metres. Some of this material is proposed to be reused on-site for the new road pavement. In addition, about 2240 cubic metres of material would be required to be imported from beyond the construction footprint. The final earthwork volumes and locations would be confirmed during detailed design.

Excavated materials would be managed and stored (stockpiled) in accordance with the mitigation measures outlined in this report, and subject to testing and classification in accordance with the *Waste Classification Guidelines* (EPA, 2014) prior to any offsite disposal.

### 3.3.6 Source and quantity of materials

The type and indicative quantities of resources and materials needed to build proposal include:

- natural material (from earthworks and imported materials) – 2850 cubic metres
- steel for bridge components, piling and road furniture – 500 tonnes
- concrete for bridge elements, piling, shotcrete and drainage – 810 cubic metres
- precast concrete and fibre reinforced drainage pipes – 60 metres
- rock for scour protection – 50 tonnes
- pavement sub-base and base materials – 450 tonnes
- heavy duty asphalt – 890 tonnes

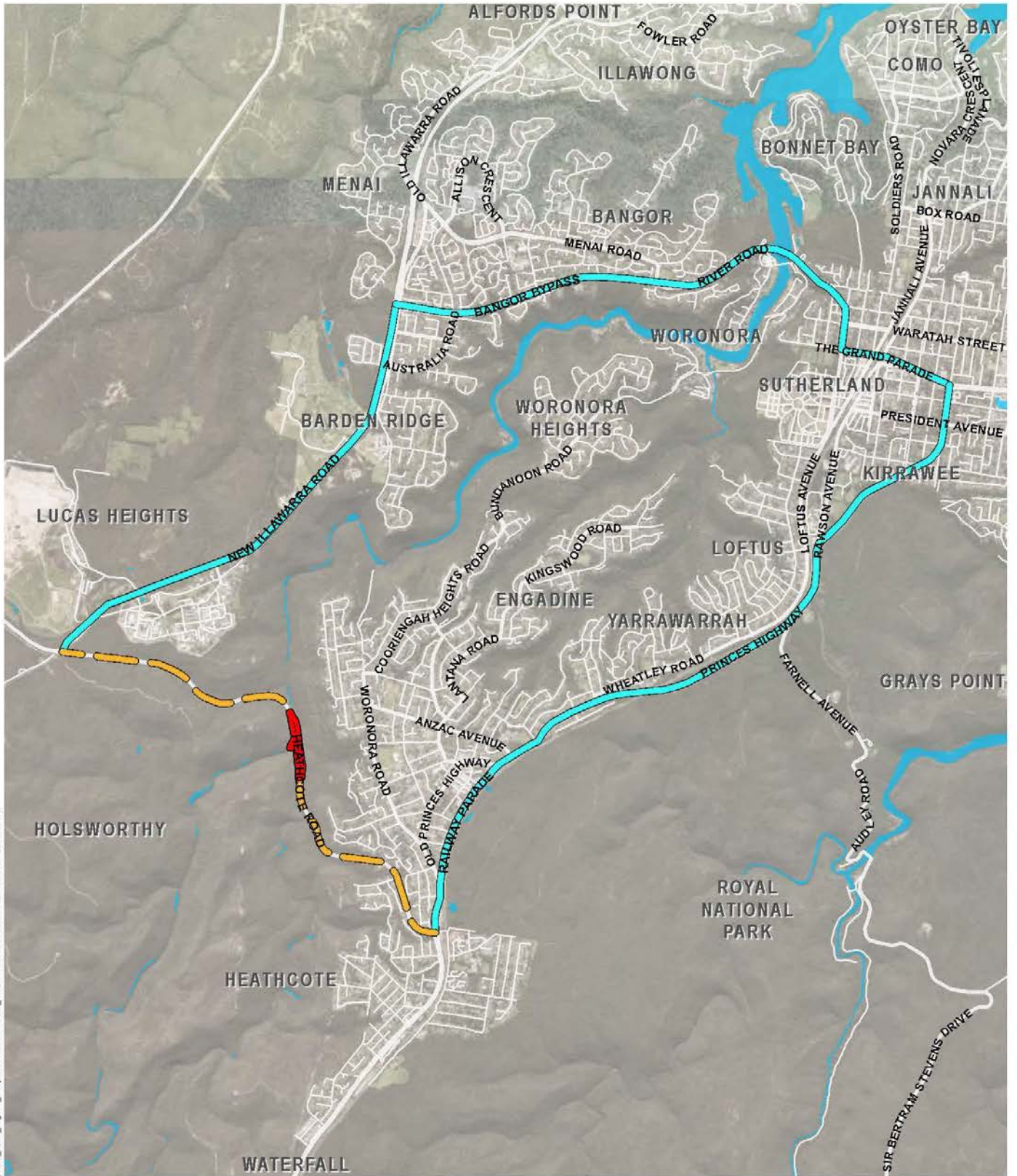
Water would also be required for construction, which would be either trucked into site or sourced from an existing water hydrant located at Forum Drive in Heathcote, east of the proposal area. Activities that would require water use include (but are not limited to) compaction, dust suppression, shotcreting, hydro-demolition, and geotechnical investigations.




### 3.3.7 Traffic management and access

Construction traffic for the proposal would typically access the bridge construction site via New Illawarra Road to the north and the Princes Highway to the south. It is expected that there would be about 24 heavy vehicle and 40 light vehicle movements to and from the site each day, during peak construction. Due to the lack of parking near the bridge, construction workers would generally be transported to and from the site via a shuttle bus.

Construction for the proposal would require full road closure of the section of Heathcote Road between New Illawarra Road and the Princes Highway due to the limited space within the existing road corridor to safely carry out construction work for the proposal and complexity of construction activities required. It is anticipated that six months of continuous full road closure would be required, however this duration would be confirmed in the CEMP and minimised where possible. This full road closure would take place with approval from the Transport Management Centre under the terms of a road occupancy licence. The consultation activities would also be carried out to inform the community in advance of the full road closure including updates of its expected start and end date. During this full road closure, traffic would be diverted to an alternative route that would be about 20 kilometres longer than the existing route via Heathcote Road. This alternative route would use New Illawarra Road, Bangor Bypass, River Road, Linden Street, The Grand Parade and the Princes Highway (refer to Figure 3-7). The potential traffic impact of this is discussed in Section 6.1 (Traffic and transport).





-  Existing route via Heathcote Road
-  Proposed detour route
-  Proposal area

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Source: Aurecon, TNSW, Spatial Services, Esri Topo, Nearmap



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Projection: GDA 1994 MGA Zone 56

### Heathcote Road bridge widening REF

FIGURE 3-7: Proposed detour route during the full road closure of Heathcote Road

## 3.4 Ancillary facilities

### 3.4.1 Main compound sites

Two existing compound sites owned by Transport for NSW are proposed for use during construction for various activities including material and equipment storage and laydown, vehicle and equipment refuelling, site offices, staff parking and staff amenities. The potential impacts associated with the use of these compound sites is assessed in Chapter 6 (Environmental assessment) of this REF.

Compound Location 1 (also referred to as the Lucas Heights compound) is located at the corner of Heathcote Road and New Illawarra Road about five kilometres west of the construction footprint and covers an area of about 700 square metres.

Compound Location 2 (also referred to as the Heathcote compound) is located at the corner of Princes Highway and Wilson Parade about 2.6 kilometres east of the construction footprint and covers an area of about 2100 square metres.



The locations of these compounds are shown in Figure 3-8 and Figure 3-9, respectively.

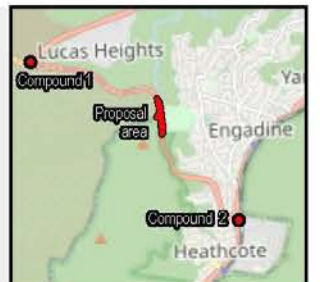
As these compounds have been previously cleared, covered in hardstand and fenced for use as compound sites, use of these sites for the proposal would not require any additional vegetation removal or ground disturbance. However, the existing driveways and concrete kerbs at the entrance to the sites may need to be widened to cater for the number and types of vehicles and equipment expected during construction. The kerb on the northern side of Compound Location 2 would be adjusted to enable access to the compound from Wilson Parade, as an alternative and safer access than directly off the Princes Highway.



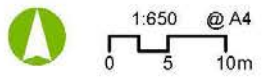


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-  Compound access
-  Proposal area



Source: Aurecon, TfNSW, Spatial Services, Esri Topo, Nearmap



Projection: GDA 1994 MGA Zone 58

**Heathcote Road bridge widening REF**

**FIGURE 3-8:** Compound Location 1 - Lucas Heights compound

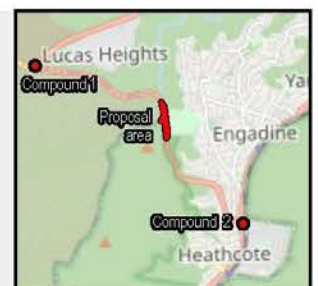




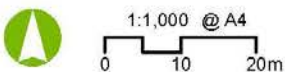
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↕ Compound access

▭ Proposal area



Source: Aurecon, TfNSW, Spatial Services, Esri Topo, Nearmap



Projection: GDA 1994 MGA Zone 56

Heathcote Road bridge widening REF

FIGURE 3-9: Compound Location 2 - Heathcote compound

### **3.4.2 Temporary access track, laydown area and waterway crossing**

A temporary access track, laydown area and waterway crossing are proposed to be established in an area under the bridge near the Woronora River to provide access for construction equipment and temporary storage locations for construction materials closer to the construction footprint.

The new temporary access track (refer to Figure 3-1 and Figure 3-10) would be constructed from the northern abutment on Heathcote Road down to an area under the bridge near the Woronora River, which would largely follow the alignment of an old section of Heathcote Road that was in use prior to 1942. The purpose of this access track is to provide safe access for vehicles, equipment and plant beneath the bridge as well as areas for crane platforms and material laydown. The access track would be designed to be suitable for vehicles and equipment up to a 400 tonne mobile crane in size. A new hardstand laydown area would also be established next to the access track under the bridge.

The temporary waterway crossing across Woronora River would be established to provide safe equipment and vehicle access to the southern side of the bridge. The crossing structure would likely consist of ballast and gravel surrounding large steel pipes, which would be wrapped in geofabric. The large steel pipes would allow free flow of water through the structure. The waterway crossing would include a temporary (in-stream) pad for a mobile crane to lift materials into place for upgrade of the bridge.

It is noted that these areas were unable to be located at least 40 metres away from the Woronora River (as directed in the Transport for NSW guide for selection of ancillary facility locations) due to the steep topography within the Woronora River valley, which significantly restricted the feasible locations for access and laydown areas near the construction footprint. As such, several safeguards have been developed to minimise potential environmental risks associated with the use of these ancillary locations. This would include implementation of a flood action plan, spill response procedures, monitoring of rainfall and dam water release and restrictions around refuelling operations (refer to Section 7.2). The temporary access tracks and waterway crossings would be rehabilitated after construction to return the disturbed areas to pre-existing conditions and limit the need for ongoing maintenance and potential hazards to the general public.



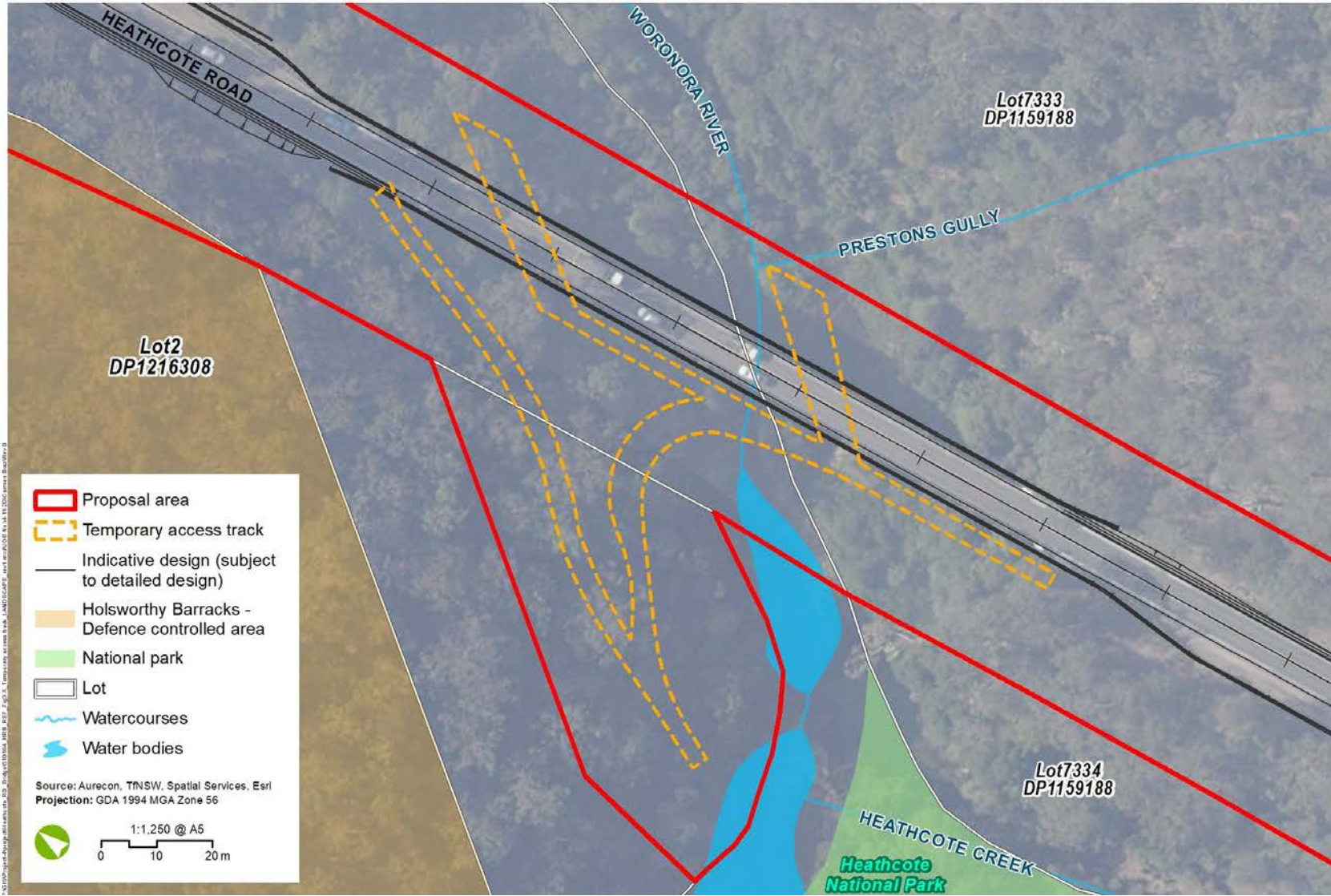


Figure 3-10 Location of temporary access track, laydown area and waterway crossing

### 3.4.3 Minor ancillary facilities within road corridor

It is also proposed to utilise the existing hardstand road corridor within the proposal area as potential alternate minor ancillary areas, subject to appropriate safety and environmental controls. This may include waiting areas for long vehicle deliveries, storage and fabrication of large bridge elements such as bridge girders, laydown area, or short-term stockpiling of excess materials awaiting removal. This may reduce the haulage distance and trips for transport of materials. At the end of construction, these areas would be cleared of all rubbish and materials and rehabilitated to pre-existing conditions.

### 3.5 Public utility adjustment

Preliminary investigations identified that an existing optic fibre cable would be impacted by the proposal. Confirmation of the strategy for relocation of the optical fibre cable would be carried out in consultation with the relevant utility owner during detailed design.

In addition, minor adjustments to electrical cables would be required to reinstate the electronic road signage and CCTV on the northern approach and connect it to the reinstated solar panel tower.

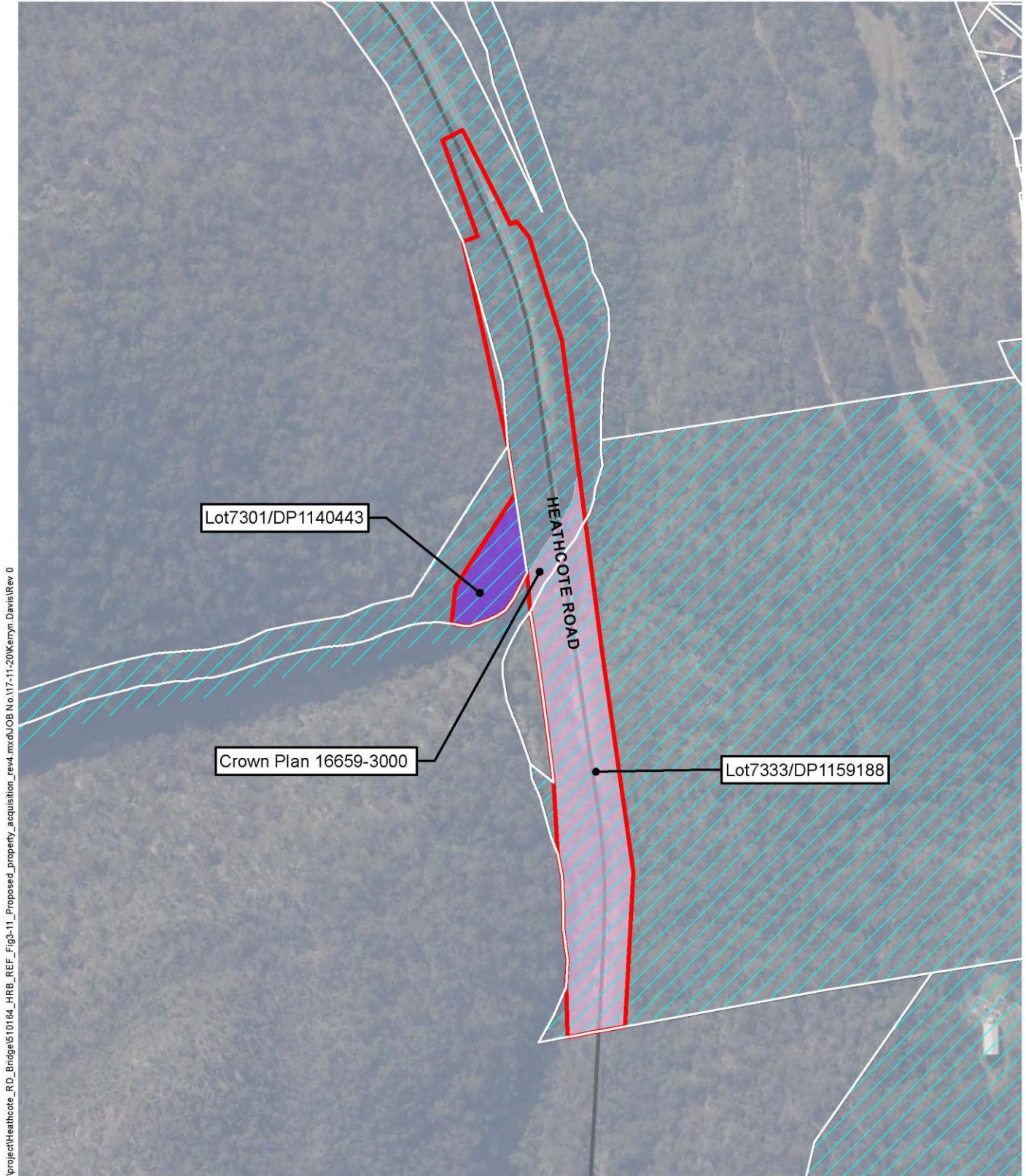
### 3.6 Property acquisition

Transport for NSW would need to acquire about 15,020 square metres of land as well as temporarily lease or negotiate access for additional land for construction of the proposal (refer to Table 3-5 and Figure 3-11). While the final land purchase requirements would be confirmed during the detailed design, all land acquisition would be carried out in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991*.

**Table 3-5 Proposed property acquisition**

Description	Area (m <sup>2</sup> )	Acquisition type	Current owner	Lot and DP	Land use zone (LEP)
Land required to be leased for the access track to the valley	4400	Lease	State of NSW (NSW Crown Lands)	Lot 7301 DP 1140443	SP2 - Infrastructure: Defence
Land required for ownership of the road corridor	14,140	Partial	State of NSW (NSW Crown Lands)	Lot 7333 DP 1159188	E2 - Environmental Conservation E4 - Environmental Living SP2 - Infrastructure: Classified Road / Sewerage System
Land directly beneath the bridge (Woronora River)	880	Partial	Crown Waterway	Crown Plan 16659-3000	N/A



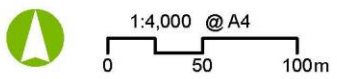


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- Proposal area
- Crown waterway and land
- Property subject to partial acquisition
- Property subject to lease
- Lot
- Heathcote Road



Source: Aurecon, TfNSW, Spatial Services, Esri Topo



Projection: GDA 1994 MGA Zone 56

Heathcote Road bridge widening **REF**

FIGURE 3-11: Proposed property acquisition

## 4 Statutory planning framework

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This chapter provides the statutory and planning framework for the proposal and considers the provisions of relevant state environmental planning policies, local environmental plans and other legislation.

### 4.1 Environmental Planning and Assessment Act 1979

#### 4.1.1 State Environmental Planning Policies

##### **State Environmental Planning Policy (Infrastructure) 2007**

State Environmental Planning Policy (Infrastructure) 2007 (ISEPP) aims to facilitate the effective delivery of infrastructure across the State.

Clause 94 of ISEPP permits development on any land for the purpose of a road or road infrastructure facilities to be carried out by or on behalf of a public authority without consent.

As the proposal is for the widening of a road and a vehicle bridge, which is included in the definition of road infrastructure facilities and is to be carried out by Transport for NSW, it can be assessed under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). Development consent from council is not required.

The proposal is not located on land reserved under the *National Parks and Wildlife Act 1974* and does not require development consent or approval under State Environmental Planning Policy (Coastal Management) 2018, State Environmental Planning Policy (State and Regional Development) 2011 or State Environmental Planning Policy (State Significant Precincts) 2005.

Part 2 of ISEPP contains provisions for public authorities to consult with local councils and other public authorities prior to the commencement of certain types of development. Consultation, including consultation as required by ISEPP (where applicable), is discussed in Chapter 5 of this REF.

##### **Greater Metropolitan Regional Environmental Plan No 2 – Georges River Catchment**

The *Greater Metropolitan Regional Environmental Plan No 2 – Georges River Catchment* (Georges River Catchment REP) applies to land within the Georges River Catchment and provides a series of general and specific planning principles and requirements to establish a consistent and coordinated approach to environmental planning and assessment and protect the environmental quality within the Georges River catchment. The Georges River Catchment REP is a deemed State Environmental Planning Policy (SEPP) in accordance with the EP&A Act.

In accordance with Part 2, Clause 7(c) of the Georges River Catchment REP, Transport for NSW is required to take the planning principles specified in this Plan into account as the proposal is located within the Georges River catchment and is development without consent that may have the potential to adversely affect the water quality, river flows, floor regime or ecosystems within the Catchment.

Table 4-1 outlines how the principles from the Georges River Catchment REP have been considered and addressed in this REF.



**Table 4-1 Consideration of the Georges River Catchment REP planning principles**

Georges River REP principle	Where considered or addressed
<b>General planning principles</b>	
a) the aims, objectives and planning principles of this plan;	As detailed in the following sections of this table, the aims, objectives and planning principles of the REP are considered throughout the REF.
b) the likely effect of the proposed plan, development or activity on adjacent or downstream local government areas;	Chapter 6 (Environmental assessment) examines the potential impacts of the proposal on the environment in the immediate vicinity of the proposal, as well as downstream where possible. Safeguards and management measures have been identified to avoid, minimise or mitigate potential impacts on all receivers, where relevant (refer to Section 7.2).
c) the cumulative impact of the proposed development or activity on the Georges River or its tributaries,	Sections 6.4 and 6.5 outline the potential impacts of the proposal on water quality and hydrology, with a focus on the Woronora River, which is a major tributary of the Georges River. The assessment considered the impacts of the existing development and any additional cumulative impact of this proposal.
d) any relevant plans of management including any River and Water Management Plans approved by the Minister for Environment and the Minister for Land and Water Conservation and best practice guidelines approved by the Department of Urban Affairs and Planning (all of which are available from the respective offices of those Departments);	<p>The plans of management considered include but are not limited to:</p> <ul style="list-style-type: none"> <li>• <i>NSW Metropolitan Water Plan</i></li> <li>• <i>Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources (2011)</i></li> <li>• <i>Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources (2011)</i></li> </ul> <p>Relevant legislation and guidelines are further outlined in Section 6.4.2.</p>
e) the <i>Georges River Catchment Regional Planning Strategy</i> (prepared by, and available from the offices of, the Department of Urban Affairs and Planning);	The NSW Office of Water and the NSW Office of Environment and Heritage (OEH) Water Quality Objectives (WQOs) and the River Flow Objectives (RFOs) for the Georges River catchment supersede the Georges River Catchment Strategy (which is an old document). The specific WQOs and the RFOs are considered for the proposal within Section 6.4.



Georges River REP principle	Where considered or addressed
<p>f) all relevant State Government policies, manuals and guidelines of which the council, consent authority, public authority or person has notice; and</p>	<p>The assessment of hydrology and water quality impacts has been based on:</p> <ul style="list-style-type: none"> <li>• <i>NSW Water Quality and River Flow Objectives</i></li> <li>• <i>NSW State Groundwater Policy Framework:</i></li> <li>• <i>NSW Aquifer Interference Policy</i></li> <li>• <i>NSW Metropolitan Water Plan</i></li> </ul> <p>In addition, this Chapter outlines the relevant NSW State Government regulations applicable to the proposal including state environmental planning policies and other legislation.</p> <p>Relevant legislation and guidelines are further outlined in Section 6.4.2.</p>
<p>g) whether there are any feasible alternatives to the development or other proposal concerned.</p>	<p>Section 2.4 discusses the alternatives identified for the proposal and justifies the preferred option.</p>
<b>Specific planning principles</b>	
<p><b>(1) Acid sulfate soils</b></p> <p>Disturbance of acid sulfate soil areas is to be avoided or minimised and those areas are to be protected in accordance with the requirements set out in the Acid Sulfate Soils Assessment and Management Guidelines prepared by the Acid Sulfate Soils Management Advisory Committee. Measures to minimise that disturbance are to take into account the following—</p> <p>(a) verification of the existence, locations and extent of acid sulfate soils,</p> <p>(b) the capacity of land to sustain the proposed land uses, having regard to—</p> <p>(i) potential impacts on surface and groundwater quality and quantity, and</p> <p>(ii) potential impacts on ecosystems and on biodiversity, and</p> <p>(iii) potential impacts on agricultural, fisheries and aquaculture productivity, and</p> <p>(iv) any likely engineering constraints and impacts on infrastructure, and</p> <p>(v) cumulative environmental impacts.</p>	<p>A review of the acid sulfate soil (ASS) mapping on the Australian Soil Resource Information System (ASRIS) identified that there is an extremely low probability of encountering ASS within the proposal footprint (CSIRO, 2014). As such, it is unlikely that ASS would be disturbed during construction or operation of the proposal.</p>

Georges River REP principle	Where considered or addressed
<p><b>(2) Bank disturbance</b></p> <p>Disturbance of the bank or foreshore along the Georges River and its tributaries is to be avoided and those areas and any adjoining open space or vegetated buffer area must be protected from degradation.</p>	<p>The construction methodology and materials for the temporary access track, waterway crossing and crane pads would be subject to design input from a soil conservation specialist and approved construction work method statements. Appropriate erosion and sediment control including progressive stabilisation plans and severe weather event plans would be implemented to mitigate risk of bank disturbance during construction.</p> <p>Disturbed areas would be restored on completion and design features including new pier protection, formalised drainage outlets with scour protection, and new bridge aprons would assist to alleviate risk of bank disturbance during operation.</p> <p>The final safeguards and mitigation measures to be implemented during construction to minimise bank disturbance would be outlined in the Soil and Water Management Plan as part of the CEMP.</p>
<p><b>(3) Flooding</b></p> <p>The following are to be recognised—</p> <ul style="list-style-type: none"> <li>(a) the benefits of periodic flooding to wetland and other riverine ecosystems,</li> <li>(b) the pollution hazard posed by development on flood liable land in the event of a flood,</li> <li>(c) the cumulative environmental effect of development on the behaviour of flood water and the importance of not filling flood prone land.</li> </ul>	<p>The proposal is generally located outside the 1% annual exceedance probability (AEP) flood zone and does not extend into flood prone land with the exception of the temporary access track, waterway crossing and crane pad located under the bridge (refer to Section 3.4.2).</p> <p>As discussed in Section 6.4, potential impacts on flooding may result during construction from the temporary waterway crossing and crane pads that would be installed within the waterway. These potential impacts would be minimised by designing the waterway crossing to include appropriate pipe outlets to maintain flow, scour protection and flood immunity. However, impacts on flooding during operation of the proposal would be minimal as the new bridge elements and widened approaches would generally be located above flood prone land.</p>

Georges River REP principle	Where considered or addressed
<p><b>(4) Industrial discharges</b></p> <p>The discharging of industrial waste into the Georges River or its tributaries must be avoided and the requirements of the relevant consent authority and licensing authority must be met in those instances where industrial discharges into the river and its tributaries occur.</p>	<p>The proposal would not involve any discharging of industrial waste into the Georges River or its tributaries.</p>
<p><b>(5) Land degradation</b></p> <p>Land degradation processes, such as—</p> <ul style="list-style-type: none"> <li>(a) erosion,</li> <li>(b) sedimentation,</li> <li>(c) deterioration of soil structure,</li> <li>(d) significant loss of native vegetation,</li> <li>(e) pollution of ground or surface water,</li> <li>(f) soil salinity and acidity, and</li> <li>(g) adverse effects on habitats and sensitive natural environments (aquatic and terrestrial) within the Catchment, must be avoided where possible, and minimised where avoidance is not possible.</li> </ul>	<p>Potential land degradation and contamination impacts as a result of the proposal are discussed in Sections 6.3 and 6.4.</p> <p>Where potential impacts have been identified, safeguards and mitigation measures have been proposed, as outlined in Sections 6.3.4 and 6.3.5, to avoid or minimise these impacts.</p>
<p><b>(6) On-site sewage management</b></p> <p>The potential adverse environmental and health impact associated with effluent disposal is to be recognised and guarded against by meeting the criteria set out in the <i>Environment Health Protection Guidelines: On-site Sewage Management for single households</i> and the provisions of the <i>Local Government (Approvals) Regulation 1993</i>.</p>	<p>The proposal would not involve any on-site sewage management.</p>
<p><b>(7) River-related uses</b></p> <p>Uses located on immediate foreshore land on the Georges River and its tributaries must be water-related and public access to the foreshore of the river and its tributaries must be provided in order to enhance the environment of the Catchment.</p>	<p>The proposal would not change the existing use of the land for the Heathcote Road bridge. No additional land uses would be permanently established on foreshore land as a result of the proposal.</p>

Georges River REP principle	Where considered or addressed
<p><b>(8) Sewer overflows</b></p> <p>The adverse impact of sewer overflows, including exfiltration, on the environment within the Catchment, and specifically on the water quality of the river and its tributaries, is to be recognised and that issue is to be addressed through appropriate planning and management of development within the Catchment.</p>	<p>The proposal would not involve development of or adjustment to sewage infrastructure.</p>
<p><b>(9) Urban/stormwater runoff</b></p> <p>The impacts of stormwater runoff, including sewage contaminated runoff into or near streams within the Catchment, is to be minimised and mitigation measures that address urban stormwater runoff are to be implemented in accordance with the local council requirements and the Managing Urban Stormwater series of documents. Development is also to be in accordance with the NSW State Rivers and Estuaries Policy available from offices of the Department of Urban Affairs and Planning. Stormwater management must be integrated so that quality, quantity and land use aspects are all encompassed.</p>	<p>Potential impacts associated with stormwater runoff during construction and operation of the proposal are discussed in Section 6.4.5. To minimise the potential impacts, safeguards and management measures would be implemented, including implementation of a Soil and Water Management Plan, site specific Erosion and Sediment Control Plans and incorporation of water sensitive urban design (WSUD) measures in the detailed design, where feasible.</p>
<p><b>(10) Urban development areas</b></p> <p>The environment within the Catchment is to be protected by ensuring that new or expanding urban development areas are developed in accordance with the Urban Development Program and the Metropolitan Strategy and that the requirements of the NSW Floodplain Development Policy and Manual (prepared by and available from the Department of Land and Water Conservation) are also satisfied. It is important to ensure that the level of nutrients entering the waterways and creeks is not increased by the development.</p>	<p>The proposal would not involve the establishment of new or expanding urban development areas or increase the level of nutrients likely to enter the surrounding waterways.</p>
<p><b>(11) Vegetated buffer areas</b></p> <p>Appropriate buffer widths (as identified in item 21 relating to Development in Vegetated Buffer Areas in the Planning Control Table in Part 3) must be retained as a means of improving surface runoff entering into the Georges River or its tributaries.</p>	<p>The potential impacts of the proposal on vegetation is discussed in Section 6.3. The proposal would not notably reduce the existing vegetated buffer widths along the Woronora River, which is a tributary of the Georges River.</p>

Georges River REP principle	Where considered or addressed
<p><b>(12) Water quality and river flows</b></p> <p>Water quality and river flows within the Catchment are to be improved through the implementation of environmental objectives for water quality and river flows agreed between the Minister for Environment and the Minister for Land and Water Conservation and by the application of consistent decisions affecting the use and management of land.</p>	<p>As detailed above, water quality would be protected through a variety of strategies associated with stormwater management, as well as responsible construction and operation practices (e.g. to avoid or minimise erosion and sedimentation or other forms of contamination). The environmental values and water quality guidelines specific to the Georges River, and which have been used for the basis of the assessment of water quality impacts, are identified in Section 6.4.3.</p>
<p><b>(13) Wetlands</b></p> <p>Wetlands must be protected through the application of consistent land use and management decisions that take into account the potential impact of surrounding land uses, incorporate measures to mitigate adverse effects and are in accordance with the NSW Wetlands Management Policy (prepared by and available from the Department of Land and Water Conservation). Wetlands must also be protected by requiring adequate provisions where clearing, construction of a levee, draining or landscaping is to be undertaken.</p>	<p>The proposal does not involve any impact on wetlands.</p>

#### 4.1.2 Sutherland Shire Local Environmental Plan 2015

The proposal is located within the Sutherland Shire Local Government Area (LGA). Local development control and land use zoning within the Sutherland Shire LGA is managed under the *Sutherland Shire Local Environmental Plan 2015* (Sutherland Shire LEP). The operation of the ISEPP means that the Sutherland Shire LEP does not apply where they impose controls that are inconsistent with the ISEPP. However, the LEP is still relevant in identifying land use objectives, potential land use impacts and planning policy conflicts and as such, has still been considered.

The proposal is located within land zoned as SP2: Infrastructure under the Sutherland Shire LEP (refer to Figure 6-28). The proposal is consistent with the objectives of this zone, which are to provide for infrastructure and related uses as well as to prevent development that is not compatible with or that may detract from the provision of infrastructure, as it is associated with road and bridge infrastructure.



## 4.2 Other relevant NSW legislation

### 4.2.1 Roads Act 1993

The *Roads Act 1993* establishes that consent is required from the relevant road authority for the carrying out of work in, on or over a public road. A road occupancy licence would be obtained from the Transport Management Centre under Section 138 of the *Roads Act 1993* to build the proposal as it would impact the operation of Heathcote Road, which is a classified road managed by Transport for NSW.

### 4.2.2 Crown Lands Management Act 2016 and Crown Land Legislation Amendment Act 2017

The *Crown Lands Management Act 2016* and *Crown Land Legislation Amendment Act 2017* set out the requirements for ownership, use and management of Crown Land. They describe the permissions and authorisation needed when planning the development of activities on Crown Land. They also include provisions relating to specific controls and restrictions on the development of Crown Land for Division 5.1 activities. The *Crown Lands Management Act 2016* also describes the process for the acquisition of Crown Land.

Most of the proposal is located within Crown Land (refer to Table 3-5). As such, Transport for NSW would need to secure the required lease and/or land acquisition in accordance with these Acts before starting work and for ongoing ownership of the road corridor during operation.

### 4.2.3 Heritage Act 1977

The *Heritage Act 1977* (Heritage Act) is designed to protect both known heritage items (such as standing structures) and items that may not be immediately obvious (such as potential archaeological remains or 'relics'). Different parts of the Heritage Act deal with different situations and types of heritage and the Act provides a number of mechanisms by which items and places of heritage significance may be protected.

Section 57(1) of the Heritage Act lists the types of activities/works that require approval from Heritage NSW (a branch of the NSW Department of Premier and Cabinet) under Section 60 of the Heritage Act, when working on/in an item/place listed on the State Heritage Register (SHR). An application for an exemption can also be made under some circumstances. There are no items or conservation areas listed on the SHR within the proposal area, therefore no approvals under Section 60 of the Heritage Act would be required.

Section 139 of the Heritage Act protects archaeological 'relics' from being 'exposed, moved, damaged or destroyed' by the disturbance or excavation of land. This protection extends to the situation where a person has 'reasonable cause to suspect' that archaeological remains may be affected by the disturbance or excavation of the land. This section applies to all land in NSW that is not included on the SHR. Mitigation measures would be implemented to prevent harm to archaeological relics including implementation of the *Standard Management Procedure - Unexpected Heritage Items* (Roads and Maritime, 2015), which would be followed in the event that any potential relics are encountered during construction of the proposal (refer to Section 6.7.4).

Section 170 of the Heritage Act requires that culturally significant items or places managed or owned by Government agencies are listed on a departmental Heritage and Conservation Register.

Section 170A(1) requires that, if a government instrumentality intends to undertake any of the following actions regarding items listed on their s170 Heritage and Conservation Register, it must give the Heritage Council a minimum of 14 days' notice:

- remove an item from the s170 register
- transfer ownership
- cease to occupy an item currently on the s170 register
- demolish an item

The Heathcote Road bridge is listed on the Roads and Maritime Services s170 Heritage and Conservation Register as 'Woronora River Bridge, RTA Bridge No. 152'. Transport for NSW has carried out consultation with Heritage NSW regarding potential impacts to the bridge structure due to the proposal (refer to Section 5.5).

#### **4.2.4 Protection of the Environment Operations Act 1997**

The NSW *Protection of the Environment Operations Act 1997* (POEO Act) aims to reduce pollution and manage the storage, treatment and disposal of waste within NSW. The POEO Act also introduces the requirement for environmental protection licences (EPLs) to be obtained for scheduled activities that are of a nature and scale that have a potential to cause environmental pollution.

Road construction is declared to be a scheduled activity in accordance with Clause 35, Schedule 1 of the Act if it results in one or more of the following:

- the extraction or processing (over the life of the construction) of more than—
  - i. 50,000 tonnes of materials in the case of premises in the regulated area or in the local government areas of Bega Valley, Eurobodalla, Goulburn Mulwaree, Queanbeyan-Palerang Regional or Snowy Monaro Regional, or
  - ii. 150,000 tonnes of material in any other case,
- the existence of 4 or more traffic lanes (other than bicycle lanes or lanes used for entry or exit) for a continuous length of at least—
  - i. 1 kilometre—where the road is in a metropolitan area and is classified, or proposed to be classified, as a freeway or tollway under the *Roads Act 1993*, or
  - ii. 3 kilometres—where the road is in a metropolitan area and is classified, or proposed to be classified, as a main road (but not a freeway or tollway) under the *Roads Act 1993*, or
  - iii. 5 kilometres—where the road is not in a metropolitan area and is classified, or proposed to be classified, as a main road, freeway or tollway under the *Roads Act 1993*.

Current estimates for the proposal are that it would not exceed the trigger for extraction or processing of over 150,000 tonnes of material during construction and would not result in the existence of four or more traffic lanes for a continuous length of three kilometres, an EPL would not be required.

#### **4.2.5 National Parks and Wildlife Act 1974**

The *National Parks and Wildlife Act 1974* (NPW Act) provides for the control and management of all national parks, historic sites, nature reserves, wetlands and other state reserves. The proposal is not located within land reserved under the NPW Act, however is located next to Heathcote National Park. Safeguards and management measures would be implemented (refer to Section 7.2) to prevent any direct or indirect impacts on Heathcote National Park as a result of the proposal.

The NPW Act also provides for the protection of 'Aboriginal objects' and 'Aboriginal places' and makes it an offence to harm Aboriginal objects, places or sites without permission.

An Aboriginal archaeological survey report prepared for the proposal identified one known Aboriginal site to be located within the initial proposal footprint (refer to Section 6.6). Safeguards and mitigation measures would be implemented to ensure this site would be avoided during construction and operation of the proposal. Therefore, an Aboriginal heritage impact permit under Part 6 of this Act would not be required.

An unexpected finds procedure and other appropriate safeguards would also be implemented to address circumstances if an unexpected find occurs to prevent any damage to any Aboriginal objects, places or sites due to the proposal.

#### **4.2.6 Biodiversity Conservation Act 2016**

The *Biodiversity Conservation Act 2016* (BC Act) is directed at conserving threatened species, populations and ecological communities of animals and plants. The BC Act outlines the framework for addressing impacts on biodiversity from development and clearing. It establishes a framework to avoid, minimise and offset impacts on biodiversity from development through the Biodiversity Offsets Scheme.

A biodiversity assessment report (BAR) has been prepared for the proposal in accordance with the requirements of the Biodiversity Assessment Methodology (BAM) under the BC Act. Significant impact assessments, in accordance with the BC Act, have been carried out for threatened species and endangered ecological communities with a moderate to high likelihood of occurrence within the proposal area and considered likely to be impacted upon by the proposal. These assessments concluded that the proposal is unlikely to have a significant impact on threatened species (refer to Section 6.3.3).

#### **4.2.7 Water Management Act 2000 and Water Act 1912**

The *Water Management Act 2000* (WM Act) provides for the sustainable and integrated management of water resources. Aquifer interference approval requirements under the WM Act have not yet commenced, and regulation is managed under Part 5 of the *Water Act 1912*.

The WM Act includes requirements for:

- a water access licence to take water from a river, lake, dam or groundwater for irrigation, industrial or commercial purposes
- a water supply work approval to construct and use a water supply work, such as a pump, dam, channel or bore
- a water use approval to use water for a specific purpose at a particular location
- a flood work approval for works on floodplains that divert floodwaters
- a controlled activity approval to carry out work in a watercourse or within 40 metres of the bank of a river, lake or estuary, such as extracting material from a river bed, constructing a creek crossing or residential developments

The proposal would require establishment of a watercourse crossing and work within 40 metres of Woronora River, which is considered a controlled activity. However, Transport for NSW is exempt from controlled activity approvals under Subdivision 4, Clause 41 of the *Water Management (General) Regulation 2018* as they are a public authority. The proposal does not involve any water take, use or supply from natural sources or flood diversion work.

The proposal would not be likely to intercept groundwater aquifers and require dewatering. Therefore, no approvals or licences are required for the proposal under the WM Act and *Water Act 1912*.

#### **4.2.8 Fisheries Management Act 1994**

The *Fisheries Management Act 1994* (FM Act) provides for the identification, conservation and recovery of threatened fish, aquatic invertebrates and marine vegetation. One of the key objectives of the FM Act is to conserve fish stocks and key fish habitats.

Part 7 of the FM Act establishes that a permit is generally required to dredge, reclaim, obstruct fish passage, harm marine vegetation, use explosives or electrical devices in a waterway that is classified as key fish habitat.

The proposal would involve construction of a watercourse crossing of Woronora River and crane pads along the banks. Woronora River and Heathcote Creek are mapped as key fish habitat. However, as no marine vegetation is likely to be harmed from the proposal, a section 205 permit under Part 7 of the FM Act is not required. Under section 219(5)(a), any work that is permitted under the FM Act turns off the requirement for a section 219 permit to block fish passage, therefore a section 219 permit is also not required.

#### **4.2.9 Biosecurity Act 2015**

The *Biosecurity Act 2015* requires Transport for NSW to control, remove and eradicate weeds on land that they own to avoid further growth and spreading. A total of five priority weed species were observed opportunistically within the biodiversity study area: African Olive, Ground Asparagus, Lantana, Primrose and Alligator Weed. Section 6.1 includes safeguards and management measures to manage these weeds in accordance with the *Biosecurity Act 2015* during construction and operation of the proposal.

#### **4.2.10 Waste Avoidance and Resource Recovery Act 2001**

The NSW *Waste Avoidance and Resource Recovery Act 2001* (WARR Act) promotes the waste hierarchy to avoid resource consumption and implement resource recovery in the form of material reuse and recycling in preference to waste disposal. The Act acknowledges that certain materials present either human or environmental risk, requiring classification, treatment and disposal of in accordance with specific waste management provisions. Waste generated during construction and operation of the proposal would be managed in accordance with the waste hierarchy and where required, disposed of in accordance its waste classification and relevant legislation and guidelines.

### **4.3 Commonwealth legislation**

#### **4.3.1 Environment Protection and Biodiversity Conservation Act 1999**

Under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) a referral is required to the Australian Government for proposed actions that have the potential to significantly impact on matters of national environmental significance or the environment of Commonwealth land. These are considered in Appendix A and Chapter 6 of the REF.

#### **Findings – matters of national environmental significance**

The assessment of the proposal's impact on matters of national environmental significance and the environment of Commonwealth land found that there is unlikely to be a significant impact on relevant matters of national environmental significance or on Commonwealth land. Accordingly, the proposal has not been referred to the Australian Government Department of Agriculture, Water and Environment under the EPBC Act.



## Findings – nationally listed biodiversity matters

The assessment of the proposal's impact on nationally listed threatened species, endangered ecological communities and migratory species found that there is unlikely to be a significant impact on relevant matters of national environmental significance. Chapter 6 of the REF describes the safeguards and management measures to be applied. Potential impacts to these biodiversity matters are also considered as part of Chapter 6 of the REF and Appendix D. As such, the proposal has not been referred to the Australian Government Department of Agriculture, Water and Environment under the EPBC Act.

### 4.3.2 Other relevant Commonwealth legislation

#### Native Title Act 1993

The *Native Title Act 1993* recognises and protects native title. The Act covers actions affecting native title and the processes for determining whether native title exists and compensation for actions affecting native title. It establishes the Native Title Registrar, the National Native Title Tribunal, the Register of Native Title Claims and the Register of Indigenous Land Use Agreements, and the National Native Title Register. Under the Act a future act includes proposed public infrastructure on land or waters that affects native title rights or interest.

A search of the Native Title Tribunal Native Title Vision website was carried out in September 2020, with one Native Title claim identified within the proposal footprint, NC2017/003 – South Coast People. Accordingly, Transport for NSW would provide notice of the proposal to NTSCORP under section 24KA of the Act and would invite comment on the proposal.

## 4.4 Confirmation of statutory position

The proposal is categorised as development for the purpose of a road and road infrastructure facilities and is being carried out by or on behalf of a public authority. Under clause 94 of ISEPP the proposal is permissible without consent. The proposal is not State significant infrastructure or State significant development. The proposal can be assessed under Division 5.1 of the EP&A Act.

Transport for NSW is the determining authority for the proposal. This REF fulfils Transport for NSW's obligation under section 5.5 of the EP&A Act including to examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the activity. Transport for NSW has also:

- taken into account the planning principles outlined in the Georges River Catchment REP, as required by Part 2, Clause 7(c) of the REP, to minimise any potential impacts of the proposal on the water quality, river flows, floor regime or ecosystems within the Georges River Catchment
- carried out consultation with National Parks and Wildlife Service in accordance with the ISEPP (refer to Section 5.4) due to the proposal being located directly adjacent to Heathcote National Park
- carried out consultation with DPI Fisheries in accordance with the FM Act (refer to Section 5.5) due to works meeting the definition of 'dredging and reclamation' and potential risk of the temporary waterway crossing structure to fish passage
- carried out consultation with Heritage NSW due to potential impacts on an item listed on a s170 heritage register (refer to Section 4.2.3)

## 5 Consultation

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This chapter discusses the consultation carried out to date for the proposal and the consultation proposed for the future.

### 5.1 Consultation strategy

Transport for NSW has prepared a Community and Stakeholder Engagement Plan (CSEP) to guide communications and consultation activities for the proposal. The consultation approach for the proposal aims to:

- provide regular and targeted information to the community and stakeholders on the need and benefits of the proposal and the progress of the proposal and construction activities
- provide opportunities for the public to have meaningful input during development of the proposal
- ensure community and stakeholder feedback and issues are considered in the decision-making process
- build stakeholder and community confidence by demonstrating Transport for NSW's understanding of the community values and the potential impacts of the proposal, and the measures carried out to manage and minimise potential issues
- manage stakeholder feedback and complaints in a timely, respectful way

The CSEP outlines the relevant stakeholder groups that have been identified for the proposal, as they may have interested or be affected by the proposal. These groups include, but are not limited to:

- State and local government agencies and elected government representatives
- Key organisations such as ANSTO and Holsworthy Barracks
- Emergency services
- Utility providers
- Aboriginal groups including local Aboriginal land councils
- special interest groups such as transport and heritage groups
- local residents, businesses and road users

These stakeholder groups would be consulted with on relevant aspects of the proposal using a variety of engagement activities and consultation methods.

### 5.2 Community involvement

Table 5-1 summarises the community engagement activities carried out to date for the proposal, which included a targeted community consultation campaign in May and June 2020. It is noted that the consultation approach for the proposal to date has largely avoided face-to-face consultation activities due to the COVID-19 restrictions and social distancing requirements.

**Table 5-1 Community engagement activities carried out for the proposal**

Activity/ consultation method	Dates	Summary
Letterbox drop	23-24 May 2020	9000 postcards were distributed to local residents and businesses to inform them about the proposal
Facebook video advertisement	25 May – 5 June 2020	This advertisement was targeted to local residents and road users and reached 85,627 people
Facebook Live event	25 May – 3 June 2020	This Facebook Live event was targeted to local residents and road users and reached an audience of 391 people
Posters	25 May 2020	Posters advertising the proposal were put up in several community locations including local shopping centres and businesses.
Online questionnaire	May and June 2020	An online questionnaire inviting community feedback on the proposal, which collected 1042 responses.
Media release	1 June 2020	A media release about the proposal was distributed via local and state media channels.
Variable message signs (VMS)	1-6 June 2020	Three VMS have been setup in strategic locations to inform motorists passing by routes to the Heathcote Road bridge about the proposal.
Toll free community enquiry number	Ongoing	A dedicated toll-free 1800 telephone number (1800 572 004) has been created to receive and respond to enquiries from the community and interested stakeholders on the proposal.
Project website	Ongoing	The project website ( <a href="https://www.rms.nsw.gov.au/projects/heathcote-road-bridge/index.html">https://www.rms.nsw.gov.au/projects/heathcote-road-bridge/index.html</a> ) provides information on the proposal background, key features, benefits, proposal milestones and timelines, and contact information.
Project email address	Ongoing	A dedicated email address ( <a href="mailto:HeathcoteRoadBridge@transport.nsw.gov.au">HeathcoteRoadBridge@transport.nsw.gov.au</a> ) has been created to receive and respond to enquiries from the community and interested stakeholders.

Table 5-2 summarises the key issues raised in the feedback received on the proposal during the targeted community consultation and online questionnaire in May and June 2020. More information is provided in the *Proposed safety improvements to Heathcote Road narrow bridge over Woronora River, Engadine – Engagement Report* (TfNSW, 2020a).

**Table 5-2 Summary of issues raised by the community**

Issue raised	Response/where addressed in REF
<b>The bridge lacks a consistently used name</b>	The most popular name for the bridge from the online questionnaire, 'Heathcote Road bridge', has been adopted to refer to the bridge in this REF.
<b>Over 80 per cent of responses were concerned with the safety of the existing bridge, including the narrow road lanes and narrow shoulder and approach access</b>	The design for the proposal has focused on improving the safety of the Heathcote Road bridge in accordance with current design standards (refer to Section 3.2.1).
<b>Need for more lanes or another bridge and/or need for road upgrades to meet future demand</b>	<p>Due to the community feedback, duplication of the existing bridge to provide an additional lane in each direction was separately considered. However, providing additional lanes would be more expensive, be more challenging to design, take longer to construct, result in greater potential environmental impacts and would not be justified based on current traffic volumes.</p> <p>These challenges and the associated increased timeframe for delivery would make providing additional lanes incompatible with the proposal objectives, which are to provide a short-term solution that can improve road safety and network reliability. As a result, providing additional lanes was considered out of the scope of the current proposal and instead considered as a longer-term upgrade that could be investigated in the future, if additional road capacity is required due to growth in traffic volumes (refer to Section 2.4.2).</p> <p>Traffic modelling for the proposal showed that the current number of lanes would be adequate to cater for the current and predicted volume of vehicles that would use the Heathcote Road bridge in the short to medium term.</p> <p>It is noted that the current preferred option does not prevent a further upgrade in the future, in the case of a significant increase in traffic demand that would require additional lanes. As such, provision of additional lanes or duplication of the existing bridge may be considered in future separately to this proposal.</p>



Issue raised	Response/where addressed in REF
<p><b>Concern regarding the bridge closure during construction work</b></p>	<p>This REF assesses the ‘worst-case’ construction scenario, where a full road closure would be required continuously for six months, due to the limited space available in the road corridor to safely construct the proposal. During this time, an alternate detour route would be provided for local road users. The potential traffic impacts associated this bridge closure and detour route is discussed in detail in Section 6.1.3.</p> <p>However, Transport for NSW acknowledges the community concern regarding this closure and are investigating innovations and alternative construction methodologies to minimise the duration and/or eliminate the need for daytime road closures, where possible. The community would be kept informed regarding the likely timing and duration of bridge closures in the lead up to, and throughout the construction period.</p> <p>Construction work would be carried out so that one lane remains accessible for construction vehicles and emergency vehicles to ensure that emergency services are not compromised for the local community.</p>

### 5.3 Aboriginal community involvement

The potential Aboriginal heritage impacts of the proposal have been considered in accordance with the requirements of Transport for NSW’s *Procedure for Cultural Heritage Consultation and Investigation* (PACHCI) (Roads and Maritime, 2011). Table 5-3 summarises the stages outlined in the PACHCI.

**Table 5-3 Summary of Transport for NSW Procedure for Aboriginal Cultural Heritage Consultation and Investigation**

Stage	Description
<b>Stage 1</b>	Initial Transport for NSW assessment
<b>Stage 2</b>	Site survey and further assessment
<b>Stage 3</b>	Formal consultation and preparation of a cultural heritage assessment report
<b>Stage 4</b>	Implement environmental impact assessment recommendations

Stages 1 and 2 of the PACHCI have been completed for the proposal. This included field surveys of the proposal footprint by an archaeologist and Land Council representatives to assess the proposal’s potential to harm Aboriginal cultural heritage and determine whether formal Aboriginal community consultation and a cultural heritage assessment report is needed.

Identified stakeholders for the proposal area included Gandangarra Local Aboriginal Land Council (GLALC), Tharawal Local Aboriginal Land Council (TLALC) and the registered Native Title claimant for the area, the South Coast People. Field surveys were conducted in May and August 2020 by archaeologists and with representation from GLALC. All identified stakeholders were invited, though only GLALC was able to provide a representative.

During the surveys, one known AHIMS site was found (though at a location about 300 metres out from the recorded coordinates). Recommendations were made to update the site coordinate details with Office of Environment and Heritage (OEH). On completion of the surveys, Transport for NSW received verbal confirmation from GLALC and TLALC supporting this action to update the coordinates of the heritage feature. This has since been actioned.

Refer to Section 6.6 for more information on consultation as per the PACHCI.

## **5.4 ISEPP consultation**

Clause 94 of the ISEPP provides that “development on behalf of a public authority for the purpose of a road or road infrastructure facilities may be carried out without consent” providing that certain key parties are consulted and/or notified about the work.

The National Parks and Wildlife Service (a directorate of the DPIE) has been consulted about the proposal as per the requirements of clause 16(2)(a) of ISEPP. Appendix B contains an ISEPP consultation checklist that documents how ISEPP consultation requirements have been considered.

Issues that have been raised as a result of this consultation are outlined below in Table 5-4.

**Table 5-4 Issues raised through ISEPP consultation**

Agency	Issue raised	Response/where addressed in REF
<p><b>National Parks and Wildlife Service (NPWS)</b></p>	<p>NPWS requests a copy of the REF once completed and an on-site meeting with NPWS representatives once the REF has been received and reviewed.</p>	<p>Transport for NSW would provide National Parks and Wildlife Service a copy of the final REF and arrange an on-site meeting with NPWS representatives.</p>
	<p>NPWS requests that the Heathcote National Park boundary is clearly delineated, for example using temporary orange safety mesh fence, before any works commence.</p>	<p>This suggestion has been adopted as a safeguard to minimise potential impacts on Heathcote National Park (refer to Section 6.8.4)</p>
	<p>Any trees to be removed be fully assessed by a qualified arborist to establish if animals may be living in them. If this is a possibility, then alternatives to direct felling should be considered.</p>	<p>This suggestion has been adopted as a mitigation measure to minimise potential impacts on fauna (refer to Section 6.3.4).</p>
	<p>Consideration must be given to the bridge design to support koala and other fauna crossing needs in mind, as Heathcote Road is a known 'hot-spot' for koala deaths due to car strike.</p>	<p>As discussed in Section 2.5, opportunities for fauna connectivity and habitat features are being investigated for the proposal to support koala and other fauna crossing needs. The final design solution/s would be confirmed during detailed design.</p>
	<p>NPWS requests that additional koala crossing signs be installed as part of this project, similar to Picton Road and Campbelltown Council examples.</p>	<p>Transport for NSW note there is existing fauna signage to the west of the proposal location. The applicability of additional Koala signage within the proposal area would be subject to further review during detailed design in consultation with Transport for NSW Biodiversity Officer.</p>
	<p>Detailed locations of site compounds, amenities block, laydown areas, temporary water crossings and proposed construction of new access tracks.</p>	<p>Chapter 3 provides an indicative summary of the locations of site compounds, laydown areas, temporary water crossings and access tracks. The construction methodology would be confirmed during detailed design and outlined within the Construction Environmental Management Plan (CEMP).</p>
	<p>Ongoing access to Heathcote National Park (via Pipeline Trail and Scouters Mountain Trail) off Heathcote Road for NPWS staff, emergency services, Sydney Water, AARNET and TransGrid access during the works and full road closure for up to 6 months.</p>	<p>Key stakeholders including NPWS, emergency services and utility providers would be consulted during the development of a Traffic Management Plan, which would outline access agreements to the Pipeline Trail and Scouters Mountain Trail during full road closures.</p>

## 5.5 Government agency and stakeholder involvement

Various government agencies and key stakeholders have been consulted about the proposal via email and phone calls, including:

- Sutherland Shire Council
- ANSTO
- Holsworthy Military Barracks
- Emergency Services organisations
- Local Aboriginal land councils
- Native Title claimant
- DPI Fisheries
- Heritage NSW

Issues that have been raised as a result of consultation with these agencies and stakeholders are outlined below in Table 5-5.

**Table 5-5 Issues raised through stakeholder consultation**

Agency	Issue raised	Response/where addressed in REF
Various agencies and stakeholders	Concern regarding the potential traffic impacts as a result of the proposal road closures.	The potential impacts on traffic as a result of the proposed road closures and mitigation measures that would be implemented to minimise impacts have been discussed in Section 6.1.4.
DPI Fisheries	<p>DPI Fisheries was specifically consulted due to the proposal's potential impact on key fish habitat from dredging and reclamation activities. DPI Fisheries confirmed that no permit would be required under the FM Act and that they have no objections to the proposed works provided that:</p> <ul style="list-style-type: none"> <li>• environmental safeguards are to be used during the works to ensure that there is no escape of turbid plumes into the adjacent aquatic environment</li> <li>• any material removed from the waterway that is to be temporarily deposited or stockpiles on land is to be located well away from the waterway and to be contained by appropriate sediment control devices</li> </ul>	Environmental safeguards would be implemented during construction of the proposal, including those recommended by DPI Fisheries, to minimise the potential impact of the proposal on key fish habitat (refer to Section 6.3).



Agency	Issue raised	Response/where addressed in REF
	<ul style="list-style-type: none"> <li>DPI Fisheries and the EPA is to be notified immediately if any fish kills occur in the vicinity of the works. In such cases, all works other than emergency response procedures are to cease until the issue is rectified and approval is given by DPI Fisheries and/or the EPA for the works to proceed</li> </ul>	
Heritage NSW	<p>During development of the Statement of Heritage Impact report (SOHI), Transport for NSW's Heritage Officer consulted with Heritage NSW on the scope of the proposal and proposed measures to mitigate impacts. These updates were provided to Heritage NSW as part of recurring inter-agency meetings. The SOHI has also been provided to Heritage NSW for consideration.</p> <p>No formal response has been received to date apart from noting receipt of the SOHI and the plans for REF display. If any further comment is received from Heritage NSW during the REF display period, any issues and responses would be captured within the Submissions Report.</p> <p>Should the proposal proceed, Transport for NSW would continue to consult with Heritage NSW throughout the development of Urban Design.</p>	A commitment to continue consultation with Heritage NSW has been provided in Section 6.7.4.

## 5.6 Ongoing or future consultation

Transport for NSW will continue to seek feedback from the community and key stakeholders as the proposal progresses, including during detailed design and construction.

The REF will be displayed for comment for about six weeks, during which it would be available to download on Transport for NSW's project website. It is noted that physical copies of the REF may not be available during the public display period as the COVID-19 Legislation Amendment (Emergency Measures) Bill 2020 removed the requirement for planning decision makers to display physical copies of some documents for public safety.

Following the public display period, Transport for NSW will collate and consider the submissions received then determine whether the proposal should proceed as described in the REF, or whether any changes are required. A submissions report will then be published, which will respond to the comments received. Transport for NSW will notify those who made submissions and distribute a community update. The update will summarise the submissions report and the actions that Transport for NSW took to address these comments.

## 6 Environmental assessment

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This section of the REF provides a detailed description of the potential environmental impacts associated with the construction and operation of the proposal. All aspects of the environment potentially impacted upon by the proposal are considered. This includes consideration of:

- potential impacts on MNES under the EPBC Act
- the factors specified in the guidelines *Is an EIS required?* (DUAP 1995/1996) as required under clause 228(1) of the Environmental Planning and Assessment Regulation 2000 and the *Roads and Related Facilities EIS Guideline (DUAP 1996)*. The factors specified in clause 228(2) of the Environmental Planning and Assessment Regulation 2000 are also considered in Appendix A.

Site-specific safeguards and management measures are provided to mitigate the identified potential impacts.

### 6.1 Traffic and transport

This section describes the traffic, transport and access impacts that may occur when constructing and operating the proposal. The assessment of the construction traffic impacts associated with the proposed route closure and detour route has been informed by a technical memo prepared by Transport for NSW (TfNSW, 2020b).

#### 6.1.1 Methodology

The methodology for the traffic and transport assessment involved:

- reviewing the key features of the design and the indicative construction methodology, including the proposed road closure and detour route during construction
- reviewing the existing traffic conditions and transport infrastructure surrounding the proposal
- modelling the potential construction traffic impacts associated with the proposed road closure and detour route
- carrying out a semi-quantitative assessment of potential traffic and transport impacts during construction of the proposal
- carrying out a qualitative assessment of the potential traffic and transport impacts during operation of the proposal
- providing mitigation measures to manage the potential impacts on traffic and transport

#### Modelling approach

A model was developed using the *Sydney Greater Metropolitan Area (GMA) Strategic traffic forecasting model* to quantitatively assess the potential traffic impacts of the detour route proposed during construction of the proposal. The *Sydney GMA Strategic traffic forecasting model* was calibrated using traffic counts across the road network.

The model was developed to capture the potential traffic impacts on alternative potential crossing locations of the Georges River (and its tributaries) and other potential alternative routes to the Heathcote Road bridge that may be used by motorists during the road closure. As such, the model was developed to be bound by the following geographical locations:

- Picton Road

- Appin Road
- Heathcote Road at Holsworthy
- Alford's Point Road at Alford's Point (bridge across the Georges River)
- The Princes Highway at Tom Ugly's Bridge (bridge across the Georges River)
- Rocky Point Rd at Captain Cook Bridge (bridge across the Georges River)

The model assessed major arterial roads within this geographical area.

Although the full road closure is expected to be implemented in 2022, a *Sydney GMA Strategic traffic forecasting model* does not exist for this year. As such, available scenarios before and after this date were adopted in the model (i.e. scenarios in 2019 and 2026) to allow the potential impacts in 2022 to be identified between the 2019 and 2026 scenarios.

The model assessed multiple scenarios to compare the potential impact of the detour route. This included scenarios:

- with or without the road closure and detour route
- based on predicted traffic volumes in 2019 or 2026
- during weekday morning or afternoon peak periods

## 6.1.2 Existing environment

### Road network

#### *Heathcote Road and Heathcote Road Bridge*

Heathcote Road is a key connecting road for motorists travelling between south and western Sydney as it crosses the Woronora River, which is major geographical restriction to the road network in this area. Heathcote Road is a State classified road managed by Transport for NSW. Heathcote Road generally consists of an undivided carriageway with one travel lane in each direction except for short sections near the intersections with New Illawarra Road and the Princes Highway, which have two lanes in each direction.

As discussed in Section 2.1.1, the proposal is located within the A6 section of Heathcote Road, which comprises the section of Heathcote Road between New Illawarra Road and the Princes Highway. A6 is a major arterial road that services north–south journeys for freight and general traffic in Sydney and was previously called 'Metroad 6'. The A6 road corridor is also a designated secondary freight route in the *NSW Freight and Ports Strategy* and is approved for use by vehicles up to 26 metre long B-double trucks (NSW Government, 2013).

The Transport for NSW *Traffic Volume Viewer* shows that the A6 section of Heathcote Road experiences an average of around 22,000 vehicles per day (northbound and southbound combined), of which about eight per cent is freight vehicles (TfNSW, 2020c). The posted speed limit on this section of Heathcote Road is 70 kilometres per hour.

Historical crash data for the Heathcote Road bridge and its approaches include a fatality and two additional injuries in 2015 resulting from a head-on collision during the day as well as two serious injuries in 2014 and 2016 from rear-end and head-on collisions, respectively. In addition, during the five-year period between 1 July 2011 and 30 June 2016, there were 139 reported crashes on the A6 section of Heathcote Road including two crashes that resulted in fatalities and 28 crashes that resulted in serious injuries (TfNSW, 2020c). The A6 section of Heathcote Road has an urban casualty crash rate of 1.77 (casualties per kilometre per year), which is about 2.14 times greater than the typical urban casualty rate on a 70 kilometre per hour State highway.

#### *Other key roads surrounding the proposal*

Table 6-1 summarises other key roads within the road network surrounding the proposal and within the proposed detour route. The location of these roads is shown on Figure 3-7.

**Table 6-1 Summary of key roads surrounding the proposal and along the proposed detour route**

Road name	Description
Princes Highway	The Princes Highway (Highway 1) is a State and Regional classified road that runs from the City of Sydney in Newtown to the start of the Southern Freeway at Waterfall through to the Victorian Border. The Princes Highway intersects with Heathcote Road in Heathcote, about 2.5 kilometres south-east of the proposal.
New Illawarra Road	New Illawarra Road is a State classified road located within the A6 road corridor that intersects with Heathcote Road in Lucas Heights, about 2.5 kilometres north-west of the proposal. New Illawarra Road runs generally north-east and joins Alfords Point Road at Menai.
Bangor Bypass	Bangor Bypass is a State classified road that joins New Illawarra Road in Menai to River Road in Bangor. Bangor Bypass was built in 2005 and replaced Menai Road as the main road between the A6 and River Road to reduce traffic congestion in the area.
River Road	River Road is a State classified road that joins the Bangor Bypass to Linden Street via the Woronora Bridge. The Woronora Bridge is a four-lane road bridge that carries River Road across the Woronora River.
Linden Street	Linden Street is a main road in Sutherland. The section of Linden Street that joins River Road with the Grand Parade is a State classified road.
The Grand Parade	The Grand Parade in Sutherland is a State classified road that joins Linden Street and the Princes Highway.
Wilson Parade	Wilson Parade is a local road that runs north-south, generally parallel to the Princes Highway and Eastern Suburbs and Illawarra rail line, and provides access to Heathcote East. Wilson Parade joins the Princes Highway and Heathcote Road at a four-way intersection at its northern extent.
Forum Drive	Forum Drive is a local road that intersects with Heathcote Road about 1.6 kilometres south-east of the proposal and is the only road connecting to Heathcote Road between the Princes Highway and New Illawarra Road. It provides access to the residential area of Heathcote, west of Heathcote Road.

## Public transport

There are no public transport services that travel over the Heathcote Road bridge or within the construction footprint.

The closest bus service to the proposal is Bus Route 991 Heathcote to Sutherland, which travels along a short section of Heathcote Road before turning onto Forum Drive towards Heathcote. Bus Route 991 operates on weekdays only and travels along the A6 corridor to Forum Drive about four times per day. There are no bus stops directly located on Heathcote Road.

The closest railway station to the proposal is Engadine Station, which is located about two kilometres south-east of the proposal off the Princes Highway.



## Active transport

There is no dedicated pedestrian or cyclist infrastructure along Heathcote Road. However, cyclists are permitted to travel along the A6 section of Heathcote Road and ride in the travel lanes where the narrow shoulder widths do not allow safe travel.

### 6.1.3 Potential impacts

#### Construction

##### *Traffic redistribution due to the road closure and detour route*

The proposal would require the full closure of Heathcote Road between New Illawarra Road and the Princes Highway for up to six months during construction due to the constraints of the location including steep terrain of the surrounding area and narrow width of existing roadway (refer to Section 3.2.2). The proposal would also generate additional traffic on the surrounding road network as a result of movements of construction equipment and construction staff.

During this road closure, traffic is proposed to be diverted to a detour route that crosses the Woronora River at the Bangor Bypass instead of Heathcote Road (refer to Figure 3-7). This proposed detour route is about 20 kilometres long within the Sutherland Shire LGA and only uses State classified roads that are managed by Transport for NSW (New Illawarra Road, the Bangor Bypass, River Road, Linden Street, the Grand Parade and the Princes Highway) to minimise the potential for impacts on local roads. It is noted that implementation of the proposed detour route would be subject to approval and the requirements of the Transport Management Centre.

Table 6-2 presents the modelling results for the predicted traffic volume changes on surrounding major roads and crossings during the proposed road closure and detour route for scenarios in 2019 and 2026<sup>1</sup>.

Figure 6-1 and Figure 6-2 show the changes in traffic volumes on the surrounding road network predicted during the proposed road closure in 2026 during the AM and PM peak hour scenarios, respectively. In these figures, increases in traffic volumes are shown in red, whereas traffic volume decreases are shown in green.

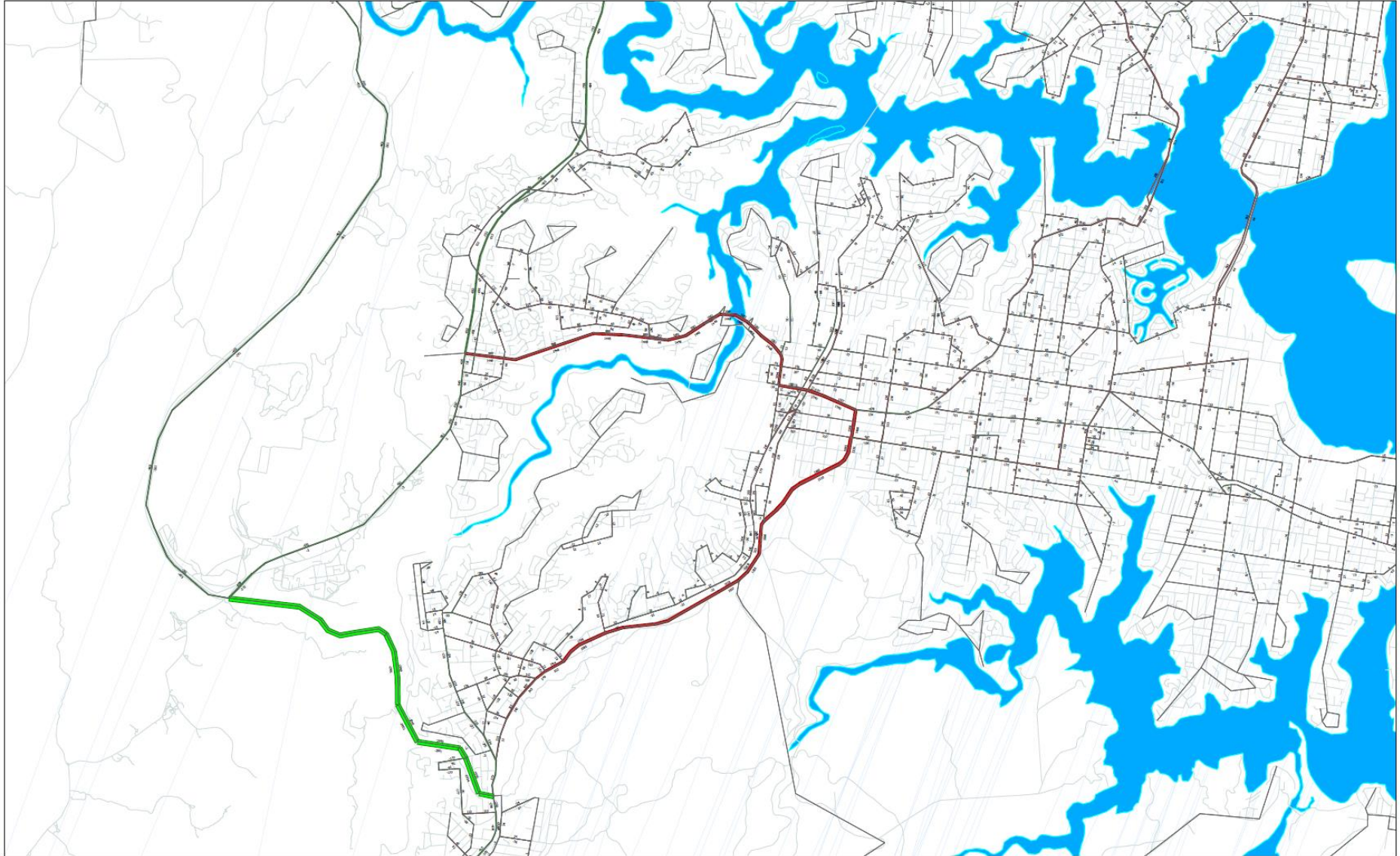
**Table 6-2 Predicted traffic volume changes on surrounding major roads and crossings due to the proposed road closure and detour route**

Road / Location	Change in traffic volume compared to existing volume (number of vehicles)							
	2019 – AM Peak		2019 – PM Peak		2026 – AM Peak		2026 – PM Peak	
	EB <sup>1</sup>	WB <sup>2</sup>	EB <sup>1</sup>	WB <sup>2</sup>	EB <sup>1</sup>	WB <sup>2</sup>	EB <sup>1</sup>	WB <sup>2</sup>
<b>Heathcote Road at Holsworthy</b>	-257	-435	-374	-41	-260	-463	-390	6

<sup>1</sup> As discussed in Section 6.1.1, although the full road closure is expected to be implemented in 2022, a traffic forecasting model does not exist for this year. As such, scenarios before and after this date were adopted in the model to provide an upper and lower limit, with the likely volumes during 2022 being somewhere between.

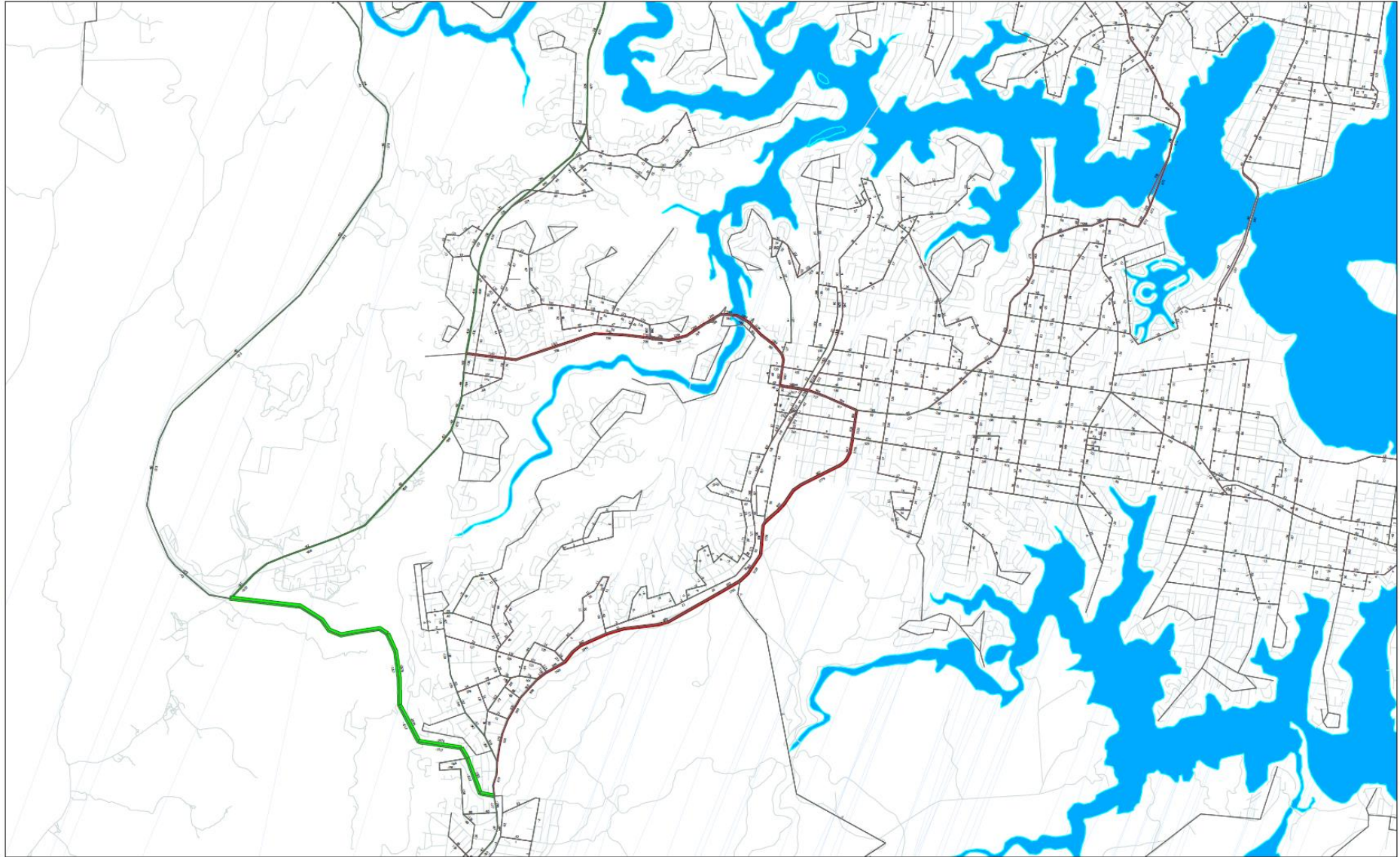
<b>Alfords Point Road at Alfords Point Bridge</b>	-472	-773	-677	-326	-484	-755	-709	-486
<b>Picton Road</b>	25	193	115	80	43	314	151	62
<b>Appin Road</b>	145	185	197	27	195	99	161	52
<b>Proposed detour route<sup>3</sup></b>	1193	1486	1344	1017	1107	1540	1694	1204
<b>Georges River at Tom Ugly's Bridge (via M5)</b>	424	300	672	399	501	288	559	466
<b>Georges River at Captain Cook Bridge (via M5)</b>	79	553	197	49	44	545	358	90

**Notes:** (1) Eastbound, (2) Westbound, (3) Detour route includes New Illawarra Road, Bangor Bypass, River Road, Linden Street, The Grand Parade and the Princes Highway



**Figure 6-1 Predicted changes in traffic volumes on the surrounding road network during the proposed road closure in the 2026 AM Peak**





**Figure 6-2 Predicted changes in traffic volumes on the surrounding road network during the proposed road closure in the 2026 PM Peak**



The modelling results show that in all scenarios, most of the traffic that would normally use the Heathcote Road bridge would use the proposed detour route, which would increase the traffic volumes on these roads during the AM and PM peak periods by about 1000 to 1700 vehicles. The detour route uses State roads as these roads are generally suitable for high traffic volumes as well as heavy vehicles, which would minimise impacts on the local road network. However, there is still the potential for 'rat-runs' to be formed from vehicles attempting to use local roads instead of the proposed detour route to avoid congestion. Transport for NSW would continue to consult with the Transport Management Centre and Emergency Services to minimise potential traffic impacts associated with implementation of the proposed detour route and identify additional safeguards or management measures, as required. This would include identification of additional safeguards and management measures if 'rat-runs' are observed to be forming to enforce and/or encourage use of the designated detour route.

The detour route would also result in increased traffic on Picton Road, Appin Road, Tom Ugly's Bridge and Captain Cook Bridge, however these traffic volume increases are considered to be relatively minor compared to existing traffic volumes and are not expected to cause significant traffic impacts.

The modelling indicates that the proposed detour route may indirectly result in a short-term minor improvement to traffic flows on Heathcote Road at Holsworthy and Alford's Point Road at Alford's Point Bridge. Modelling demonstrates a reduction of about 1200 vehicles during AM peak and PM peak on Alford's Point Road at Alford's Point Bridge. Traffic volumes for Heathcote Road at Holsworthy may reduce by about 700 vehicles during AM peak and 400 vehicles during PM peak. This is attributed to motorists taking alternate routes to get to their destination.

#### *Travel time impacts due to the road closure and detour route*

The traffic model shows that the average travel time in 2022 (when the full road closure is proposed to be implemented) during peak traffic periods between New Illawarra Road and the Princes Highway:

- via Heathcote Road bridge during normal conditions would be about six to eight minutes
- via the proposed detour route during the road closure would be about 31 to 43 minutes, which would be on average 29 minutes longer than normal conditions

As discussed in Section 6.1, due to this large increase in travel time predicted during the proposed road closure for motorists who would usually use the Heathcote Road bridge, Transport for NSW are investigating ways to modify the construction methodology to eliminate the need for continuous daytime road closures during certain construction activities, where possible. As such, the six month full road closure assessed in this REF is considered the 'worst-case' traffic scenario, and is likely to be less in reality.

Construction work would be carried out so that at least one lane remains accessible for emergency vehicles to minimise delays for emergency services and maintain public safety unless alternate arrangements are made in advance in consultation with the Transport Management Centre and Emergency Services.

Proposed road closures may also impact ANSTO's ability to efficiently deliver materials and equipment (including nuclear medicine) via Heathcote Road. Transport for NSW would continue to directly consult with ANSTO in an effort to provide early notification of planned full road closures and investigate opportunities for collaborative efforts to mitigate impacts to critical deliveries.

### *Traffic generated during construction*

The proposal would result in a temporary increase in vehicle movements on the surrounding road network due to the need to deliver equipment and resources to and from the construction footprint and compound locations, as well as construction staff vehicle movements. It is estimated that there would be up to 40 light vehicle and 24 heavy vehicle movements to and from the construction footprint per day during peak construction, which would be staged throughout the day. There is also estimated to be up to 95 light vehicles associated with construction staff that would travel to and from the compound locations each day at the start and end of their shift. Most of these construction staff are expected to use the Heathcote Road compound.

Construction vehicles would access the Lucas Heights compound via Heathcote Road or New Illawarra Road and the Heathcote compound via the Princes Highway or an upgraded driveway off Wilson Parade. The vehicles would then travel to site directly via Heathcote Road. Construction staff parking would be provided within the compound locations.

The traffic volumes generated by construction of the proposal are expected to be relatively low compared to the existing traffic volumes using Heathcote Road, New Illawarra Road, the Princes Highway or Wilson Parade, and would be spaced throughout the day. As such, it is expected that the road network and intersections would have capacity to temporarily accommodate the increased vehicle traffic due to construction of the proposal.

### *Other impacts*

There is no public transport, pedestrian or cyclist infrastructure within or near the construction footprint. As such, no impacts on public transport or active transport are expected due to construction of the proposal.

In addition, no direct impacts on private property access are expected during construction of the proposal. Ongoing access to Heathcote National Park (via Pipeline Trail and Scouters Mountain Trail) off Heathcote Road would be provided for NPWS staff, emergency services, Sydney Water, AARNET and TransGrid during construction as per an approved Traffic Management Plan.

### **Operation**

During operation, the proposal is expected to result in benefits to road users including:

- increased road safety on the Heathcote Road bridge and its approaches due to provision of wider traffic lanes and shoulders that meet current road design standards
- improved reliability along the A6 section of Heathcote Road due to the increased lane and shoulder width that would allow vehicles to pass broken-down vehicles or road incidents. This would also alleviate the existing issue of traffic delays caused by larger vehicles slowing on approach to the bridge, and on occasion also stalling
- a potential decrease in the frequency of incidents and their associated traffic delays

There would be no impacts on public or active transport during operation of the proposal.

#### 6.1.4 Safeguards and management measures

Table 6-3 describes the proposed safeguards and management measures that would be implemented to manage the potential traffic and transport impacts from the proposal.

**Table 6-3 Traffic and transport safeguards and management measures**

Impact	Environmental safeguards	Responsibility	Timing	Reference
Traffic and transport impacts	<p>A Traffic Management Plan (TMP) will be prepared and implemented as part of the CEMP. The TMP will be prepared in accordance with the <i>Traffic Control at Work Sites Manual</i> (TfNSW, 2020d) and <i>QA Specification G10 Control of Traffic</i> (Roads and Maritime, 2008). The TMP will include:</p> <ul style="list-style-type: none"> <li>• confirmation of haulage routes and any Transport Management Centre requirements</li> <li>• measures to maintain access to local roads and properties and minimise the potential for 'rat-runs' to form on local roads during road closures</li> <li>• site specific traffic control measures (including signage) to manage and regulate traffic movement</li> <li>• measures to maintain pedestrian and cyclist access</li> <li>• requirements and methods to consult and inform the local community of impacts on the local road network</li> <li>• access to construction sites including entry and exit locations and measures to prevent construction vehicles queuing on public roads</li> <li>• a response plan for any construction traffic incident</li> <li>• consideration of other developments that may be under construction to minimise traffic conflict and congestion that may occur due to the cumulative increase in construction vehicle traffic</li> <li>• monitoring, review and amendment mechanisms.</li> </ul>	Contractor	Detailed design / pre-construction	Section 4.8 of QA G36 <i>Environment Protection</i>

Impact	Environmental safeguards	Responsibility	Timing	Reference
Travel time impacts	Transport for NSW will investigate alternate construction methodologies and design innovations to minimise the duration of road closures required during construction.	Transport for NSW	Detailed design	Additional safeguard
Changed traffic conditions	The community will be notified in advance of any road closures and the likely disruptions to access in accordance with the Community and Stakeholder Engagement Plan.  Adequate advisory and warning signage will be provided to inform motorists of the road conditions ahead including any road closure and/or detour route.	Contractor	Construction	Additional safeguard
Emergency vehicle and key stakeholder access	Access will be maintained for emergency response vehicles, NPWS staff and utility providers at all times, where possible. If a stage of the work restricts access along Heathcote Road, alternative arrangements will be developed in consultation with the relevant stakeholders in advance.	Contractor	Construction	Additional safeguard
Road closures and detours	Temporary traffic diversions and road closures will be implemented in consultation with and in accordance with the Transport Management Centre requirements.	Contractor	Construction	Additional safeguard
Road closures and detours	Prior to any proposed road closures Transport for NSW will consult with ANSTO to provide early notification of works and to investigate collaborative efforts to minimise impact to nuclear medicine deliveries.	Transport for NSW	Pre-construction	Additional safeguard



## 6.2 Noise and vibration

This section describes the noise and vibration impacts that may occur when constructing and operating the proposal. This section summarises the *Heathcote Road bridge widening – noise and vibration impact assessment* prepared for the proposal by Aurecon that is provided in Appendix C.

### 6.2.1 Methodology

#### Overview

The methodology for the noise and vibration assessment focused on potential impacts during construction and involved:

- identifying sensitive receivers surrounding the proposal and grouping receivers that are located at similar distances from noise generating activities into noise catchment areas (NCA)
- determining existing background noise levels and relevant assessment criteria to assess the potential noise and vibration impacts of the proposal
- identifying construction scenarios, which comprised (refer to Annexure A in Appendix C for more detail on the construction equipment within each scenario):
  - Scenario 1: Bulk earthworks
  - Scenario 2: Bridge works
  - Scenario 3: Drainage works
  - Scenario 4: Retaining walls
  - Scenario 5: Compound operations
    - Scenario 5a: Compound Location 1 (Lucas Heights compound)
    - Scenario 5b: Compound Location 2 (Heathcote compound)
- predicting and assessing construction noise levels for the construction scenarios using Transport for NSW's *Noise Estimator Tool* and in accordance with the *Construction Noise and Vibration Guideline* (CNVG) (Roads and Maritime Services, 2016)
- predicting construction road traffic noise levels with and without the proposed detour route using Transport for NSW's *Noise Estimator Tool* and existing traffic volumes along Heathcote Road, Princes Highway, Bangor Bypass and New Illawarra Road
- calculating and assessing construction vibration and ground-borne noise using source vibration levels from available data on similar vibration intensive equipment
- recommending safeguards and management measures to be implemented, where feasible and reasonable, to minimise noise and vibration noise impacts

The use of the *Noise Estimator Tool* for prediction of construction noise levels is a conservative approach as it is based on a 2D distance between a receiver and construction activity (the 'true' distance would generally be further due to the topography) and does not account for dense bushland that may result in lower noise levels than predicted.

## 6.2.2 Existing environment

The existing background noise levels surrounding the proposal are expected to be influenced by:

- light and heavy vehicle traffic on Heathcote Road, New Illawarra Road, Princes Highway and other roads in the area
- residential, commercial and industrial activities
- other intermittent noise sources including trains and planes passing overhead

The existing background noise levels experienced throughout the proposal area would differ depending on the dominant noise sources. As such, three different noise locations have been considered, which are the areas surrounding Heathcote Road (proposal area), Compound Location 1 (Lucas Heights compound) and Compound Location 2 (Heathcote compound).

The Heathcote Road area includes residential receivers located to the east of the Heathcote Road bridge in the suburb of Engadine. Heathcote Road is the primary road traffic noise source for these receivers. The general topography of the area consists of a valley with extensive vegetation between the bridge and the residential area to the east, which is elevated above the proposal area. Given their elevation, the closest residences to the proposal area may have direct line of sight of the Heathcote Road bridge. However, it is expected that most residences would be shielded from the proposal area by other residences or the topography. The distance from the proposal area to the nearest residence is around 390 metres in Fairview Avenue, Engadine (refer to Figure 6-3 to Figure 6-7).

Compound Location 1 is surrounded by bushland and is in proximity to Suez Lucas Heights Resource Recovery Park to the north and ANSTO to the east, both of which are considered to be an industrial noise receiver, with the latter being considered a critical working area. The existing background noise levels in this area would be influenced by road traffic noise from New Illawarra Road and Heathcote Road.

Compound Location 2 is located in an urban environment, sitting between the Princes Highway and the T4 rail line. The nearest residence is about 40 metres away on the other side of the Princes Highway. The existing background noise levels in this area would be influenced by the traffic travelling along the Princes Highway and Heathcote Road as well as the nearby rail line.

## 6.2.3 Criteria

### Construction noise management levels

The *Interim Construction Noise Guideline* (ICNG) (DECC, 2009) has been used to guide the appropriate noise management levels (NMLs) for the proposal. Rating background levels (RBLs) have been determined in accordance with Transport for NSW's *Noise Estimator Tool*, which provides categories with similar existing background noise levels based on the existing land uses in an area (refer to Chapter 6 of the *Noise and Vibration Impact Assessment* in Appendix C).

Table 6-4 presents the NMLs that would be adopted for non-residential receivers. Table 6-5 presents the applicable RBLs and NMLs that would be adopted for residential receivers surrounding the proposal.

Sensitive receivers are considered noise affected if they are predicted to experience noise levels above the relevant NMLs. In addition, sensitive receivers would be highly noise affected if they are predicted to experience noise levels above 75 dBL<sub>Aeq,15mins</sub>. Where construction noise is predicted to exceed the NMLs at surrounding receivers, additional mitigation (beyond standard construction safeguards) would need to be considered in accordance with the approach specified in the CNVG.

**Table 6-4 NMLs for non-residential receivers**

Time of day	Noise Management Level (dBL <sub>Aeq,15mins</sub> )
Recommended standard hours Monday – Friday (7 am – 6 pm) Saturday (8 am – 1 pm)	Classrooms / child care (Internal - 45 dBL <sub>Aeq,15mins</sub> )
	Places of Worship (Internal - 45 dBL <sub>Aeq,15mins</sub> )
	Active recreation areas (External - 65 dBL <sub>Aeq,15mins</sub> )
	Passive recreation areas (External - 60 dBL <sub>Aeq,15mins</sub> )
	Commercial (External - 70 dBL <sub>Aeq,15mins</sub> )
Outside recommended standard hours, incl. Sundays and Public Holidays	Places of Worship (Internal - 55 dBL <sub>Aeq,15mins</sub> )
	Active recreation areas (External - 65 dBL <sub>Aeq,15mins</sub> )
	Passive recreation areas (External - 60 dBL <sub>Aeq,15mins</sub> )
	Commercial (External - 70 dBL <sub>Aeq,15mins</sub> )

**Table 6-5 Adopted RBLs and NMLs for the proposal for residential receivers**

Location	Representative noise category area <sup>1</sup>	Time period <sup>3</sup>	RBL dBL <sub>A90</sub>	NML dBL <sub>Aeq,15mins</sub>
<b>Heathcote Road area (proposal area)</b>	Noise category area: R0 (the lowest noise area category characterised by isolated residences)	Day	30	40
		Day (OOHW)	30	35
		Evening	-	35
		Night	30	35
<b>Compound Location 1: Lucas Heights compound</b>	Noise category area: R2	Day	45	N/A <sup>2</sup>
		Day (OOHW)	-	
		Evening	40	
		Night	35	
<b>Compound Location 2: Heathcote compound</b>	Noise category area: R3 (due to proximity to Princes Highway)	Day	50	60
		Day (OOHW)	-	55
		Evening	45	50
		Night	40	45

1) Based on AS1055.3-1997 and descriptions as specified in the *Noise Estimator Tool*

2) Not applicable as no residential receivers nearby

3) **Day** – 7am to 6pm Monday to Friday, 8am to 1pm Saturdays; **Day out of hours work (OOHW)** – 7am to 8am, 1pm to 6pm Saturdays, 8am to 6pm Sundays and public holidays; **Evening** – 6pm to 10pm Monday to Sunday and public holidays; **Night** – 10pm to 7am Monday to Friday, 10pm to 8am Saturdays, 6pm to 7am Sunday and public holidays

## Construction vibration and ground borne noise criteria

The construction vibration criteria for this proposal have been derived from *DIN4150-3:2016 Vibrations in buildings – Part 3: Effects on structures* (German Institute for Standardisation, 2016) and *Assessing vibration: a technical guideline* (DEC, 2006).

The applicable criteria for the proposal in accordance with these guidelines is:

- 2.5 mm/s as the nominal vibration goal for heritage structures
- 0.2 (night preferred) mm/s and 0.4 mm/s (night maximum) for human comfort
- 0.14 mm/s for critical working spaces where sensitive equipment is likely in use

Criteria for cosmetic and structural damage to residential buildings has not been included in this assessment, as compliance with the human comfort criteria would automatically result in compliance with structural damage criteria. If vibration levels are predicted to exceed the 'maximum' human comfort criteria, additional mitigation measures are required as per the CNVG. Conversely, if they do not exceed the 'maximum' human comfort criteria, no further action is required.

In addition, ground-borne noise would be assessed where ground-borne noise levels are greater than airborne noise levels. The ICNG states:

- for evening periods (6 pm – 10 pm), internal ground-borne noise levels objectives are 40 dB<sub>LAeq,15mins</sub>
- for night time periods (10 pm – 7 am), internal ground-borne noise levels objectives are 35 dB<sub>LAeq,15mins</sub>

## Construction traffic noise criteria

The noise impact assessment of construction traffic on public roads and temporary detours has been based on an initial screening test as outlined in Section 9 of the CNVG, which states:

*“An initial screening test should first be applied by evaluating whether noise levels will increase by more than 2 dBA due to construction traffic or a temporary reroute due to a road closure. Where increases are 2 dBA or less then no further assessment is required.*

*Where noise levels increase by more than 2 dBA (2.1 dBA) further assessment is required using Roads and Maritime’s Noise Criteria Guideline.”*

## Operational noise and vibration criteria

No predicted change in operational traffic noise levels are expected due to the bridge widening as the proposal is for the purpose of safety improvements not increased traffic capacity. Therefore, no criteria nor predictions have occurred for operational traffic noise. Similarly, operational vibration is considered negligible and not expected to change due to the bridge widening. No criteria is therefore provided for this assessment.

### 6.2.4 Potential impacts

#### Construction noise

Table 6-6 presents the predicted noise levels for residential receivers within various noise catchment distances from the proposal area for the construction scenarios, as assessed using the *Noise Estimator Tool*. The noise levels have been assessed against the NMLs for residential receivers during the night-time period, as these NMLs are the most conservative.



**Table 6-6 Summary of construction noise impacts predicted for residential receivers at night**

Noise catchment area (NCA)	Noise catchment distances <sup>1</sup> (m)	NML (dBA)	Predicted noise levels (dBA)	Recommended additional mitigation measures as per CNVG <sup>2</sup>	
<b>Construction Scenario 1: Bulk Earthworks</b>					
NCA1	≤370	35	60	AA, N, PC, SN, R2, DR	
NCA2 (shielded)	≤575		50	N, PC, SN, R2, DR	
NCA2	370 – 880		40	40	N, R2, DR
NCA3	880 – 1000				
NCA3 (shielded)	575 – 1000				
<b>Construction Scenario 2: Bridge works</b>					
NCA3 (shielded)	≤440	35	50	N, PC, SN, R2, DR	
NCA2	≤685				
NCA3	<1000		40	N, R2, DR	
NCA4 (shielded)	440 – 685				N
<b>Construction Scenario 3: Drainage works</b>					
NCA2	≤440	35	50	N, PC, SN, R2, DR	
NCA3 (shielded)	≤ 685		40	N, R2, DR	
NCA3	440 – 1000		35	35	N
NCA4 (shielded)	685 – 1000				
<b>Construction Scenario 4: Retaining wall works</b>					
NCA2 (shielded)	≤405	35	50	N, PC, SN, R2, DR	
NCA2	≤630				
NCA3 (shielded)	405 – 955		40	40	N, R2, DR
NCA3	630 – 1000				
NCA4 (shielded)	955 – 1000				
<b>Construction Scenario 5b<sup>3</sup>: Compound operations</b>					
NCA1	≤50	50	70	AA, N, PC, SN, R2, DR	
NCA2 (shielded)	≤90		65	65	N, PC, SN, R2, DR
NCA2	50 – 155				
NCA3 (shielded)	90 – 250		55	55	N, R2, DR
NCA3	155 – 405				
NCA4 (shielded)	250 – 405				
NCA4	405 – 630		50	50	N
<b>Notes:</b>	1) Distances from the proposal area 2) AA = alternative accommodation, N = notification, PC = phone calls, SN= specific notifications, R2 = respite period 2, DR = duration respite 3) Results are not presented for Construction Scenario 5a: Compound operations as there are no residential receivers located close enough to the Heathcote compound to be noise affected				

The results have been presented for NCAs, which represent groups of sensitive receivers that are predicted to experience similar levels of noise from the proposed construction scenarios. For example, sensitive receivers within NCA1 are all located within 370 metres of the proposal area and would experience predicted noise levels above 60 dBA (as a result of Construction Scenario 1 (bulk earthworks)), which exceeds the applicable NML of 35 dBA for the night-time period.

Sensitive receivers in NCAs that are denoted as 'shielded' are residential properties that do not have a direct line of sight to the proposal area, due to topography or residential properties in front, and therefore would experience lower noise levels than non-shielded residential receivers.

Figure 6-3 to Figure 6-7 show high-level visual representations of the NCAs for each scenario.

These results show that the predicted noise levels generated during construction of the proposal would exceed the adopted NMLs for residential receivers during the night-time period for all scenarios. Residential receivers would be considered noise affected during the night-time period if they are located within about:

- one kilometre of the proposal area during Construction Scenario 1: Bulk earthworks, Construction Scenario 3: Drainage works and Construction Scenario 4: Retaining wall works
- 685 metres of the proposal area during Construction Scenario 2: Bridge works
- 630 metres of the proposal area (specifically the Heathcote compound) during Construction Scenario 5b: Compound operations.

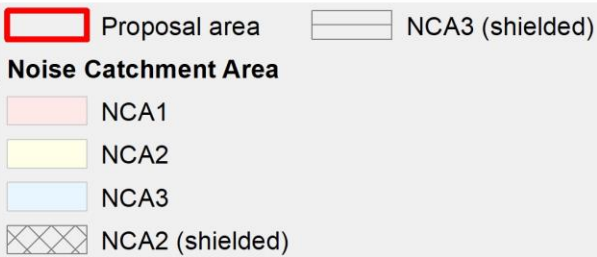
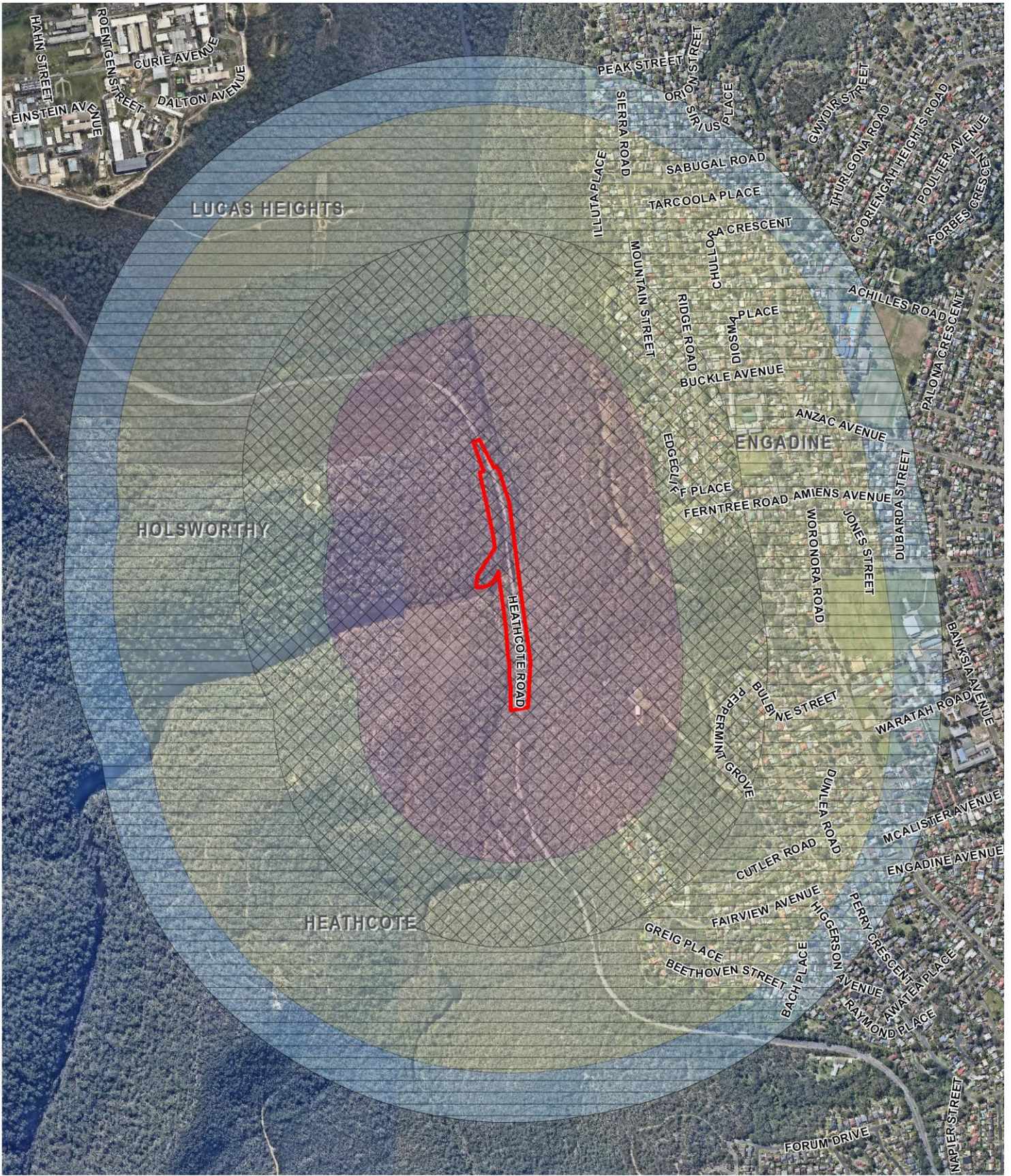
However, the use of the *Noise Estimator Tool* for the construction noise assessment is conservative (as discussed in Section 6.2.1), so it is likely that the real noise levels would be lower than predicted. The noise assessment would be refined during detailed design, to confirm the potential for noise impacts at residential receivers and the requirement for any additional mitigation.

Table 6-6 also outlines the additional mitigation measures (above standard construction noise safeguards) that are recommended to be implemented, where feasible and reasonable in accordance with the CNVG, to minimise noise impacts at potential noise affected residential receivers. The types of additional mitigation measures recommended differs depending on the level of noise exceedance predicted.

The distance from the proposal area beyond which non-residential receivers (including commercial, industrial, educational and recreational receivers as well as places of worship) would experience noise levels that would exceed the relevant NMLs was also calculated (refer to Table 9 in Appendix C). The results predict that there are no non-residential receivers that would be located close enough to the proposal to be noise affected during construction of the proposal.



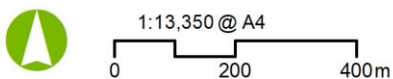
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**Note:** Post these distances, it is likely that the RBL/NML will change due to proximity to other major roads or significant shielding from the site is applicable, reducing noise impacts greater than predicted above



Source: Aurecon, TfNSW, Spatial Services, Esri Topo, Nearmap

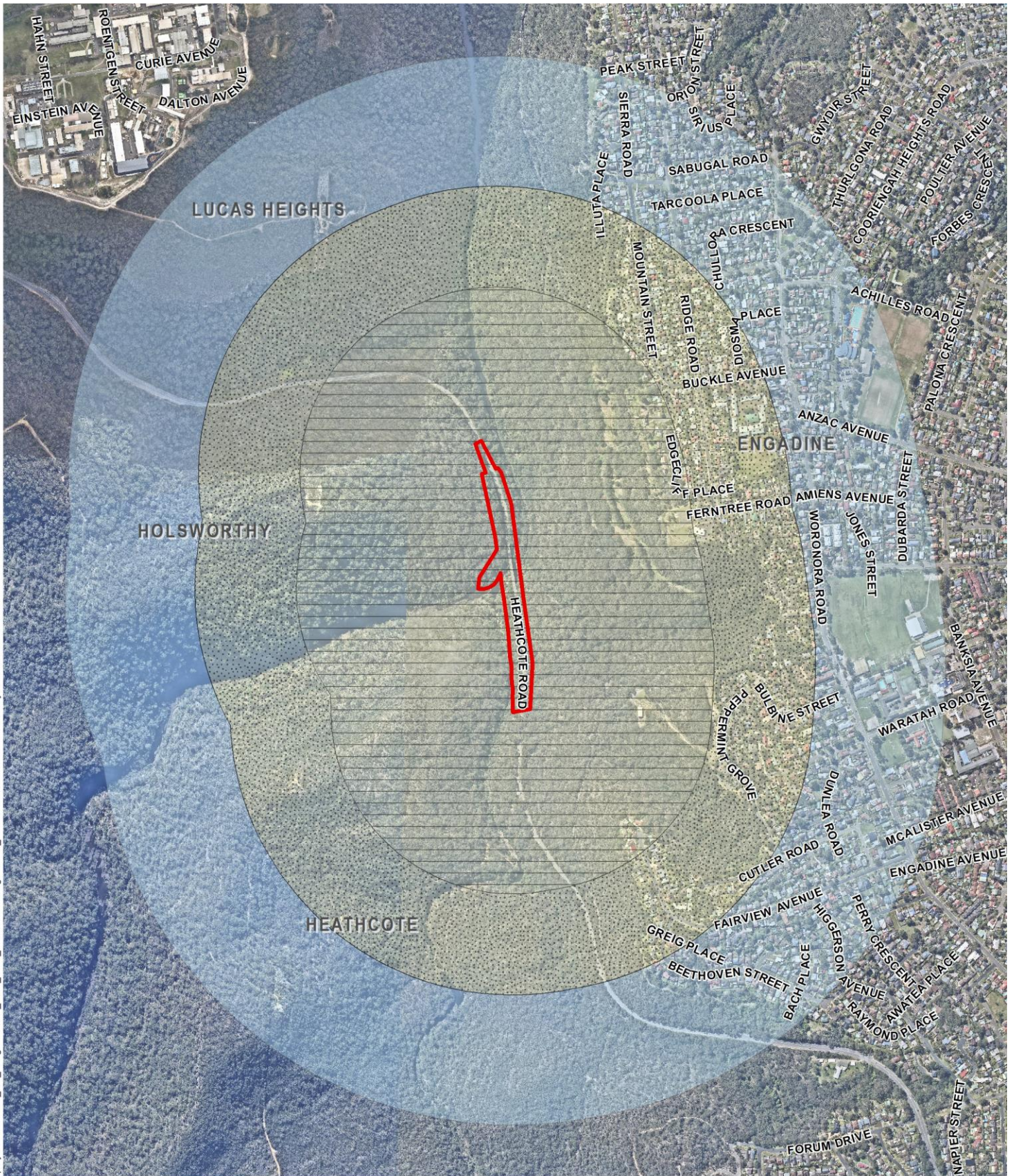


Projection: GDA 1994 MGA Zone 56

Heathcote Road bridge widening REF

**Figure 6-3:** NCAs calculated for Scenario 1: Bulk earthworks during the night-time period

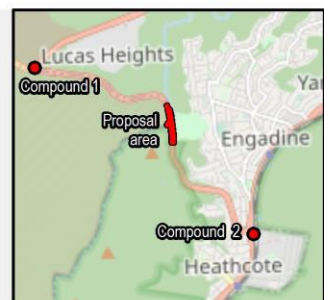




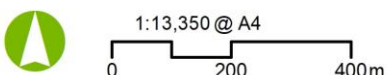
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- Proposal area
- Noise Catchment Area**
- NCA2
- NCA3
- NCA3 (shielded)
- NCA4 (shielded)

**Note:** Post these distances, it is likely that the RBL/NML will change due to proximity to other major roads or significant shielding from the site is applicable, reducing noise impacts greater than predicted above



Source: Aurecon, TfNSW, Spatial Services, Esri Topo, Nearmap



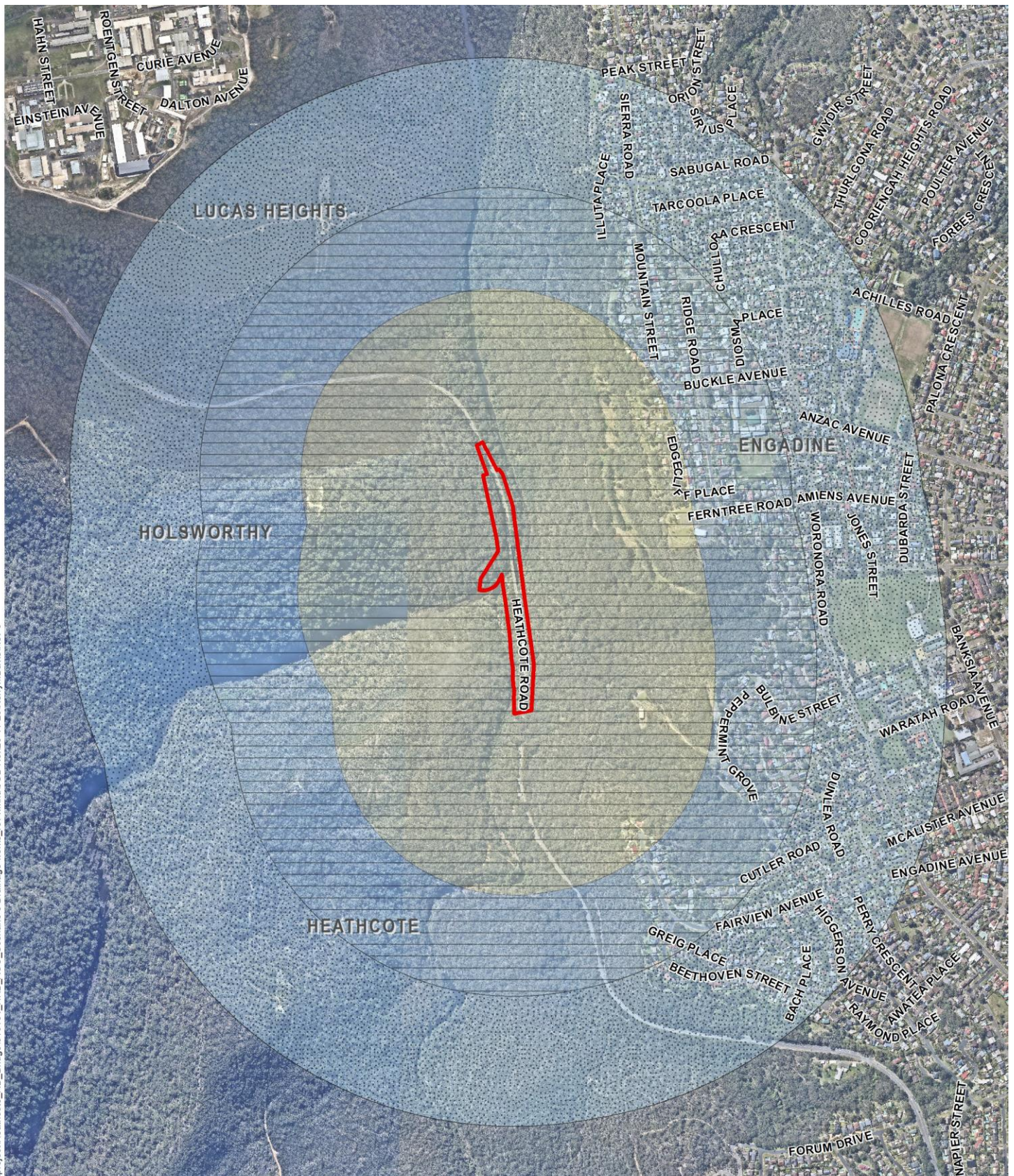
Projection: GDA 1994 MGA Zone 56

### Heathcote Road bridge widening REF

**Figure 6-4:** NCAs calculated for Scenario 2: Bridge works during the night-time period

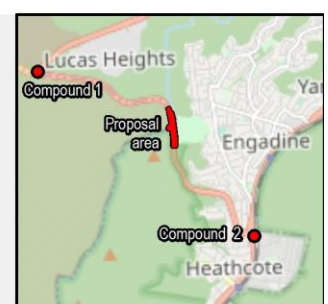


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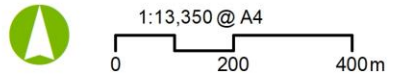


- Proposal area
- Noise Catchment Area**
- NCA2
- NCA3
- NCA3 (shielded)
- NCA4 (shielded)

**Note:** Post these distances, it is likely that the RBL/NML will change due to proximity to other major roads or significant shielding from the site is applicable, reducing noise impacts greater than predicted above



Source: Aurecon, TfNSW, Spatial Services, Esri Topo, Nearmap

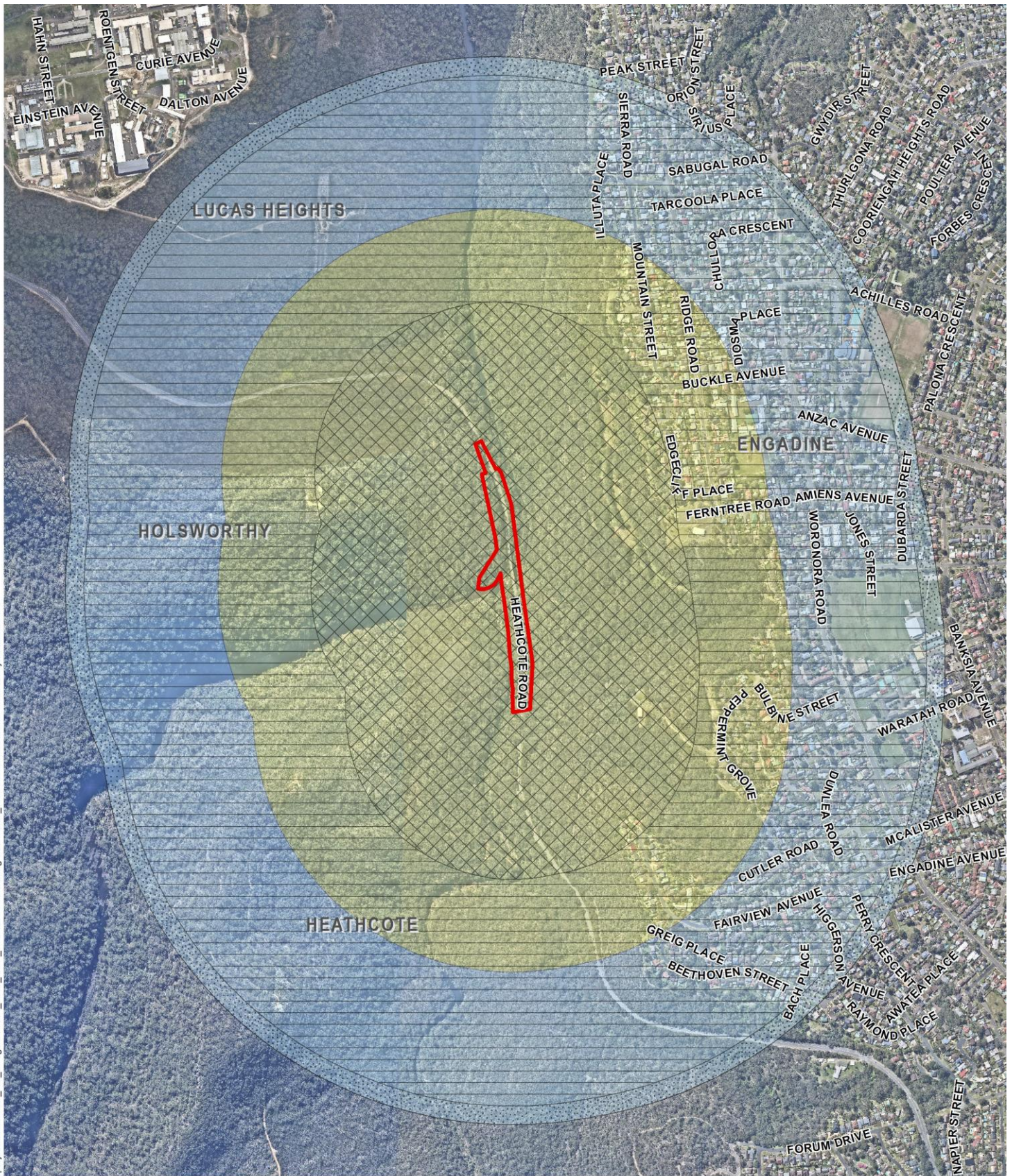


Projection: GDA 1994 MGA Zone 56

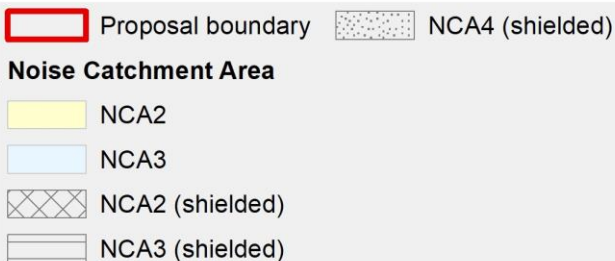
**Heathcote Road bridge widening REF**

**Figure 6-5:** NCAs calculated for Scenario 3: Drainage works during the night-time period

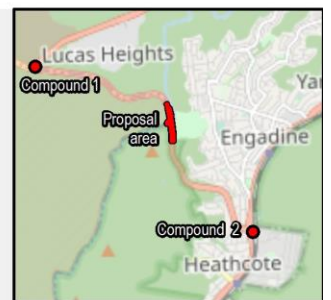




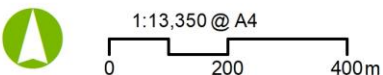
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**Note:** Post these distances, it is likely that the RBL/NML will change due to proximity to other major roads or significant shielding from the site is applicable, reducing noise impacts greater than predicted above



Source: Aurecon, TfNSW, Spatial Services, Esri Topo, Nearmap

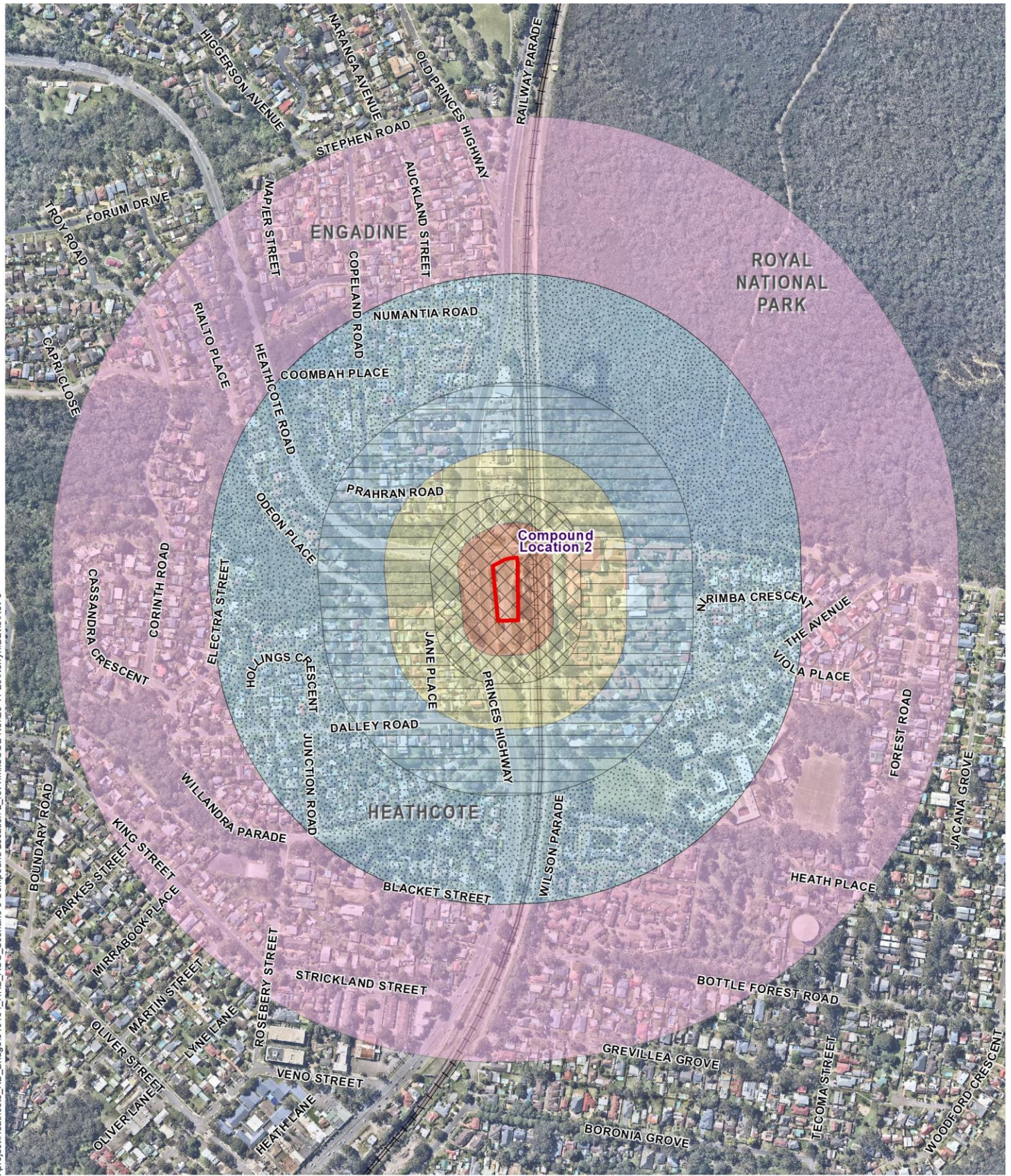


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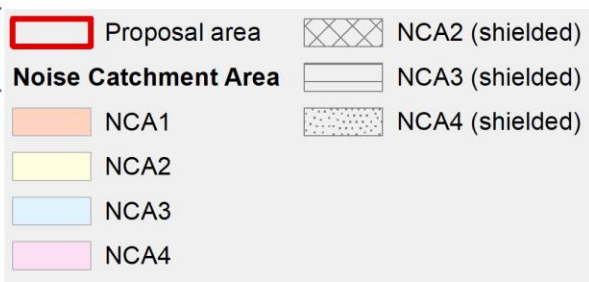
### Heathcote Road bridge widening REF

**Figure 6-6:** NCAs calculated for Scenario 4: Retaining wall works during night-time period

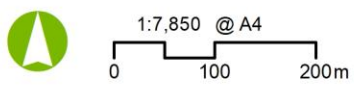




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Source: Aurecon, TfNSW, Spatial Services, Esri Topo



Projection: GDA 1994 MGA Zone 56

**Figure 6-7:** NCAs calculated for Scenario 5b: Operation of the Heathcote compound during the night-time period

Heathcote Road bridge widening REF



### Construction road traffic noise

Table 6-7 presents the predicted noise impacts of construction traffic during implementation of the proposed road closure and detour route. The results show that the road closure would reduce noise levels along Heathcote Road and New Illawarra Road, and increase noise along the Bangor Bypass by less than 2 dB, which complies with the adopted road traffic noise criteria.

**Table 6-7 Predicted construction road traffic noise levels**

Road	Change in day noise levels (dB)	Change in night noise levels (dB)	Compliance (< 2 dB)
Heathcote Road	-24	-17	Yes
New Illawarra Road	-1	-1	Yes
Bangor Bypass	1	1	Yes
Princes Highway	0	0	Yes

### Construction vibration and ground-borne noise

Figure 6-8 and Figure 6-9 show the predicted peak particle velocity (PPV) from construction of the proposal versus distance from the proposal area for external and internal vibration levels, respectively. The predicted vibration levels show that:

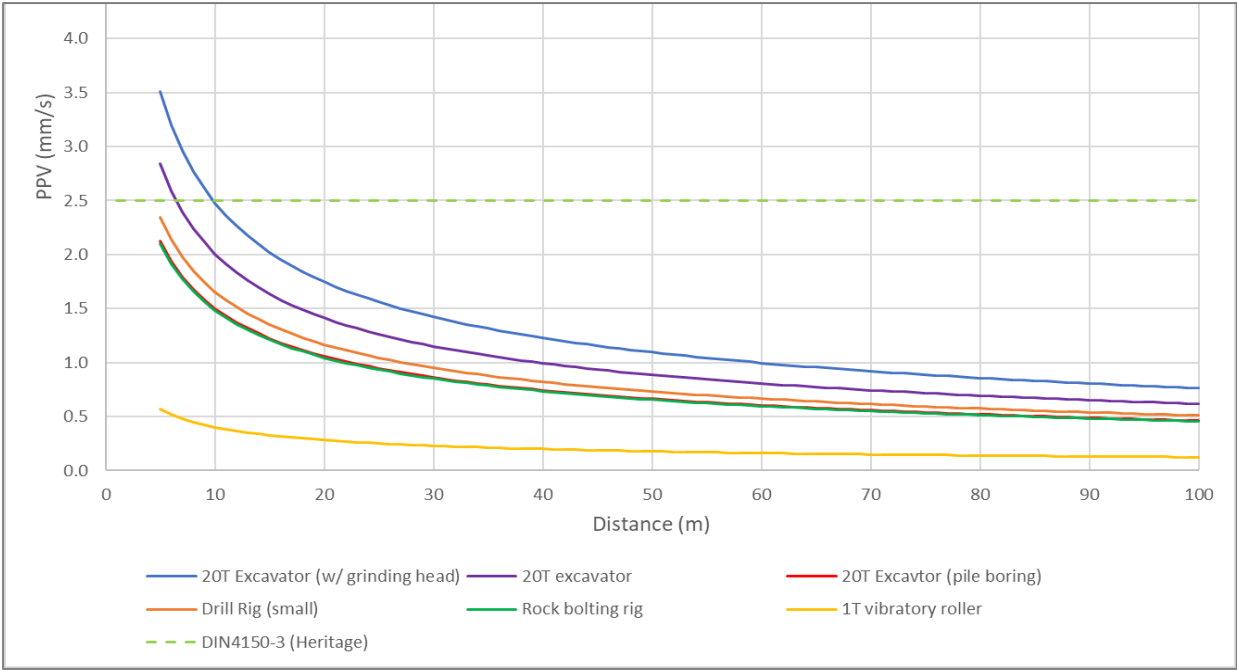
- use of the 20T excavator (with grinding head) would exceed the DIN4150-3 heritage vibration criterion at distances of less than 10 metres
- use of the 20T excavator would exceed the DIN4150-3 heritage vibration criterion at distances of less than eight metres
- use of the 20T excavator (with grinding head) would exceed the maximum continuous human comfort criteria at night at distances of less than 390 metres
- all construction activities assessed (except for the use of the 20T excavator with grinding head) would comply with the night-time maximum continuous human comfort criteria at night beyond 350 metres from the proposal area

Based on these results, the construction methodology would need to be reviewed during detailed design, including consideration of alternative equipment to the 20T excavator where possible, to minimise the potential for vibration impacts to potentially vibration sensitive sites nearby, including:

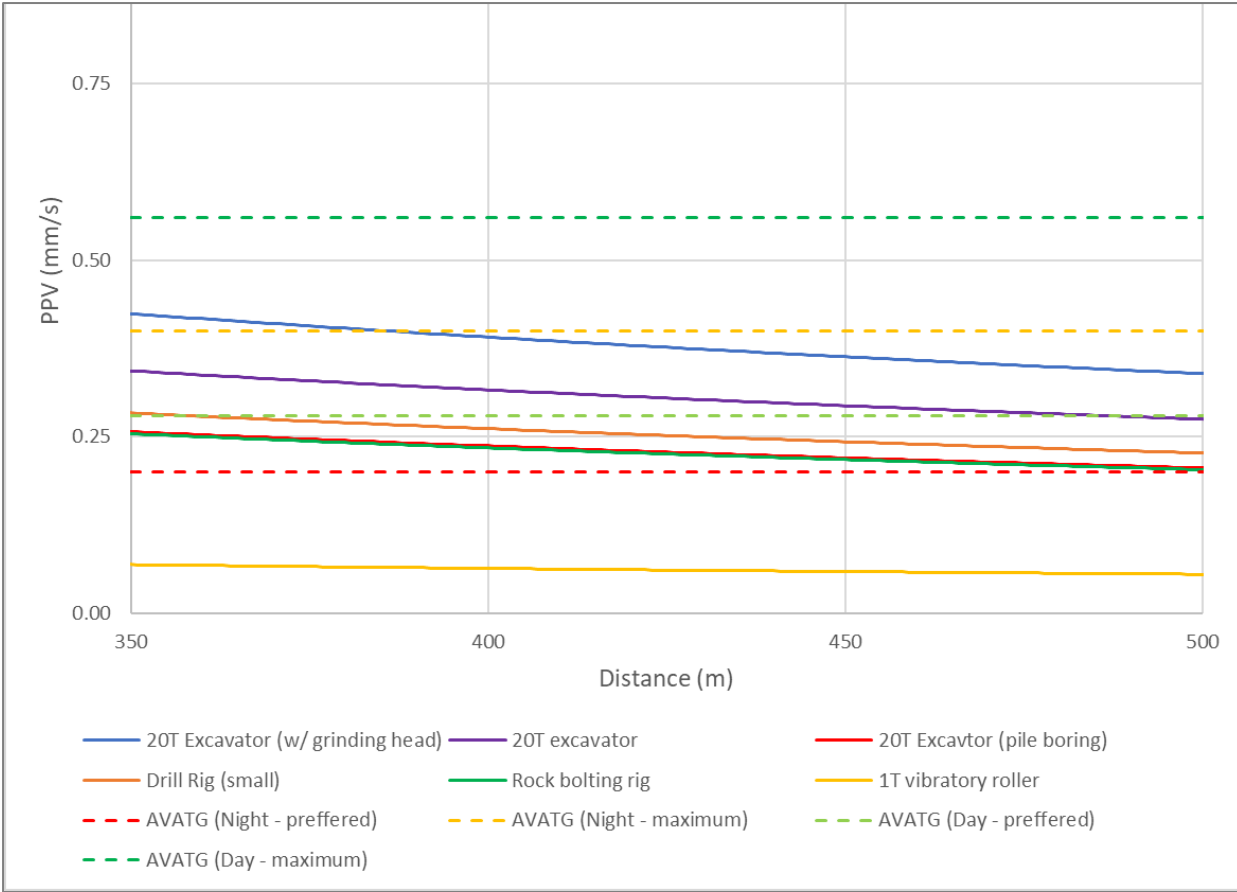
- the identified Aboriginal heritage site
- the Heathcote Road bridge itself, which is a heritage structure listed on s170 register, to minimise potential for cosmetic damage particularly near the sandstone abutments
- ANSTO, as the 20T excavator (with grinding head) is predicted to exceed the *preferred* vibration criteria of 0.14 mm/s at ANSTO but compliant with the *maximum* criteria of 0.28 mm/s

Vibration is expected to be below the maximum levels for the night period for all residences 390 metres and further from the construction activities. For residences located within 390 metres of the proposal area, vibration levels may exceed the night period maximum criteria. This means additional measures to minimise vibration related impacts may be required for these residences, in accordance with the CVNG. The potential for vibration related impacts would be confirmed during detailed design through further review of the ground strata, refining specific location of works, and incorporating changes in elevation. A Vibration Risk Assessment would evaluate feasible and reasonable mitigation measures such as validation monitoring, specific notifications and limiting the use of the grinding head works to non-night periods. No impacts associated with ground-borne noise are expected.





**Figure 6-8 Predicted PPV from construction work (external vibration levels)**



**Figure 6-9 Predicted PPV from construction work (vibration levels within buildings)**

## Operation

The proposal is not expected to result in any noticeable change in noise or vibration as the widening of the Heathcote Road bridge and its approaches are not expected to result in increased traffic volumes that would change the noise or vibration levels generated from vehicles travelling along Heathcote Road. In addition, the widening of the bridge and its approaches and any associated road realignment would be minor, which means that traffic travelling along Heathcote Road would only be up to a few metres closer to sensitive receivers, which would result in negligible changes in traffic noise experienced given the closest residences to the proposal area are around 390 metres away (in Fairview Avenue, Engadine).

### 6.2.5 Safeguards and management measures

Construction noise would be managed in accordance with the CNVG, which specifies several standard mitigation measures and the need to consider additional mitigation measures, where feasible and reasonable, where construction noise is predicted to exceed the NMLs. Section 7.1 of Appendix C provides further discussion regarding the potential feasibility of the additional mitigation measures for the proposal.

Table 6-8 describes the proposed safeguards and management measures that would be implemented to manage the potential construction noise and vibration impacts from the proposal. Further detail regarding the implementation of specific safeguards and management measures at sensitive receivers would be confirmed during detailed design and outlined in the Construction Noise Management Plan, Vibration Risk Assessment and Ground Vibration Management Plan prepared for the proposal.

**Table 6-8 Noise and vibration safeguards and management measures**

Impact	Environmental safeguards	Responsibility	Timing	Reference
Noise and vibration impacts	<p>A Construction Noise Management Plan (CNMP) would be prepared as part of the CEMP. This plan would include but not be limited to:</p> <ul style="list-style-type: none"> <li>• a map indicating the locations of sensitive receivers including residential properties</li> <li>• a quantitative noise assessment based on the detailed design of the proposal in accordance with the EPA <i>Interim Construction Noise Guidelines</i> (DECC, 2009)</li> <li>• management measures to minimise the potential noise impacts from the quantitative noise assessment and for potential works outside of standard working hours (including implementation of EPA <i>Interim Construction Noise Guidelines</i> (DECC, 2009), including specific mitigation measures for truck movements</li> <li>• a risk assessment to determine potential risk for activities likely to affect receivers (for activities carried out during and outside of standard working hours)</li> <li>• a process for assessing the performance of the implemented mitigation measures such as a program of noise monitoring for sensitive receivers</li> <li>• a process for documenting and resolving issues and complaints</li> <li>• a construction staging program</li> <li>• a process for updating the plan when activities affecting construction noise and vibration change</li> <li>• an outline of the content for toolbox talks regarding noise management</li> </ul>	Contractor	Detailed design/ pre-construction	Standard safeguard Section 4.6 of QA G36 <i>Environment Protection</i>



Impact	Environmental safeguards	Responsibility	Timing	Reference
Noise and vibration impacts	<p>All sensitive receivers (i.e. local residents) likely to be affected will be notified at least seven days prior to commencement of any works associated with the activity that may have an adverse noise or vibration impact. The notification will provide details of:</p> <ul style="list-style-type: none"> <li>• the project</li> <li>• the construction period and construction hours</li> <li>• contact information for project management staff</li> <li>• complaint and incident reporting</li> <li>• how to obtain further information</li> </ul>	Contractor	Detailed design / pre-construction	Noise and vibration
Vibration impacts	<p>During detailed design and pre-construction, a Vibration Risk Assessment is to be completed and as a minimum will involve:</p> <ul style="list-style-type: none"> <li>• identifying construction ground vibration criteria, including applicable criteria for Aboriginal and Non-Aboriginal heritage features and ANSTO</li> <li>• identifying the ground type and topography in the vicinity of the works location (in terms of its susceptibility to ground vibration)</li> <li>• identifying and describing the potentially affected properties and heritage features which may be impacted by ground vibration during construction</li> <li>• consulting with ANSTO to confirm the location of any vibration sensitive equipment</li> <li>• identifying the types of activities to be carried out, the machinery and equipment to be used, including the predicted vibration emission levels from each plant and their corresponding buffer distances</li> </ul>	Transport for NSW / Contractor	Detailed design/ pre-construction	Standard safeguard Section 4.6 of QA G36 <i>Environment Protection</i>

Impact	Environmental safeguards	Responsibility	Timing	Reference
	<ul style="list-style-type: none"> <li>• reviewing the construction methodology and identifying discrete work activities with the potential to affect identified buildings or heritage features</li> <li>• assessing the potential vibration impacts on building structures and heritage features.</li> <li>• reviewing predicted vibration emissions against construction criteria</li> <li>• providing a map indicating the heritage features / buildings on adjacent properties considered likely to be impacted by ground vibration</li> <li>• detailing which features of the natural and built environment require condition inspections</li> <li>• identifying mitigation measures to be incorporated during construction to address ground vibration impacts including assessment of 'at-source' mitigation measures</li> <li>• evaluating the potential reductions that could be achieved with the application of recommended measures</li> <li>• evaluating the use of a fixed vibration monitoring system which would appropriately warn plant operators (i.e. flashing light, audible alarm, SMS) when vibration levels approach established criteria limits</li> </ul>			

Impact	Environmental safeguards	Responsibility	Timing	Reference
Vibration impacts	<p>A Ground Vibration Management Plan is to be prepared incorporating outcomes of the Vibration Risk Assessment and incorporated into the CEMP. As a minimum the plan must include:</p> <ul style="list-style-type: none"> <li>• identification of all potentially affected properties or features of the natural/built environment and show on a map</li> <li>• identification of all vibration generating tasks, duration and predicted vibration levels</li> <li>• a schedule of properties or features of the natural/built environment where condition inspections are required to be undertaken (based on the Vibration Risk Assessment)</li> <li>• locations and types of management measures to be implemented to reduce excessive ground vibration such as: <ul style="list-style-type: none"> <li>○ maximising the offset distance between high vibration plant items and nearby buildings</li> <li>○ substitution by alternative equipment, plant and processes</li> <li>○ screening or enclosures</li> <li>○ restricted times when work is being carried out;</li> <li>○ increased work setback distances</li> <li>○ consultation with affected receivers;</li> <li>○ orienting equipment away from vibration-sensitive areas</li> <li>○ specific physical and managerial measures for controlling ground vibration to comply with the relevant OEH guidelines and best practice</li> </ul> </li> <li>• a vibration trial to determine the dominant frequency of vibration</li> </ul>	Transport for NSW/ Contractor	Pre-construction/ construction	Standard safeguard Section 4.6 of QA G36 <i>Environment Protection</i>

Impact	Environmental safeguards	Responsibility	Timing	Reference
	<ul style="list-style-type: none"> <li>• vibration monitoring, reporting and response procedures including a short and long term ground vibration monitoring program to assess compliance with the identified criteria</li> <li>• procedures for notifying any residents or business premises about vibration-generating activities likely to affect buildings on their property</li> <li>• contingency plans to be implemented in the event of non-compliances and/or vibration complaints</li> <li>• procedures for regularly reviewing the effectiveness of the Vibration Management Plan including specific review in response to any exceedance events and when activities affecting construction vibration change</li> <li>• outline of the content for toolbox talks regarding vibration management</li> </ul>			



## 6.3 Biodiversity

This section describes the biodiversity impacts that may occur when constructing and operating the proposal. This section summarises the *Heathcote Road Bridge Widening Biodiversity Assessment Report* prepared for the proposal by NGH Consulting and is provided in Appendix D.

### 6.3.1 Methodology

#### Overview of key tasks

The methodology for the biodiversity assessment involved:

- a desktop review of existing information to identify biodiversity values likely to occur within the proposal area and plan appropriate field surveys. This involved a review of:
  - previous ecological studies and survey data within the proposal area
  - broadscale vegetation mapping and aerial photography
  - publicly available databases including:
    - BioNet Atlas
    - OEH Vegetation Information System database and the Vegetation Types Database
    - DPI Weed Wise
    - DPI Fisheries Fish Records Viewer
    - EPBC Act Protected Matters Search
    - National Atlas of Groundwater Dependent Ecosystems
    - NSW Government's sharing and enabling environmental data (SEED) datasets
    - Coastal Management SEPP data
    - Areas of outstanding biodiversity value (critical habitat)
- preparing a habitat assessment to determine the likelihood of occurrence of threatened flora, fauna and ecological communities within 10 kilometres of the proposal area
- carrying out field surveys on 25 May and 11 August 2020, which involved:
  - a random meander search to allow for inspection of all available habitat types
  - recording native flora species and vegetation communities present, targeted threatened species, opportunistic fauna sightings and weed species present
  - conducting vegetation plots in accordance with the Biodiversity Assessment Methodology (BAM) for plant community type (PCT) mapping
  - rapid assessment at Woronora River and Heathcote Creek
  - targeted surveys for Sydney Hawk Dragonfly and koalas
  - targeted microbat survey including dusk survey and ANABAT recording (during September 2020)
  - fauna habitat survey to assess habitat availability including recording coordinates of identified hollow bearing trees

## Study area

The biodiversity study area comprises the proposal area plus an additional 50 metre buffer to capture the surrounding area (refer to Figure 6-13). The locality for the biodiversity assessment is defined as the area within 10 kilometres of the proposal area.

### 6.3.2 Existing environment

#### Plant community types

Table 6-9 summarises the three PCTs that were identified within the biodiversity study area, which all relate to different types of native vegetation communities. Of the PCTs identified within the proposal area, only PCT 781 is associated with a threatened ecological community (TEC).

**Table 6-9 PCTs within the proposal area**

PCT	Vegetation class	Condition	Patch size (ha)	Associated with a TEC?	Area (ha) in study area
PCT 1292 - Water Gum-Coachwood Riparian Scrub Along Sandstone Streams, Sydney Basin (referred to as Coastal Sandstone Gully Forest)	Eastern Riverine Forests	Moderate	>100	No	8.35
PCT 1250 -Sydney Peppermint-Smooth-barked Apple-Red Bloodwood Shrubby Open Forest on Slopes of Moist Sandstone Gullies, Eastern Sydney Basin (referred to as Coastal Sandstone Riparian Scrub)	Sydney Coastal Dry Sclerophyll Forests	Moderate	>100	No	2.36
PCT 781 - Coastal Freshwater Lagoons of the Sydney Basin and South East Corner (referred to as Coastal Freshwater Wetland)	Coastal Freshwater Lagoons	High	<5	Yes – Sydney Freshwater Wetland listed as an endangered ecological community (EEC) under the BC Act	0.06
Exotic Vegetation	N/A	N/A	N/A	No	0.04
Total area of native vegetation in study area					<b>10.77</b>

Figure 6-10 to Figure 6-12 show examples of the vegetation within each PCT. Figure 6-13 shows their location within the biodiversity study area and proposal area. Section 3.1 of Appendix D describes these PCTs in more detail.



**Figure 6-10 Example of vegetation in the study area classed as PCT 1292**



**Figure 6-11 Example of vegetation in the study area classed as PCT 1250**





**Figure 6-12 Example of vegetation in the study area classed as PCT 781**



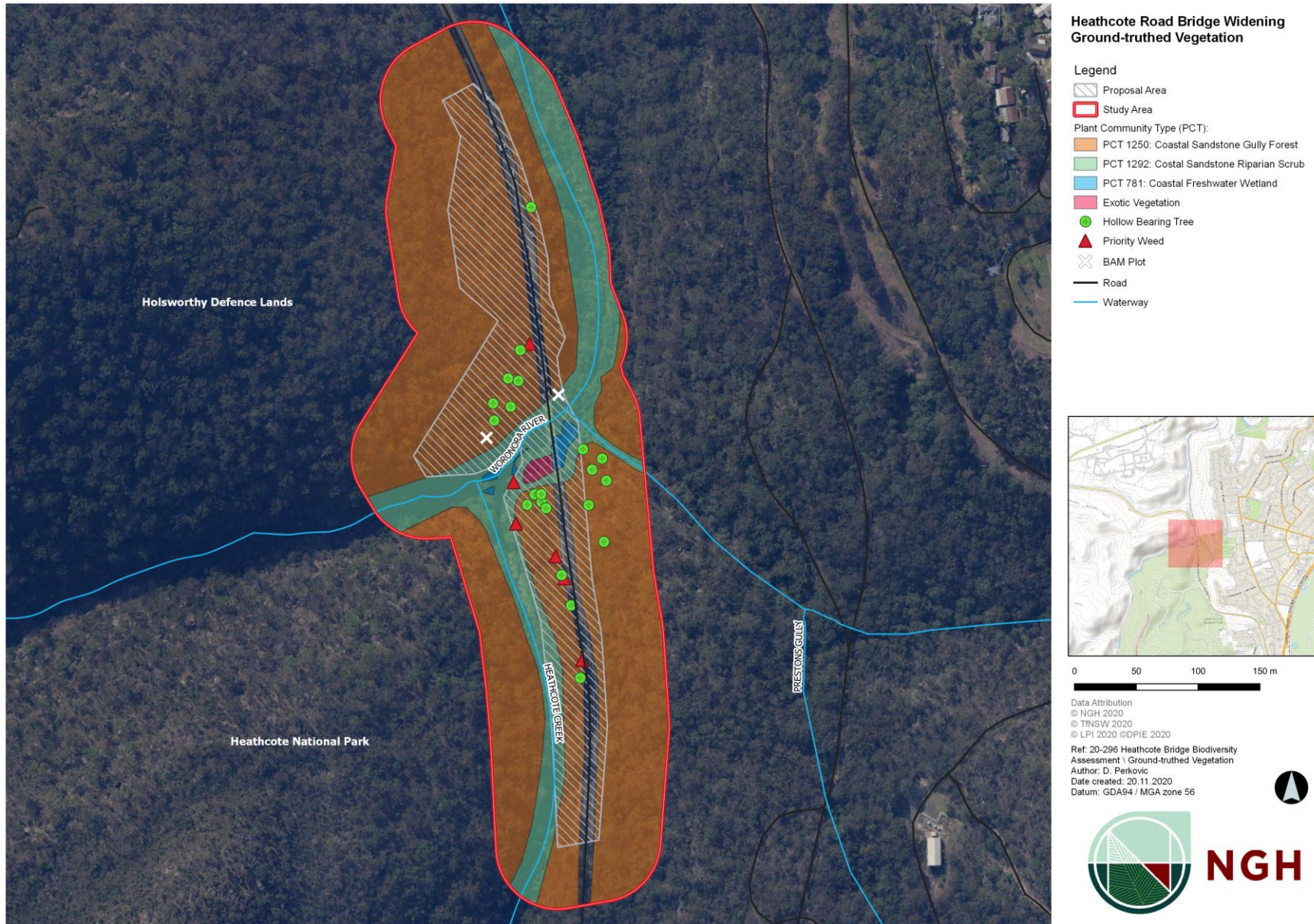


Figure 6-13 Location of PCTs mapped within biodiversity study area and proposal area

## Fauna habitat

The study area includes high-quality habitat for fauna within the native vegetation along the Woronora River and Heathcote Creek including:

- 21 habitat trees including 16 hollow bearing trees, stags and trees with arboreal termite mounds. The habitat trees included hollows ranging from small (5-10 cm) to large (five were greater than 20 cm) hollows, which would provide potential habitat for parrots, owls, gliders, possums, and some microbats including threatened species such as the Powerful Owl (*Ninox strenua*), Sooty Owl (*Tyto tenebricosa*), Eastern Pygmy Possum (*Cercartetus nanus*), and Southern Myotis (*Myotis macropus*)
- soaks and pools, of which three soaks were identified as suitable habitat for Red Crowned Toadlet
- rocks and boulders, which provide good shelter habitat for reptiles and small mammals as well as basking habitat for reptiles

Targeted survey efforts confirmed the presence of Southern Myotis (*Myotis macropus*) microbats roosting in the bridge scuppers (drainage pipes) as well as both Little Bentwing-bat (*Miniopterus australis*) and Southern Myotis using the area beneath the bridge for general foraging habitat. Other features of the proposal area which may also provide potential roosting habitat for microbats include bark, rock crevices and pipe culverts beneath the road.

Evidence of use of the habitat within the study area by fauna included incidental observations during the field survey of common bird species, small reptiles, common frog calls, wallaby tracks and two observations of brushtail possums as road kill.

No key feed tree species for the Wollondilly Koala population were recorded during the field survey within the study area. However, there are 186 records of koalas within 10 kilometres of the study area, including 13 records in 2020 (as at 21 October 2020). These records include 18 records within two kilometres of the proposal area, including a live sighting in 2010 and two roadkill records from Heathcote Road within the proposal area in 2018. This indicates that the study area does provide koala habitat and is a corridor for movement.

The *Sutherland Shire Biodiversity Strategy* identifies two major habitat corridors near the study area including:

- the bushland link between Royal National Park, Heathcote National Park, Holsworthy Military Reserve, Sydney Water Catchment, and the bushland of Wedderburn and the south west
- the bushland link along the Woronora River Valley linking Heathcote and Georges River National Parks

This suggests that a variety of species with large home ranges are likely to use the proposal area as a wildlife corridor, such as Spotted-tailed Quoll (*Dasyurus maculatus*), Koala (*Phascolarctos cinereus*), forest owls and microbats.

## Aquatic habitat

The Woronora River and Heathcote Creek are mapped as key fish habitat. These waterways and their banks may provide suitable habitat for other aquatic species such as turtles, amphibians, waterbirds and benthic invertebrates.

During the field survey, several species were incidentally observed within the Woronora River or on its banks, including common birds, frogs and invertebrates, and freshwater river mussels. Small fish were also observed and suspected to be *Gambusia holbrooki*, an introduced and predatory fish, recorded within both the Woronora River and Heathcote Creek.



The aquatic area was considered as potential habitat for several threatened species including:

- Sydney Hawk Dragonfly (*Austrocordulia leonardi*)
- Southern Myotis microbat (*Myotis macropus*)
- Australasian Bittern (*Botaurus poiciloptilus*)
- Giant Burrowing Frog (*Heleioporus australiacus*)
- Red-crowned Toadlet (*Pseudophryne australis*)
- Australian Grayling (*Prototroctes maraena*)
- Macquarie Perch (*Macquaria australasica*)

### Groundwater dependent ecosystems

A search of the Bureau of Meteorology's National Atlas of Groundwater Dependent Ecosystems (GDEs) shows that (refer to Figure 6-21):

- the section of the Woronora River that occurs within the study area is listed as high potential aquatic GDE, which includes surface water ecosystems that may have a groundwater component (i.e. rivers)
- habitat along the Woronora River is classified as a moderate to high potential terrestrial GDE, which includes ecosystems that rely on the subsurface presence of groundwater

### Threatened species

#### *Threatened flora species*

A search of the NSW BioNet database identified 16 threatened flora species with the potential to occur within the locality. Of these, five species and one population were considered to have a moderate or high likelihood of occurrence within the study area:

- *Hibbertia stricta subsp. furcatula*, which is listed as endangered under the BC Act as is considered to have a high likelihood of occurrence
- species or populations with a moderate likelihood of occurrence:
  - *Allocasuarina diminuta subsp. mimica* population in the Sutherland and Liverpool LGAs, which is listed as endangered under the BC Act
  - Thick-leaf Star-hair (*Astrotricha crassifolia*), which is listed as vulnerable under the EPBC Act
  - Small-flower Grevillea (*Grevillea parviflora subsp. parviflora*), which is listed as vulnerable under the BC Act and EPBC Act
  - Woronora Beard-heath (*Leucopogon exolasius*), which is listed as vulnerable under the BC Act and EPBC Act
  - Deane's Paperbark (*Melaleuca deanei*), which is listed as vulnerable under the BC Act and EPBC Act

Additionally, literature review identified one newly described, but as yet unlisted, flora species, *Hibbertia woronorana*, which is considered to have a very high potential of occurrence as it has been described as occurring along the lower reaches of Woronora River.

No threatened flora species were recorded within the study area during targeted field surveys.

### Threatened fauna species

A search of the NSW BioNet database identified 39 threatened terrestrial fauna species with the potential to occur within the locality. Of these, 14 species are considered to have a moderate to high likelihood of occurrence due to the high-quality habitat present within the study area (refer to Table 6-10).

Southern Myotis microbats were recorded during flyout monitoring surveys and were also observed inhabiting the bridge scuppers within the study area during targeted field surveys in September 2020. The Little Bentwing-bat and Southern Myotis were also recorded foraging close to the bridge. Targeted surveys were completed for the Sydney Hawk Dragonfly, however no individuals were recorded.

**Table 6-10 Threatened terrestrial fauna species with a moderate to high likelihood of occurrence within the study area**

Common name	Scientific name	BC Act status	EPBC Act status	Likelihood of occurrence
Southern Myotis	<i>Myotis macropus</i>	Vulnerable	-	Recorded
Little Bentwing-bat	<i>Miniopterus australis</i>	Vulnerable	-	Recorded
Red-crowned Toadlet	<i>Pseudophryne australis</i>	Vulnerable	-	High
Powerful Owl	<i>Ninox strenua</i>	Vulnerable	-	High
Rufous Fantail	<i>Rhipidura rufifrons</i>	-	Migratory	High
Koala	<i>Phascolarctos cinereus</i>	Vulnerable	Vulnerable	High
Giant Burrowing Frog	<i>Heleioporus australiacus</i>	Vulnerable	Vulnerable	Moderate
Dusky Woodswallow	<i>Artamus cyanopterus cyanopterus</i>	Vulnerable	-	Moderate
Australasian Bittern	<i>Botaurus poiciloptilus</i>	Endangered	Endangered	Moderate
Sooty Owl	<i>Tyto tenebricosa</i>	Vulnerable	-	Moderate
Varied Sittella	<i>Daphoenositta chrysoptera</i>	Vulnerable	-	Moderate
Black-faced Monarch	<i>Monarcha melanopsis</i>	-	Migratory	Moderate
Eastern Pygmy Possum	<i>Cercartetus nanus</i>	Vulnerable	-	Moderate
Large-eared Pied Bat	<i>Chalinolobus dwyeri</i>	Vulnerable	Vulnerable	Moderate
Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>	Vulnerable	Vulnerable	Moderate
Broad-headed Snake	<i>Hoplocephalus bungaroides</i>	Endangered	Vulnerable	Moderate
Sydney Hawk Dragonfly	<i>Austrocordulia leonardi</i>	Endangered	-	Moderate



Potential habitat is also present for aquatic species including:

- Australian Grayling (*Prototroctes maraena*), listed as Endangered under the FM Act and Vulnerable under the EPBC Act, in the wider Woronora estuary, however the Heathcote River has not been identified as habitat for this species on the NSW Fisheries Spatial Data Portal
- Macquarie Perch (*Macquaria australasica*), listed as Vulnerable under the FM Act, however historical surveys and records suggests that there is unlikely to be a population of Macquarie Perch within the Woronora River system (NSW Fisheries 2001)

### **Weeds, pests, pathogens and disease**

Five priority weed species listed under the *Biosecurity Act 2015* were observed within the study area during field surveys:

- African Olive (*Olea europaea* subsp. *cuspidata*)
- Ground Asparagus (*Asparagus aethiopicus*)
- Lantana (*Lantana camara*)
- Primrose (*Ludwigia peruviana*)
- Alligator Weed (*Alternanthera philoxeroides*)

In addition, four high threat exotic plants species, which if not controlled will likely invade and outcompete native plant species, were recorded:

- Mistflower (*Ageratina riparia*)
- Small-leaved Privet (*Ligustrum sinense*)
- Asparagus Fern (*Asparagus aethiopicus*)
- Crofton Weed (*Ageratina adenophora*)

Pests such as foxes (*Vulpes vulpes*), cats (*Felis catus*), Black Rat (*Rattus rattus*) and invasive fish species such as *Gambusia holbrooki* are likely to occur within the study area. There is also potential for amphibian chytrid fungus within the proposal area.

### **6.3.3 Potential impacts**

This section summarises the key potential construction and operational impacts on biodiversity as a result of the proposal. Further information and assessments of significance for potential impacts to threatened species, populations and vegetation communities listed under the BC Act and EPBC Act are provided in Appendices C and D of the Biodiversity Assessment Report in Appendix D.

## Construction

Table 6-11 summarises the biodiversity impacts that have the potential to occur during construction of the proposal.

**Table 6-11 Potential construction impacts on biodiversity**

Type and description of impact	Biodiversity likely to be affected	Assessment of impact
<p>The proposal would require removal of up to 3.12 hectares of vegetation (including 3.08 hectares of native vegetation in moderate or high condition) for the widening of the bridge and its approaches, retaining wall piling, slope stabilisation and maintenance work, drainage modifications as well as construction of the temporary access track and laydown areas.</p> <p>This would result in loss of fauna habitat such as flowering Eucalypts, native trees, bush rock and shrubs including up to 16 hollow-bearing trees.</p> <p>The proposal would also remove a number of culverts and scuppers within the bridge structure, which constitute known habitat for threatened microbats.</p>	<p>Vegetation to be cleared would comprise up to:</p> <ul style="list-style-type: none"> <li>• 0.05 hectares of PCT 781, which is associated with an EEC listed under the BC Act (Sydney Freshwater Wetlands in the Sydney Basin Bioregion)</li> <li>• 0.5 hectares of PCT 1292</li> <li>• 2.53 hectares of PCT 1250</li> <li>• 0.04 hectares of non-native vegetation</li> </ul> <p>Woodland birds, arboreal fauna and terrestrial fauna (including threatened species present within the proposal area) may be affected due to the loss of roosting, shelter and foraging habitat.</p> <p>No threatened flora species have been recorded within the proposal area.</p>	<p>Direct adverse impact on native vegetation, fauna habitat and species.</p> <p>However, the area vegetation removal is relatively small compared to the extent of habitat in the locality and therefore is unlikely to impact the abundance or diversity of flora and fauna in the region in the long-term.</p> <p>It is also unlikely that any threatened fauna species would be solely reliant on the habitat within the proposal area considering the proximity of Heathcote Road and the extensive high-quality habitat nearby within Heathcote National Park and Holsworthy Military Reserve.</p>
<p>Disturbance of aquatic habitat through impacts on water quality such as sedimentation, erosion and localised contamination. These impacts are likely to occur during construction of the temporary watercourse crossing, access track, laydown area as well as from spills or leaks from construction equipment, during application of the anti-carbonation coating and tannin leachate from mulch stockpiles (refer to Section 6.4.5).</p>	<p>Aquatic species present within the Woronora River and Heathcote Creek may be affected. However, no threatened aquatic species, populations and communities are expected to be present within the proposal area.</p>	<p>Direct adverse impact, however the potential for water quality impacts would be minimised through various safeguards (refer to Section 6.4.6) and no threatened species are likely to be impacted.</p>

Type and description of impact	Biodiversity likely to be affected	Assessment of impact
Fauna injury or death during construction equipment and vehicle movements within the proposal area or removal of vegetation.	Species at risk of injury or death include arboreal fauna, reptiles, amphibians, and small mammals (including threatened species present within the proposal area).	Direct adverse impact, however the likelihood and magnitude of fauna injury or death would be minimised through safeguards such as pre-clearing surveys (refer to Section 6.3.4).
Impacts associated with noise and vibration and altered light conditions during night work from construction activities, including potential edge effects	Native vegetation, fauna and habitat within and next to the proposal area.	Direct and indirect adverse impacts, however the impacts would be temporary and minimised through safeguards provided in Section 6.3.4.
<p>Invasion and spread of pests, weeds, pathogens and disease from construction equipment, vehicle and personnel movements within and to and from the site.</p> <p>Works within the waterway to construct the crossing, as well as general disturbance from activities along the waterway edge may also have the potential to contribute to the spread of aquatic weeds.</p>	Native flora and fauna within the proposal area likely to be affected by pests, weeds, pathogens or disease.	Indirect adverse impact, however the potential impact would be managed and minimised through weed management controls and protocols in accordance with the safeguards provided in Section 6.3.4
Changes to hydrology from the temporary waterway crossing (refer to Section 6.5.3)	The movement of aquatic species present within the Woronora River may be affected. GDEs and the Sydney Freshwater Wetlands EEC may also be affected from changes in surface water flow.	Indirect adverse impact, however the potential for impacts would be minimised through appropriate design of the temporary watercourse crossing and safeguards provided in Section 6.5.4.

## Operation

Operation of the proposal has the potential to result in direct impacts on biodiversity from traffic travelling along Heathcote Road leading to fauna injury or death. This is an existing risk associated with operation of Heathcote Road, which is evident through two observations of brushtail possums as roadkill during the field survey and two roadkill records of koalas in 2018. However, the increased risk of roadkill as a result of the proposal is low as it would only result in a relatively small increase in road width for fauna to cross.

Nonetheless, fauna connectivity structures have been incorporated into the proposal scope to contribute improved fauna connectivity (refer to Section 2.5.3). Koala crossing furniture (similar to the example provided in Figure 2-11) has been demonstrated as effective at facilitating koala movement on other Transport NSW road projects. The final location and design of the fauna connectivity features, including associated tie-in fencing details and landscape species selection, would be developed during detailed design in consultation with a suitably qualified ecologist and Transport for NSW's biodiversity officer.

The proposal would provide new scuppers similar to the existing scuppers that are currently used as roosting habitat by Southern Myotis microbats. The proposal also provides an opportunity to achieve a net biodiversity benefit by incorporating new elements on the bridge that could be used for roosting such as small gaps beneath the parapet. These features have been demonstrated to be effective at generating roosting habitat for Southern Myotis on other Transport NSW bridge projects. The final design of the microbat habitat features would be developed during detailed design in consultation with a suitably qualified ecologist and Transport for NSW's biodiversity officer.

The proposal also has the potential to contribute to minor indirect impacts on biodiversity including edge effects on native vegetation and habitat next to the proposal from soil moisture changes and altered drainage conditions.

## Conclusion on significance of impacts

The proposal is not likely to significantly impact threatened species or ecological communities or their habitats, within the meaning of the BC Act or FM Act and therefore a Species Impact Statement or Biodiversity Development Assessment Report is not required.

The proposal is not likely to significantly impact threatened species, ecological communities or migratory species, within the meaning of the EPBC Act.

### 6.3.4 Safeguards and management measures

Table 6-12 describes the proposed safeguards and management measures that would be implemented to manage the potential biodiversity impacts from the proposal. Other safeguards and management measures that would address biodiversity impacts are identified in Sections 6.2.5, 6.4.6 and 6.5.4.



**Table 6-12 Biodiversity safeguards and management measures**

Impact	Environmental safeguards	Responsibility	Timing	Reference
Biodiversity	<p>A Flora and Fauna Management Plan will be prepared in accordance with Transport for NSW 's <i>Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects</i> (Roads and Traffic Authority NSW (RTA), 2011) and implemented as part of the CEMP. It will include, but not be limited to:</p> <ul style="list-style-type: none"> <li>• plans showing areas to be cleared and areas to be protected, including exclusion zones, protected habitat features and revegetation areas</li> <li>• requirements set out in the <i>Landscape Guideline</i> (RTA, 2008)</li> <li>• pre-clearing survey requirements</li> <li>• procedures for unexpected threatened species finds and fauna handling</li> <li>• procedures addressing relevant matters specified in the <i>Policy and guidelines for fish habitat conservation and management</i> (DPI Fisheries, 2013)</li> <li>• protocols to manage weeds and pathogens.</li> <li>• procedures for retention and reuse of felled timber</li> <li>• identification of trees to be cut to base to avoid grubbing</li> <li>• an outline of the content to be included in toolbox talks including exclusion zones and stop work procedures</li> <li>• a procedure to routinely review and update the plan</li> </ul>	Contractor	Detailed design/ pre-construction	Section 4.8 of QA G36 <i>Environment Protection</i>

Impact	Environmental safeguards	Responsibility	Timing	Reference
Biodiversity	<p>A Microbat Management Plan is to be developed by a suitably qualified microbat ecologist in consultation with Transport for NSW Biodiversity Officer. The Microbat Management Plan would be incorporated into the Flora and Fauna Management Plan. As a minimum, the plan is to include:</p> <ul style="list-style-type: none"> <li>• demonstrated consideration of the roosting and breeding season requirements of the target species</li> <li>• pre-clearing requirements for artificial habitat during pre-construction</li> <li>• requirements for changes to artificial habitat during each phase of bridge work</li> <li>• a detailed methodology for pre-clearing surveys to identify microbats within the bridge structure</li> <li>• a protocol for identification, capture, and relocation of microbats</li> <li>• a protocol for microbat exclusion</li> <li>• references to examples to demonstrate proven effectiveness of proposed management measures</li> <li>• reporting requirements including species identification, number, relocation actions, exclusion methods</li> <li>• a protocol to routinely review and update the plan</li> </ul>	Transport for NSW	Detailed design/pre-construction	Additional safeguard
Biodiversity	Measures to further avoid and minimise the construction footprint and native vegetation or habitat removal (including design refinements to retain hollow bearing trees) will be investigated during detailed design.	Contractor	Detailed design/pre-construction	Additional safeguard
Biodiversity	TfNSW will consult with relevant experts within DPIE to develop a site specific management plan for the newly described but as yet unlisted <i>Hibbertia woronorana</i> .	Transport for NSW	Detailed design/pre-construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
Biodiversity/ fauna connectivity	During detailed design, the design of fauna connectivity features including arboreal fauna furniture, tie-in fencing, and landscape species selection would be further refined in consultation with suitably qualified ecologist and Transport for NSW Biodiversity officer. Design is to include consideration of landscaping, refuge areas, and natural substrate.	Transport for NSW	Detailed design/ pre-construction	Additional safeguard
Biodiversity	The applicability of Koala signage within the local road corridor would be subject to further review during detailed design in consultation with Transport for NSW Biodiversity Officer.	Transport for NSW	Detailed design/ pre-construction	Consultation with NPWS
Weed management	<p>A weed management plan would be prepared in accordance with <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA, 2011) and incorporated into the Flora and Fauna Management Plan and would:</p> <ul style="list-style-type: none"> <li>• outline the requirement for a pre-clearing inspection by an ecologist identify the weeds on site</li> <li>• outline weed management priorities and objectives</li> <li>• identify sensitive environmental areas within or adjacent to the site</li> <li>• identify the location of weed infested areas</li> <li>• provide weed control methods including machinery hygiene procedures and disposal requirements</li> <li>• outline a monitoring program to measure the success of weed management</li> <li>• requirements for communication with local Council noxious weed representative</li> </ul>	Transport for NSW	Detailed design/ pre-construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
Maintaining fish passage	TfNSW will consult with DPI Fisheries during the development of detailed design and notify DPI Fisheries prior to the commencement of construction of the temporary waterway crossing.	Transport for NSW / Contractor	Detailed design/ construction	Additional safeguard



## 6.4 Water quality and soil

### 6.4.1 Methodology

The methodology for the surface water quality assessment involved:

- reviewing existing data from the proposal area and its catchment to provide an understanding of existing environmental conditions, water quality data, current uses of the waterways and sensitive receivers
- reviewing all relevant legislation, plans and policy and guidelines for water management within the Sutherland Shire Council and NSW (as relevant) and identification of environment values for local receiving waterways
- identifying activities that could result in water quality impacts during construction and operation
- identifying mitigation and management measures and monitoring requirements, where required

The methodology for the groundwater assessment involved:

- reviewing existing data to understand the existing hydrogeology and groundwater quality and determine the baseline groundwater conditions for the project
- characterising the existing local regional hydrogeological conditions
- assessing the predicted changes in groundwater conditions to identify any potential adverse impacts
- identifying mitigation and management measures and monitoring requirements, where required

No groundwater or surface water monitoring was carried out in the preparation of the groundwater and surface water impact assessments. This desktop-based approach was adopted because:

- the magnitude of impacts is expected to be localised and temporary
- any long-term impacts are expected to be negligible relative to existing conditions

The methodology for the soils and geology assessment involved:

- reviewing the geological context, topography, soil landscapes, soil erodibility, contamination and acid sulfate soils in proximity to the proposal
- identifying activities that could result in impacts during construction and operation
- identifying mitigation and management measures, where required

A site visit was carried out in August 2020 to supplement the overall water quality and soil assessment.

### Study area

The study area for the water quality and soil assessment includes all land up to 500 metres from the proposal.

### 6.4.2 Relevant guidelines and legislation

Table 6-13 presents a summary of the relevant legislation and guidelines that are applicable to the proposal with respect to water quality and soils.

**Table 6-13 Relevant legislation and guidelines**

Document	Relevance
<p><i>Water Management Act (2000) and Water Management (General) Regulation (2018)</i></p>	<p>Refer to Section 4.2.7 for an overview.</p> <p>The proposal is located within the Lower Woronora River Management Zone (refer to Section 6.4.4) as defined by the water sharing plan for the greater metropolitan region which is managed under the <i>Water Management Act (2000)</i>.</p> <p>The 2018 Regulation specifies procedural, technical and licence requirements under the <i>Water Management Act 2000</i>, as well as the functions and powers of water supply authorities. Transport for NSW is exempt from controlled activity approvals under Subdivision 4, Clause 41 of the <i>Water Management (General) Regulation 2018</i> as they are a public authority.</p>
<p><i>Protection of the Environment Operations Act (1997)</i></p>	<p>Refer to Section 4.2.4 for an overview.</p> <p>The POEO Act has a requirement for EPL to be obtained for scheduled activities that are of a nature and scale that have a potential to cause environmental pollution. The activities required for this proposal do not trigger the requirement for an EPL.</p>
<p>NSW Water Quality and River Flow Objectives</p>	<p>The NSW Water Quality Objectives (WQOs) are the agreed environmental values and long-term goals for NSW's surface water, as determined by the Department of Environment, Climate Change and Water (DECCW) (DECCW, 2006). The objectives are consistent with the agreed national framework for assessing water quality set out in the ANZG Water Quality Guidelines (2018) (refer to Section 6.4.3 and Appendix E).</p> <p>The proposal is located within the Woronora river sub-catchment (lower), for which no current WQOs are defined. Interim WQOs for the Hawkesbury-Nepean catchment were defined by the Health Rivers Commission (1998) and approved by the NSW government in September 1999.</p> <p>For the purposes of this proposal, WQOs and RFOs are adopted from the Uncontrolled Streams WQOs and RFPs from the Georges River catchment.</p> <p>The construction of the proposal should consider the WQOs and RFOs for protecting surface water. Measures for monitoring water quality and accounting for/mitigating potential impacts are presented in Section 6.4.6.</p>
<p><i>Australia and New Zealand Guidelines for Fresh and Marine Water Quality (2018)</i></p>	<p><i>Australia and New Zealand Guidelines for Fresh and Marine Water Quality (2018)</i> provides guidance on the management of water quality for natural and semi-natural water resources in Australia and New Zealand (refer to Section 6.4.3). This includes water quality and sediment quality which have the possibility to be disturbed though the construction phase.</p>
<p><i>Guidelines for Water Quality Protection in Australia (2013)</i></p>	<p>These guidelines are designed to support the overall objective of the National Water Quality Management Strategy (NWQMS), focusing on protecting and enhancing groundwater quality to support the nominated environmental values and preventing groundwater contamination (refer to Section 6.4.3).</p>

Document	Relevance
<p>The NSW State Groundwater Policy Framework</p>	<p>The NSW State Groundwater Policy Framework (Department of Land &amp; Water Conservation (DLWC), 1998) was established to manage groundwater resources in NSW so that they can sustain environmental, social and economic uses for the people of NSW.</p> <p>The framework includes a set of three component policies, providing principals concerning the management of groundwater dependent ecosystems, groundwater quantity and groundwater quality (groundwater impacts are presented in Section 6.4.5).</p> <p><u>The NSW Groundwater Quality Protection Policy</u></p> <p>This policy identifies objectives and management tools to achieve protection of groundwater quality. The construction and operation of the proposal should account for the principles and processes expressed in this policy in protecting groundwater quality (safeguards and management measures proposed to protect groundwater quality are provided in Section 6.4.6).</p> <p><u>The NSW Groundwater Quantity Management Policy</u></p> <p>This policy identifies objectives and management tools to achieve protection of groundwater quantity. The construction and operation of the proposal is not considered to require any groundwater abstraction, as such this policy is not directly relevant to the proposal; however the proposal should account for this policy if any groundwater take is subsequently required during construction or operation (e.g. dewatering).</p> <p><u>The NSW Groundwater Dependent Ecosystem Policy</u></p> <p>GDEs refer to both terrestrial and aquatic ecosystems that require access to groundwater to meet all or some of their water requirements for their ecological processes and ecosystem services.</p> <p>This policy identifies objectives and management tools to achieve protection of GDEs. The construction and operation of the proposal should account for the principles and processes expressed in this policy in protecting GDEs (impacts related to GDEs are discussed in Section 6.4.5).</p>
<p>The NSW Aquifer Interference Policy</p>	<p>The Aquifer Interference Policy details the way the NSW Office of Water will assess aquifer interference projects to determine their potential impacts on water resources. It also explains the information and modelling that proponents will need to provide to enable the impacts to be assessed.</p> <p>These include impacts on groundwater-dependent ecosystems (impacts related to GDEs are discussed in Section 6.4.5) and culturally significant sites that are groundwater-dependent which may be impacted by the construction phase of the proposal.</p>

Document	Relevance
<p>Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources (NSW Office of Water, 2011a) and Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources (NSW Office of Water, 2011b)</p>	<p>Water Sharing Plans provide a strategy for maintaining healthy and enhanced water sources and water dependent ecosystems, and equitable water sharing among users in groundwater and surface water sources.</p> <p>The site is located within the Greater Metropolitan region with respect to water sharing plans. The Greater Metropolitan region is located on the south-east coast of NSW, extending from Shoalhaven Heads in the south, Broken Bay in the north, Lithgow in the west, and Goulburn in the south west.</p> <p>These water sharing plans include considerations for protecting environmental assets (including waterways and GDEs), considering environmental values, water supply works approvals, water entitlement and use, which are discussed further in the following sections.</p>

### 6.4.3 Environmental values and guidelines

The NSW WQOs and RFOs are the agreed environmental values and long-term goals for NSW's surface water, as determined by the Department of Environment, Climate Change and Water (DECCW) (DECCW, 2006). The objectives are consistent with the agreed national framework for assessing water quality set out in the ANZG Water Quality Guidelines (2018).

The proposal is located within the Georges River catchment for the purposes of assessing water quality objectives; however, the Woronora River is currently identified as the subject of a Healthy Rivers Commission (HRC) enquiry as part of the Georges River – Botany System. The report for the independent enquiry was completed in September 2001 (HRC, 2001), and made specific recommendations on management of the Woronora River.

The HRC guidelines classified the Woronora River as 'Substantially Unmodified' with desired outcomes being: The preservation of the natural geomorphic, hydrological and ecological processes and diversity; and management goals being: Protection of current conditions.

The section of the Woronora River associated with the proposal is sited at the mapped boundary between natural areas and urban area under the catchment divisions and environmental values (HRC, 2001), but is considered to be within the natural catchment division.

As such, the waterways within the study area have been nominated a number of representative environmental values and reflect the desired outcomes for natural rivers.

The nominated environmental/regional values correspond to the definitions of environmental values outlined by DECCW (2006). Under the Sutherland Shire Local Environment Plan (2015) the Woronora River within the study area is listed as Environmentally sensitive land - Riparian Lands and Watercourses.

The key WQOs and nominated environmental values relevant to the proposal include:

- **Protection of aquatic ecosystems** – ecological condition of waterways and the riparian zone. Physical and chemical water quality stressors that cause degradation of aquatic ecosystems. For the purpose of this assessment, indicators include nutrients, dissolved oxygen, pH, metals, salinity and turbidity
- **Protection of visual amenity** – aesthetic qualities of waters. For the purpose of this assessment, indicators include transparency, odour and colour



- **Protection of primary and secondary contact recreation** – water quality for activities, such as swimming, boating and wading where primary contact recreation implies direct contact with the water via bodily immersion or submersion with a high potential for ingestion (eg swimming, diving and water skiing), and secondary contact recreation implies some direct contact with the water would be made but ingestion of water is unlikely (eg boating, fishing and wading). Bacteriological indicators are used to assess the suitability of water for recreation.
- **Protection of irrigation water supply** – quality of waters applied to crops and pasture. The presence of algae and blue-green algae, salinity, coliforms and heavy metals and metalloids are used to assess the suitability of water for irrigation.
- **Protection of drinking water** (disinfection only and clarification and disinfection) – water quality of drinking water drawn from the raw surface source before any treatment. For the purpose of this assessment indicators include blue-green algae, turbidity, salinity (electrical conductivity), faecal and total coliforms, dissolved oxygen, pH and chemical contaminants.
- **Protection of aquatic foods** (cooked) – water quality so that it is suitable for the production of aquatic foods for human consumption and aquaculture activities. For the purpose of this assessment indicators include algae and blue-green algae, faecal coliforms, toxicants and physicochemical indicators.

A detailed summary table of the WQOs including where the objectives apply and indicator/guideline values are provided in Appendix E.

Table 6-14 presents a summary of the relevant River Flow Objectives.

**Table 6-14 Summary of River Flow Objectives and measures to achieve objectives**

Objective	Summary
<b>Maintain wetland and floodplain inundation</b>	Floodplain and wetland ecosystems develop in response to flow patterns and the nature of the landscape between the river and the wetlands or floodplains. Floodplain works can change the flooding patterns, which will then lead to changes in habitat and vegetation. These changes can be expected to reduce or change the diversity and abundance (or both) of species in the ecosystem. In particular, they can lead to reduced numbers of native fish and to water quality problems.
<b>Maintain natural flow variability</b>	Australia's rainfall and river flows are naturally variable. The way we currently store and divert river water can reduce natural pulsing of water down rivers and maintain artificially high or stable river heights.  In urban areas and other places where the ability of the land to absorb or detain rainfall is reduced, more water runs off rapidly, so water levels will rise higher. These changes often create problems with streambank stability, biodiversity and signals for breeding and migration.  Construction of temporary waterway crossings has a significant potential to impact natural flow variability within the Woronora River around the proposal area. Adequate measures should be implemented during the construction phase to ensure that changes in flow variability do not adversely impact dependent ecosystems.

Objective	Summary
<p><b>Minimise effects of weirs and other structures</b></p>	<p>Most instream structures (e.g. weirs) convert flowing water to still water, thus altering habitat and increasing the risk of algal blooms or other water quality problems. Barriers restrict the passage of plant propagules (e.g. seeds) and animals. This can be a major problem for species that depend on upstream and downstream migration at particular times in their lifecycle.</p> <p>The proposed construction of a temporary waterway crossing would also form a potential restriction to movement or migration. The initial designs for the crossing structure have been developed based on hydrological modelling including consideration for blockage, flooding/overtopping needs, and scour prevention. The crossing design would also continue to be refined during detailed design to maintain fish passage through continued consultation with DPI Fisheries.</p>

#### 6.4.4 Existing environment

##### Catchment characteristics

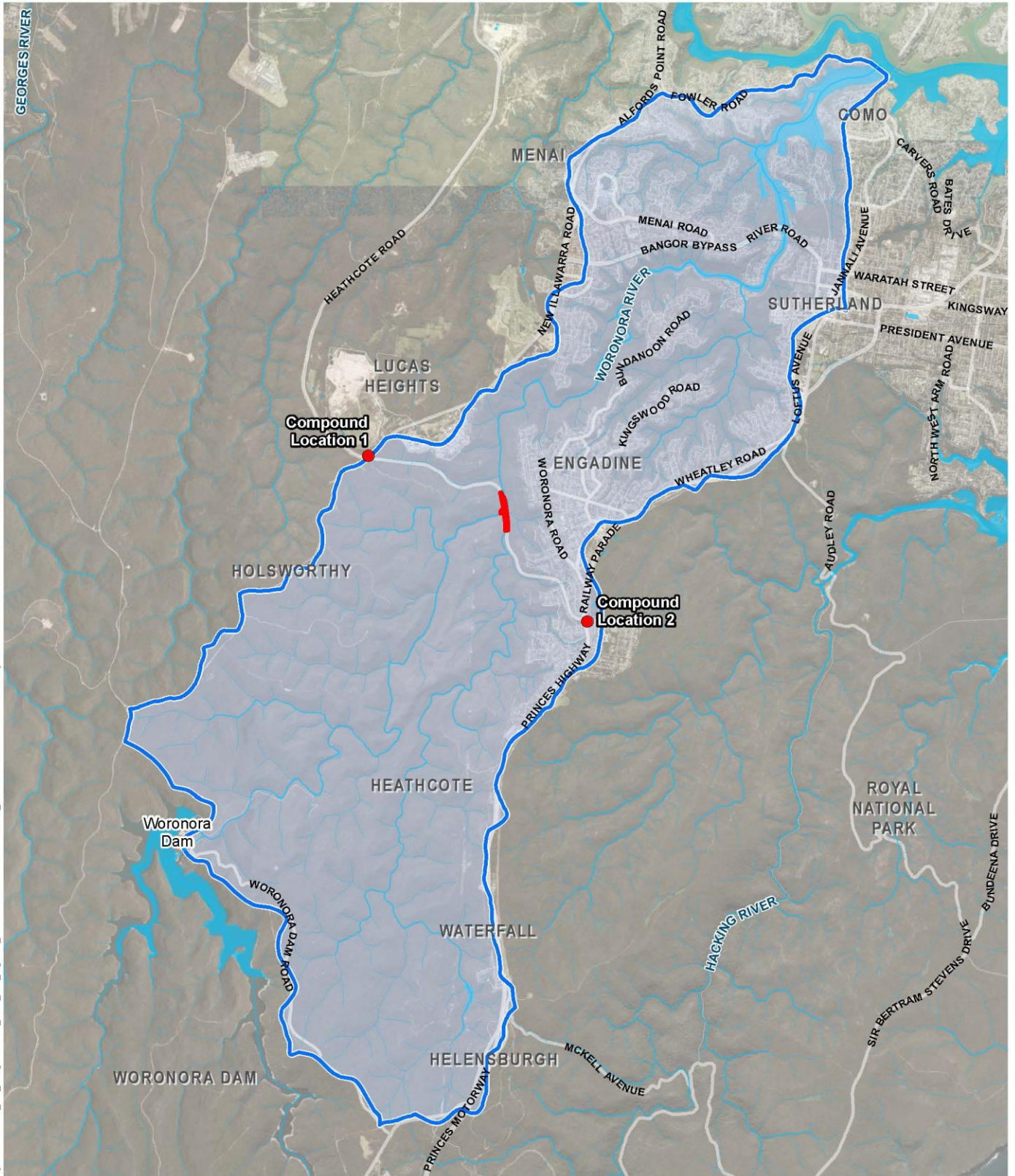
###### *Surface water catchments*

The proposal is located within the Lower Woronora River sub-catchment (Lower Woronora River Management Zone defined by Surface Water Sharing Plans (refer to Figure 6-14)) which covers an area of approximately 82 square kilometres within the Georges River Catchment.

The Lower Woronora River sub-catchment consists mainly of developed urban areas comprising low density residential areas at Lucas Heights, Woronora Heights, Bonnet Bay and Como, where the Woronora River meets the Georges River. These residential areas are positioned on the ridges near to the Woronora River.

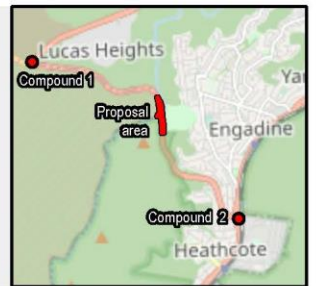
The proposal is located downstream of the confluence with Heathcote Creek, and upstream of the confluence with Prestons Gully (refer to Figure 6-). The proposed bridge spans a distance of about 90 metres across the Woronora River at this point.





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- Proposal area
- Lower Woronora River Management Zone
- ~ Watercourses



Source: Aurecon, TfNSW, Spatial Services, DPIE, Esri Topo



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Projection: GDA 1994 MGA Zone 56

Heathcote Road bridge widening **REF**

FIGURE 6-14: Lower Woronora River Sub-catchment



### Topography

The topography of the proposal area is characterised by steep slopes forming a narrow U-shaped valley in the north-west to south-east direction.

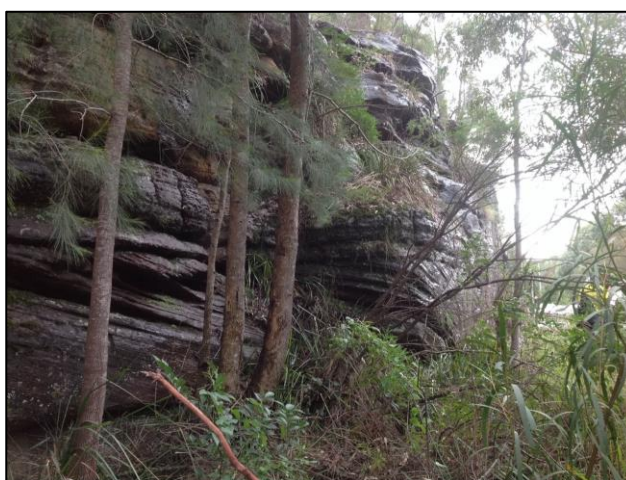
The highest point in the proposal area is around 60 metres Australian Height Datum (AHD) to the north of the proposal and the lowest point in the centre of the valley along the centreline of the Woronora River.

Valleys, including the one at the proposal site cut entirely in Hawkesbury Sandstone are steep sided, and lined by cliffs or by steep slopes made up of short benches. The base of the valley (centreline of the Woronora River) is around 20 metres AHD.

The valley slope on the southern approaches to the bridge is steep and rugged with outcrops and boulders forming terraces, overhangs, and ledges (Figure 6-15). There is a moderate slope associated with a former access track (now overgrown with vegetation) descending from the north west side of the bridge down to the Woronora River.



Rocky Outcrop (northside facing north)



Rock Outcrop (northside facing north)



Access track, upstream on northside (facing south-east)



Access track, upstream on northside gully erosion and drainage (facing north)

Figure 6-15 Site photos of local terrain



## ***Drainage***

Incised ephemeral (lasting for a short period) drainage lines are present alongside slopes forming first order drainage lines for concentrated flows during rainfall events. Sheet flows are likely to occur alongside concentrated flows over flattened areas, including the access tracks.

Drainage lines and overland flows discharge into the Woronora River from the northern and southern valley sides corresponding with northern and southern edges of the proposal area.

Culvert cross-drains are present underneath the road for the southern approach (refer to Figure 6-16). These culverts allow drainage from the cutting face and higher terrain to the east of the road to drain into Heathcote Creek and the Woronora River, which are located to the west of Heathcote Road.



**Figure 6-16 Site photo of cross drain at southern approach**

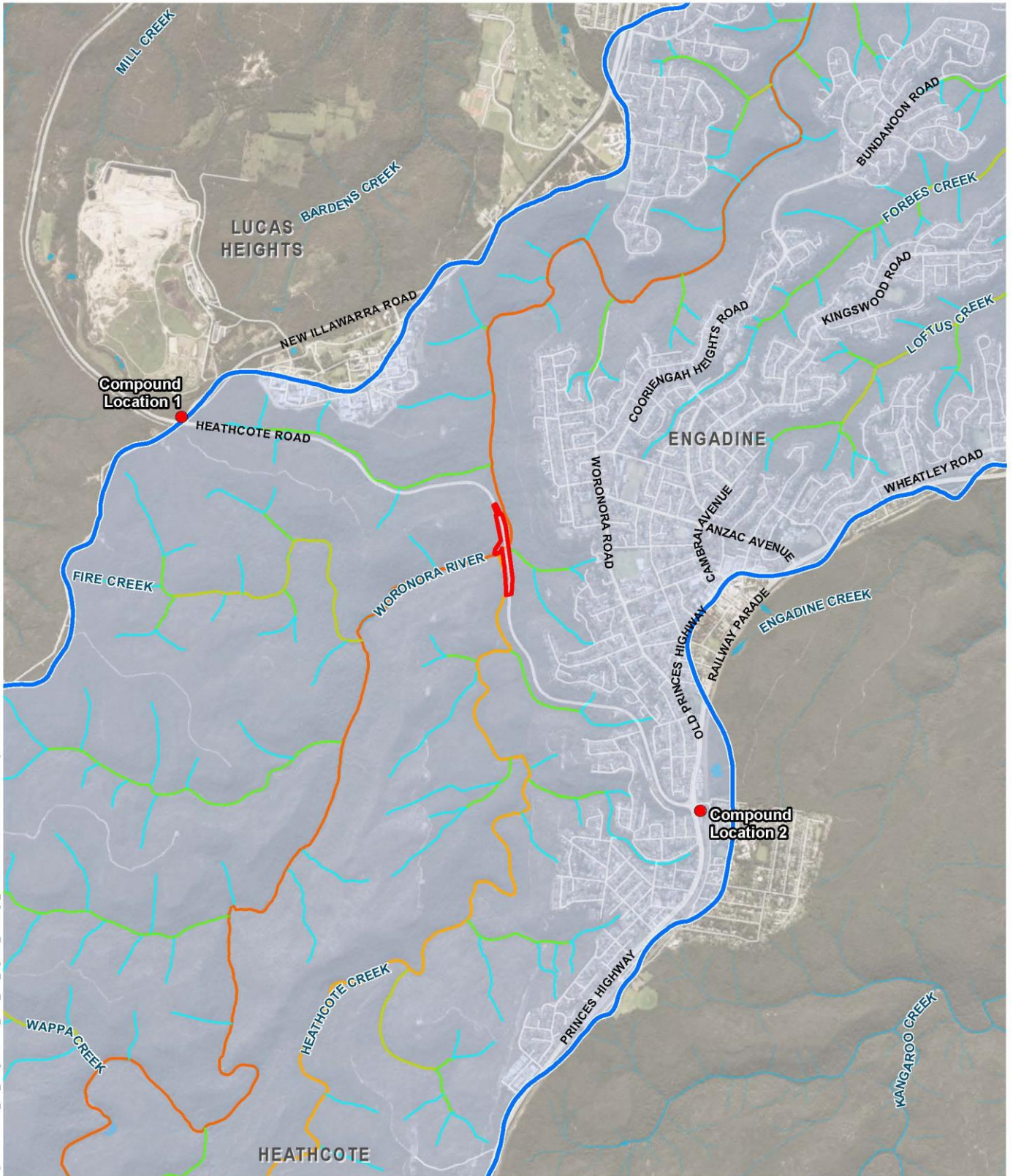
Cross culverts are present on the northern side of the Woronora River and northern approach to the Heathcote Road bridge, and convey water from the cutting face (refer to Figure 6-18), and the outlets discharge into the Woronora River. Infilled longitudinal drains along the eastern edge of the road run directly into the Woronora River via an historic access track.

### ***Surface water features and watercourse conditions***

Figure 6-17 and Figure 6-18 show the location of surface water features within and surrounding the proposal.

Mapped surface water features in the study area include the Woronora River, Heathcote Creek and Prestons Gully. The Woronora River forms the trunk channel to other local tributaries and generally flows from south to north where it intercepts the Georges River. Prestons Gully forms a confluence with the Woronora River to the east of the study area. Heathcote Creek forms a confluence with the Woronora River to the south-west of the proposal area.



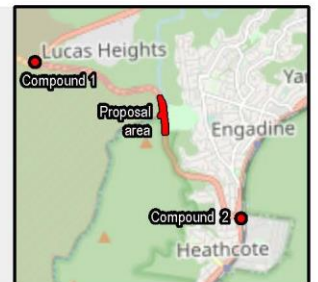


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- Proposal area
- Lower Woronora River Management Zone
- Watercourses

**Strahler Stream Order**

- 1
- 2
- 3
- 4
- 5



Source: Aurecon, TfNSW, Spatial Services, DPIE, Esri Topo



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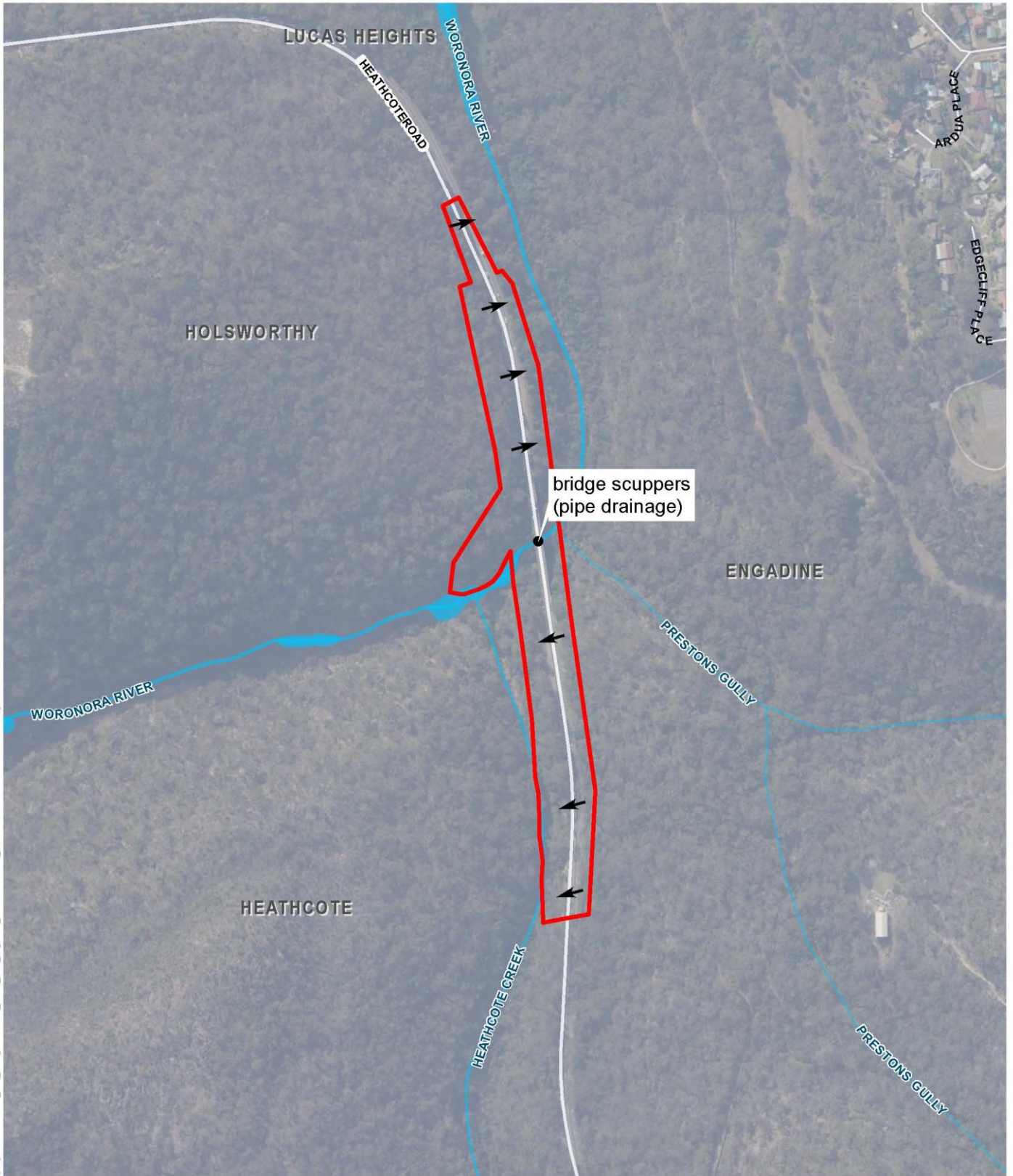


Projection: GDA 1994 MGA Zone 56

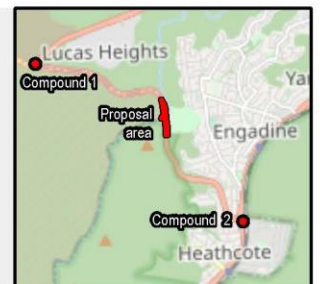
**Heathcote Road bridge widening REF**

**FIGURE 6-17: Drainage and Strahler stream orders**



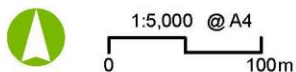


- Proposal area
- ~ Watercourses
- ➔ Cross culvert - northern side
- ➔ Cross culvert - southern side



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Source: Aurecon, TfNSW, Spatial Services, Water NSW, Esri Topo



Projection: GDA 1994 MGA Zone 56

**Heathcote Road bridge widening REF**

**FIGURE 6-18:** Surface water and drainage features within and surrounding the proposal



The Woronora River was observed to be flowing during the time of site inspection (August 2020). Water levels within the river were around one metre above the base of the channel. River flow and water levels were observed to be rapid and shallow at the channel constrictions.

Accumulations of channel sediment as point bar deposits were present within the waterway on both sides of the channel. The point bar deposits comprise coarse sand and fine gravel, shell fragments and woody debris. The river water was clear during the site inspection and no staining, oils or odours were observed. Some waste materials were observed within the waterway and nearby embankments, including vehicle parts, tyres, cloth, metal and glass (refer to Figure 6-19).



**Woronora River at proposal site (facing north)**



**Woronora River at proposal site (facing east)**



**Material waste at proposal site (southside facing south)**



**Material waste beneath bridge abutment (southside facing south)**

**Figure 6-19 Photos of river and material waste at the proposal site**

A WaterNSW surface water monitoring station is located about three kilometres downstream from the proposal at 'The Needles' (Station 213211). Table 6-15 presents water monthly average water level and discharge statistics at this surface water monitoring station.



**Table 6-15 Average monthly data and general statistics for river level and discharge in Woronora River from WaterNSW Monitoring Station (Station 213211) downstream**

Month/measure	Level (metres)	Discharge (ML/d)
January	0.06	28.71
February	0.09	86.44
March	0.09	64.69
April	0.09	46.70
May	0.09	59.44
June	0.11	88.69
July	0.10	63.67
August	0.09	56.65
September	0.08	38.37
October	0.07	32.65
November	0.07	29.03
December	0.08	42.88
Annual	0.08	53.28
Median	0.092	14.39
Minimum	0	0.75
5 <sup>th</sup> percentile	0	2.87
95 <sup>th</sup> percentile	0.165	249.78
Maximum	0.296	763.40

Note: Data range – 1992 to 2020

The water level monthly averages are around at 0.08 metres, with a peak in June of 0.1 metres and a low point in January of 0.06 metres.

The discharge follows a similar trend with a high of 88.69 ML/d in June and a low of 28.71 ML/d in January and an annual average of 53.28 ML/d. These records are consistent with annual variations in rainfall.

Median flow rates are around 14.39 ML/d, with 5<sup>th</sup> percentiles and 95<sup>th</sup> percentiles ranging from between 2.87 ML/d and 249.78 ML/d respectively. The range in values is reflective of natural variability in response to rainfall and responses to releases from the Woronora Dam.

### **Surface water quality**

The WaterNSW Monitoring Station (Station 213211) also provides records for key water quality water parameters. The station is monitored by Sutherland Shire Council as part of its Strategic Water Monitoring Program. Table 6-16 provides a summary of the average monthly water quality parameters recorded at this site.

**Table 6-16 Monthly data and general statistics for water quality in Woronora River from WaterNSW Monitoring Station (Station 213211) downstream**

Month/measure	Electrical conductivity @ 25C (uS/cm) <sup>2</sup>	Turbidity Nephelometric turbidity units (NTU)	Water temperature (°C)	pH	Dissolved oxygen (mg/L)
January	0.20	27.50	23.97	6.79	9.24
February	0.10	23.90	22.35	6.48	7.79
March	0.20	106.03	22.15	6.33	8.85
April	0.20	18.91	19.48	6.47	8.42
May	14.60	12.04	15.24	6.63	7.45
June	85.95	16.84	12.26	6.68	8.54
July	82.05	13.40	10.72	6.72	9.12
August	60.55	18.76	11.89	6.85	9.28
September	73.55	11.33	15.61	6.73	8.41
October	0.20	8.70	18.36	6.92	6.71
November	0.20	12.05	21.17	6.91	6.69
December	0.20	12.12	22.90	6.83	10.23
Annual	37.34	23.12	17.94	6.69	8.40
Median	0.2	3.45	18.12	6.55	7.09
Minimum	0.1	0.1	6.51	2.43	0.001
10 <sup>th</sup> percentile	0.2	1	10.96	6.10	4.00
90 <sup>th</sup> percentile	153.7	36.41	25.06	7.27	10.21
Maximum	171.7	1157.8	32.22	13	74.35

Note: Data range – 1992 to 2020

Note<sup>2</sup>: EC data first records recorded in May 2019, data quality not coded.

The water temperature ranges from 6.51 to 32.22 degrees Celsius with lower temperatures recorded in the winter months and the higher temperatures recorded in the summer months with an annual average of 17.94 degrees Celsius.

pH is neutral to slightly acidic all year round with monthly averages in the range of 6.33 to 6.92 with a maximum of 13 and a minimum of 2.43 and an annual average pH of 6.69.

Levels of dissolved oxygen are recorded with monthly averages ranging between 6.69 to 10.23 mg/L and an annual average of 8.4 mg/L with no visible annual trend.

### *Sensitive receiving environments*

Key Fish Habitats (KFH, *Fisheries Management Act 1994*) are located along the Woronora River, areas of interest to the proposal include KFH identified at the proposal downstream into the Georges River and Botany Bay. These areas are identified as those aquatic habitats that are important to the sustainability of the recreational and commercial fishing industries, the maintenance of fish populations generally and the survival and recovery of threatened aquatic species (DPI, n.d).

The proposal is also located within the environmentally sensitive land - Riparian Lands and Watercourses as identified by the *Sutherland Shire Local Environmental Plan (2015)*. The mapped area encompasses the Heathcote National Park to the south east and the Holsworthy Military area to the west including a large stretch of the Woronora river.

### *Wetlands*

Wetlands surrounding the proposal area are discussed in further detail in Section 6.3.2.

### **Groundwater**

The proposal is located within the Hawkesbury Hydrogeological Landscape (Hawkesbury HGL) which is characterised by plateaux, scarps, benches and hills on sandstone in the areas encompassing Lucas Heights and Woronora Plateau.

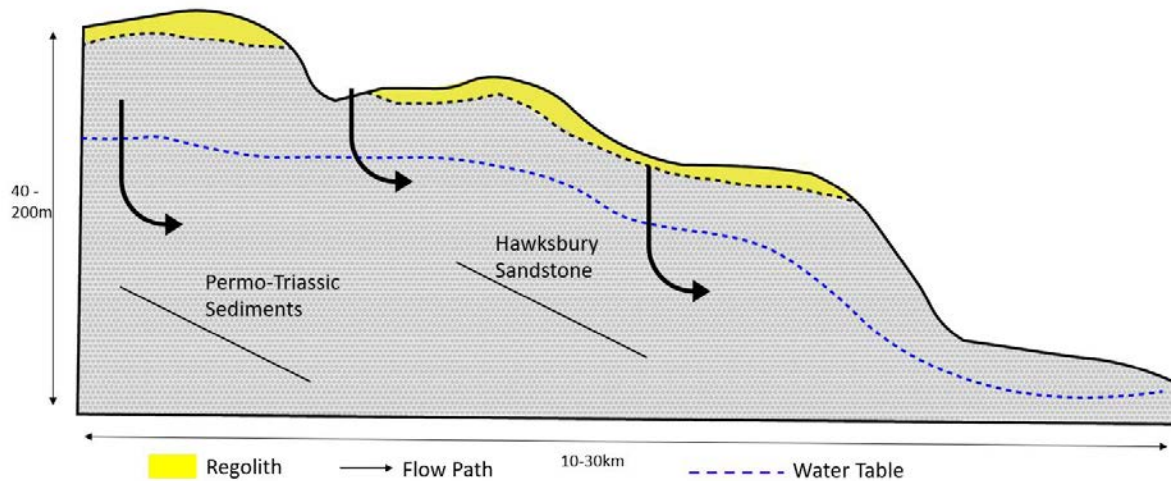
Groundwater levels are reported as generally deep ranging from eight metres below ground level or more (eSpade v2.1 – Hawkesbury Hydrogeological Landscape 2020).

Groundwater flow in the Hawkesbury HGL is unconfined along structures of bedding, joints and faults in the fractured bedrock. Flow also occurs through connected pore spaces in the sandstone. Lateral flows occur through colluvial sediments on slopes and flow will occur across the land surface where bedrock is exposed.

The general hydraulic conductivity (the ability of water to pass through pores and fractured rocks) of aquifer units is high (more than 10 m/day), and the general transmissivity is moderate to high (between two and 100 m<sup>2</sup>/day) (eSpade v2.1 – Hawkesbury Hydrogeological Landscape 2020).

Water infiltrates vertically through interbedded sandstone and sandstone fractures (primary and secondary porosity) and laterally along bedding planes. The residence time of water moving through this landscape is short to medium (months to years) due to the steep gradient and short flow path (less than 15 kilometres). As such, salt accumulation within groundwater is likely to be reduced and ground water has a generally low salinity.

Figure 6-20 provides a conceptual cross section of landforms, groundwater levels, and flow paths for units of the Hawkesbury Hydrogeological Landscape.



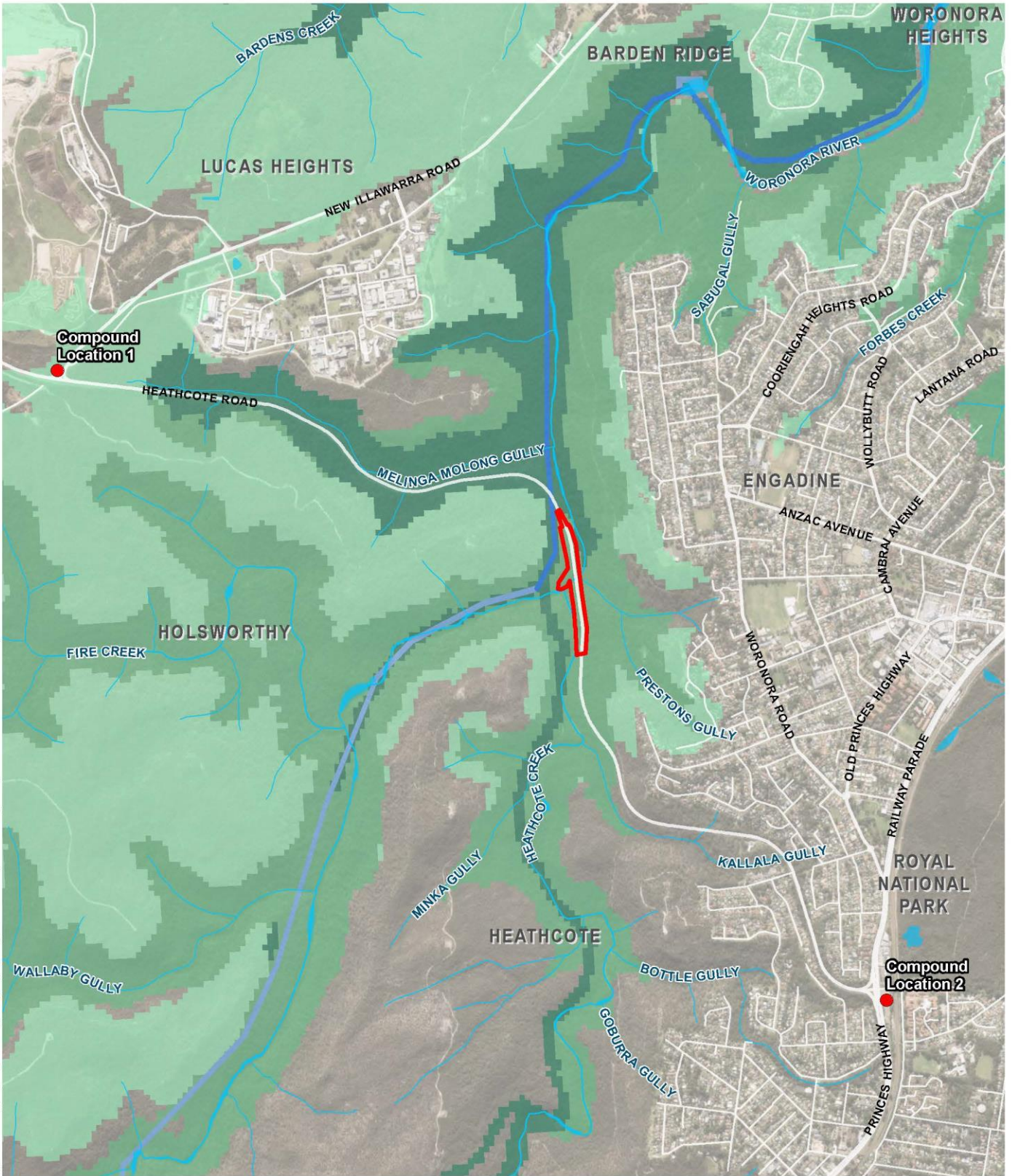
**Figure 6-20 Conceptual Hawkesbury Hydrogeological Landscape cross-section**

***Groundwater dependant ecosystems***

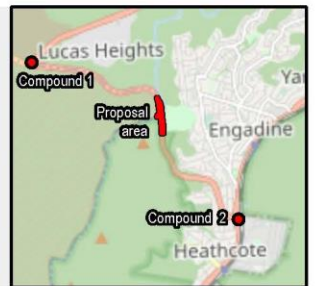
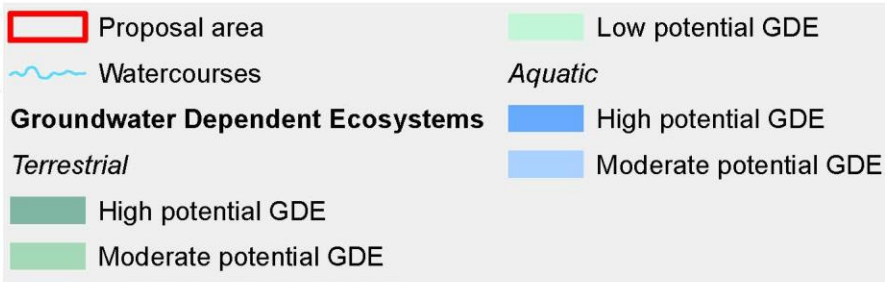
Groundwater dependant ecosystems (GDEs) were identified near the proposal and are presented in Figure 6-21.

The Woronora River is classified as high potential GDE to the north of the project and a moderate potential GDE to the south. The terrestrial GDE in the study area is classified as Hinterland Sandstone Gully Forest. The Sandstone Gully Forest is a low to moderately tall woodland and forest with an open canopy to sparse featuring eucalypts with a closed wet heath layer found on sandstone gullies and sandy drainage lines.

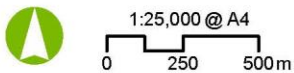




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Source: Aurecon, TfNSW, Spatial Services, BoM, Esri Topo



Projection: GDA 1994 MGA Zone 56

Heathcote Road bridge widening REF

FIGURE 6-21: Terrestrial and aquatic GDEs

## **Geology and soils**

### *Geology*

The geology of the area includes Hawkesbury Sandstone medium to coarse-grained quartz sandstone with minor shale and laminite lenses. Sandstones are either massive or cross-bedded sheet facies with vertical or sub vertical joint sets. The combination of bedding planes and widely spaced joints gives sandstone outcrops a distinctive blocky appearance.

### *Soil landscapes and characteristics*

The Soil Landscapes of Wollongong-Port Hacking 1:100,000 Sheet (Chapman and Murphy, 1989) shows the proposal intersects the Hawkesbury, Lucas Heights and Faulconbridge soil landscapes.

Figure 6-22 shows the construction and operational footprints relative to NSW soil landscape mapping.

The key characteristics and limitations to development of the NSW soil landscapes are presented in Table 6-17.



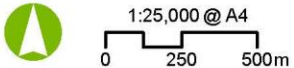


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- Proposal area
- Watercourses
- Soil Landscapes 1:100k**
- COha Hawkesbury
- ERgy Gynea
- REbu Bundeena
- REfb Faulconbridge
- RElh Lucas Heights
- DTxx Disturbed Terrain



Source: Aurecon, TfNSW, Spatial Services, DPIE, Esri Topo



Projection: GDA 1994 MGA Zone 56

**Heathcote Road bridge widening REF**  
**FIGURE 6-22: NSW soil landscape mapping**

**Table 6-17 Summary of soil landscape characteristics and limitations to development**

Soil landscape	Location	Key characteristics	Limitations to development
<b>Lucas Heights</b>	West Construction Compound	Soils are moderately deep (50 to 150 centimetres) hardsetting Yellow Podzolic Soils and Yellow Soloths on ridges and plateau surfaces, Lateritic Podzolic Soils on crests, Yellow Earths on shoulders of plateaus and ridges, and Earthy Sands in valley flats.	High capability for urban development (eSpade v2.1 Lucas Heights Soil Landscape 2020). Limitations for use include: <ul style="list-style-type: none"> <li>• stoniness</li> <li>• hardsetting surfaces</li> <li>• low soil fertility.</li> </ul>
<b>Faulconbridge</b>	East Construction Compound	Soils are shallow (less than 50 centimetres) Earthy Sands and Yellow Earths, with very shallow localised (less than 30 centimetres) Siliceous Sands/Lithosols associated with rock outcrops.	High capability for urban development eSpade v2.1 Faulconbridge Soil Landscape 2020). Limitations for use include: <ul style="list-style-type: none"> <li>• shallow, highly permeable soil</li> <li>• very low soil fertility</li> <li>• isolated rock outcrop.</li> </ul>
<b>Hawkesbury</b>	Proposal site	Shallow (less than 50 centimetres) discontinuous lithosols/siliceous sands associated with rocky outcrops, earthy sands, yellow earths and locally deep sands on inside of benches and along joints and fractures, localised yellow and red podzolic soils associated with shale lenses, and siliceous sands on narrow valley flats.	Not capable of urban development (eSpade v2.1 Hawkesbury Soil Landscape 2020). The limitations for use include: <ul style="list-style-type: none"> <li>• high to very high soil erosion hazard for concentrated flows</li> <li>• steep slopes</li> <li>• high susceptibility for concentrated flows</li> <li>• low organic matter content</li> <li>• low fertility</li> <li>• high potential aluminium toxicity.</li> </ul> <p>Developed areas in this soil landscape experience cracking of roads, buildings, sedimentation of streams, blocked drains and flooding.</p>



### *Acid sulfate soils*

Acid sulfate soils (ASS) are recorded around three kilometres downstream of the proposal and include Class 1, 2 and 5 ASS along the Woronora River (refer to Figure 6-23).

### *Hydrologic soil groups*

The proposal is located in an area containing group A soils from the hydrologic soil group classification (Horton Model). The soils have high infiltration rates, even when thoroughly wetted and consist primarily of deep well drained sands or gravel. These soils have low runoff potential when wet and have a high rate of water transmission. Typically, these soils have less than 10 percent clay and more than 90 percent sands or gravels.

### *Soil Erosion*

Table 6-18 presents the soil erosion class, which was estimated by using the Modelled Hillslope Erosion over New South Wales data available on eSpade.

**Table 6-18 Soil erosion class**

Type	Estimated Soil loss by runoff (tonnes/hectare/year)
Bare	1000 <2000
Cover	5 <10

Soil erosion removes the topsoil which has potential to result in impacts to both terrestrial and aquatic ecology through loss of/changes to habitat. Bare soil has a much higher rate of soil erosion as the cover provides protection from the wind.

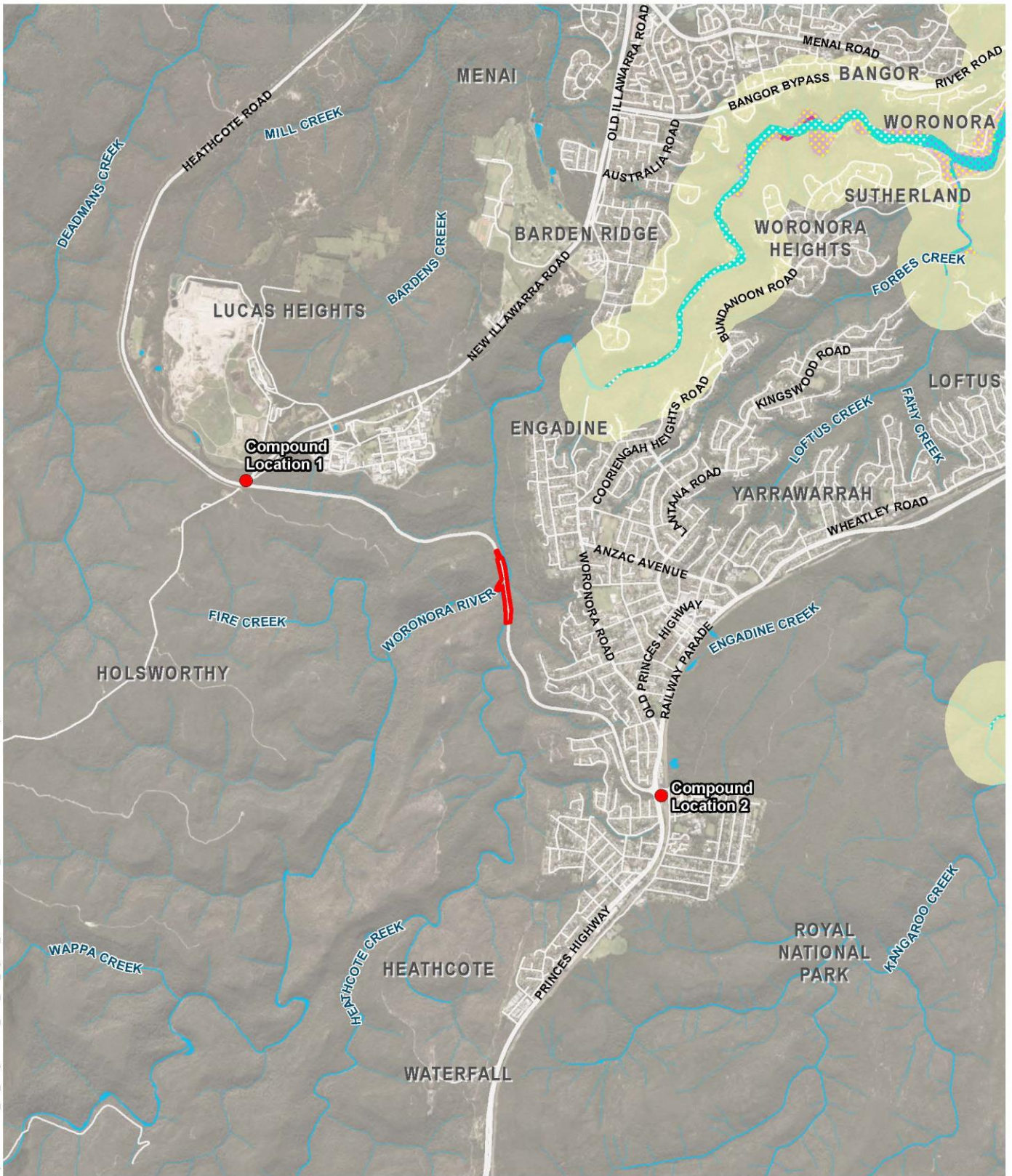
### *Contamination*

A search of the contaminated land record of notices maintained by the NSW Office of Environment and Heritage (EPA) on 24 September 2020 for the Sutherland Shire LGA identified 15 records of contaminated sites, none of these sites are within a one kilometre radius of the proposal.

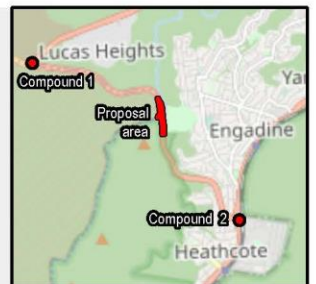
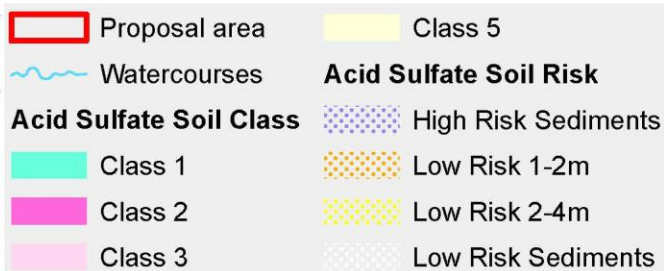
Specific sources of potential pollution in the vicinity of the proposal have been identified to include the Lucas Heights Waste Management Centre and ANSTO's nuclear research facility. A possible source of PFAS pollution is the Holsworthy Military Barracks and Reserve.

The Lucas Heights Waste Management Centre is located off New Illawarra Road, Lucas Heights. The centre receives putrescible waste material from more than ten councils plus private tipping. The centre is a non-lined valley landfill with a leachate collection system, making the site a potential source of groundwater contamination. The Waste Management Centre has a leachate control system and no record of leachate contamination reaching the Woronora River Catchment has been found.

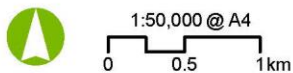
The nuclear research facilities owned by ANSTO contains the only nuclear reactor in Australia and the facility discharges treated liquid effluent to the sewer. Biological and chemical sampling at Mill, Barden and Forbes Creek do not contain significant levels of radioactivity that could be attributed to the operation of the site. The report concluded that since the levels of detected activity were very low and stormwater does not enter any known human drinking water supply, there are no environmental or health consequences to humans from the measured radioactivity in the stormwater (ANSTO, 1999).



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Source: Aurecon, TfNSW, Spatial Services, DPIE, OEH, Esri Topo



Projection: GDA 1994 MGA Zone 56

Heathcote Road bridge widening REF

FIGURE 6-23: Acid sulfate soils



Another potential specific source of pollution is the Holsworthy Military Barracks and Reserve. The Holsworthy Military Area is set on 18,484 hectares of land in southwest Sydney. The area has been used as an artillery range since 1913 with the first barracks developed in 1951. As a result of the historical use of per- and polyfluoroalkyl substances (PFAS) containing aqueous film-forming foam for firefighting and firefighting training at Holsworthy Military Barracks and reserve, there are recorded PFAS levels in the soil/sediment, surface water and groundwater on this land and in surrounding areas (Department of Defence, 2020).

#### **6.4.5 Potential impacts**

##### **Construction**

During the development of the concept design, alternate plant and construction methodologies were considered to minimise the construction footprint and need for works in the valley (and within the Woronora River). This included investigation into performing crane lifts from the bridge or approaches, however this was not feasible due of the limitations of the existing terrain (rock cuttings), and engineering limitations (i.e. load limits) of the existing bridge structure.

As construction work space is limited because of the steep river valley, construction activities would be required within low-lying, flood prone areas. Some of these activities would not be able to comply with standard requirements such as refuelling at least 50 metres away from a waterway (i.e. for cranes which require significant efforts to mobilise). Consequently, much stricter standards are to be applied in these circumstances such as double bunding with at least 120 per cent capacity during refuelling, weather restrictions on activities, bunding requirements for crane pads, and specific surveillance and monitoring requirements. These site and activity specific safeguards will be captured within the approved construction Environmental Work Method Statements (EWMS) (discussed further in Table 6-10).

##### *Surface water quality and soil*

Surface water quality and soil impacts are often interrelated, as soil erosion can result in sedimentation of waterways and increased water runoff can erode soil.

Construction of the proposal has the potential to result in surface water quality and soil impacts from disturbance of waterways, soils, topography, and vegetation. Key construction activities with the potential to impact water quality are predominately associated with construction earthworks, emplacement of fill, disturbance of soils and vegetation and changes to topography, and include:

- widening of the northern and southern bridge approaches - requiring earthworks and placement of fill materials, and disturbance of soils and vegetation, increasing the potential for erosion of surface soils and sedimentation of local waterways
- earthworks associated with the construction of new bridge abutments and new bridge aprons - requiring earthworks and placement of fill materials, and disturbance of soils and vegetation, increasing the potential for erosion of surface soils and sedimentation of local waterways
- construction of retaining walls - to support the rock cutting for the widening of both bridge approaches, requiring earthworks and placement of fill materials, and disturbance of soils and vegetation, increasing the potential for erosion of surface soils and sedimentation of local waterways
- earthworks for utility adjustments

- construction of a temporary access track and construction crane pads - requiring vegetation clearance, earthworks, and emplacement of fill materials increasing potential for erosion and sedimentation of receiving waterways. This includes works within low-lying flood zone areas which was unavoidable due to the steep river valley and limited construction space (refer to Section 3.2.2)
- establishment and use of the new temporary waterway crossing, would directly alter flow conditions within the Woronora River and has potential to cause:
  - changes in surface water flow affecting low flows, pools and natural flow variability
  - localised erosion and scouring of channel banks and channel base
  - deposition of fine and coarse sediments near channel banks and within the main channel

These changes have the potential cause degradation or loss of aquatic habitat and as such, suitable management measures are required. The potential hydrological impacts and management measures are discussed further in Section 6.5 (Hydrology and Flooding).

Other low disturbance construction activities and potential impacts include:

- bridge works including demolition works above the waterway – including concrete cutting, removal of edge barriers, and controlling drainage off the bridge once the existing drainage (scuppers) are removed
- operating plant and equipment above the waterway and from the ground - during major lifts of bridge components and movement of material and bridge components above the waterway
- bridge repair and maintenance works including works directly above the waterway and from scaffolding – including application of anti-carbonation coating, crack repairs, and joint/bearing replacement. Maintenance is also required around the base of piers within and at the edge of the waterway. Some of these activities (i.e. application of anti-carbonation coating) may require a temporary coffer dam setup.
- use of water for construction activities - including hydro demolition on the bridge, shotcrete works, piling activities, bridge coring, rock drilling, bridge washing (prior to application of anti-carbonation coating), dust suppression and vehicle wash-down, which could result in runoff of polluted or sediment laden water.
- piling, rock drilling, and activities for geotechnical investigations and associated drilling slurry. Some activities may also generate alkaline runoff such as from shotcreting
- activities and concrete hydro-demolition works on the bridge earthworks associated with drainage upgrades including culvert replacements, extensions and new scour protection at discharge points
- slope maintenance works on the rock cuttings including potential slurry from rock drilling and shotcrete application, and disturbance from vegetation removal, crest drain maintenance, and installation of rock mesh netting and associated anchor points
- mulch stockpiles, which may result in tannin leachate

Activities at the construction compound locations are considered to be low risk with respect to potential impacts to water and soils. Construction compounds are located at relatively flat and established locations that require no vegetation clearance and minimal disturbance of soils. The construction compounds are also located at considerable distances from natural waterways, minimising risks from disturbance on surface water conditions.



### ***Spills, leaks and contaminated materials***

The inappropriate containment of fuels, chemicals (including anti-carbonation coating for bridge piers), materials, and litter from construction sites and activities could result in spills, leaks or accumulation of potentially contaminated materials into the surrounding environment. Risks from leaks/spills and litter are may occur for works directly above the waterway. Some activities on the bridge and scaffolding would require an impermeable containment structure to be setup.

### ***Soil erosion***

The loss of topsoil from earthworks activities has the potential to result in impacts to both terrestrial and aquatic ecology through loss of/changes to habitat. The highest potential for soil erosion would be associated with the disturbance of soils from earthworks on the access track to the Woronora River as a result of the steep gradient and soil erodibility.

A preliminary review has been carried to assess the overall erosion risk within the proposal area of disturbance comprising the access track between Heathcote Road and the Woronora River from the northern bridge approach. This review along with Revised Universal Soil Loss Equation (RUSLE) calculations are provided in Appendix F. Based on the calculation, it was estimated that soil loss for the access track to the Woronora River would be up to 1408 tonnes per hectare per year. The constrained construction area and topography limit the potential for basins to be used as a sediment control measure. Consequently, erosion control through minimising disturbed areas and progressive stabilisation will be important considerations for the development of the Soil and Water Management Plan.

### ***Acid sulfate soils***

Available mapping indicates that acid sulfate soils are unlikely to be encountered within the project area. As such, the risks from acid sulfate soil are considered to be low, and no special measures are required. In the event that acid sulfate soils are encountered, appropriate management measures would be implemented to prevent impacts from acid leachate to groundwater receiving waterways.

A preliminary assessment of the feasible controls within the constraints of the site is provided in Section 6.4.6 alongside a summary table of environmental safeguards and management measures.

### ***Contamination***

Results from site walkover inspect identified evidence of contamination in the form of waste materials, including tyres, glass bottles, vehicle parts and potential asbestos containing materials. Waste materials should be removed from site as part of earthworks activities as part of the onsite Construction Environmental Management Plan (CEMP).

Potential gross or significant contamination not identified through site walkover would be managed in accordance with guidelines made or approved under section 105 of the *Contaminated Land Management Act 1997*.

### ***Groundwater***

Earthworks activities associated with the proposal would have minimal impacts on groundwater quantity, quality, and groundwater dependent ecosystems as no dewatering or aquifer interference activities are required.

Potential impacts on groundwater/GDEs associated with construction activities are limited to:

- the inadequate containment of fuels and chemicals (including anti-carbonation coating), which could result in spills or leaks of potentially contaminated materials into the surrounding environment, causing impacts to groundwater quality and nearby groundwater dependent ecosystems.

- sedimentation of GDEs through erosion and sedimentation of waterways and aquatic/terrestrial habitat
- direct disturbance of groundwater dependent ecosystems from earthworks activities resulting in loss of habitat

## Operation

### *Surface water quality and soil*

Operation of the proposal has the potential to result in surface water quality and soil impacts from:

- retaining walls - resulting in potential changes to hydraulic gradients causing localised erosion along footings of retaining walls and sedimentation of waterways, causing impacts to water quality
- road incidents, resulting in accidental spills or leaks of chemicals, oils and fuels, which could cause contamination of soil and waterways, causing impacts to soil and water quality
- stormwater runoff from the road corridor, which can result in contaminants or litter on the road entering the surrounding waterways, causing impacts to water quality
- localised erosion at outlets of stormwater drains resulting in removal of topsoils and sedimentation of receiving waterways, causing impacts to water quality
- localised erosion along the boundaries of the widened road corridor and bridge abutments, resulting in removal of topsoils and sedimentation of receiving waterways causing impacts to water quality

The potential for localised erosion is considered to be minor and would be minimised through provision of scour protection at the outlets of stormwater drains and slope stabilisation measures (refer to Section 3.2.3). The potential for water quality impacts from stormwater runoff and road incidents would be minimised through provision of water sensitive urban design (WSUD) measures to capture and treat runoff from the road corridor, which would be confirmed during detailed design.

### *Groundwater*

Groundwater impacts are unlikely to be significant during operation of the proposal, but may include:

- road incidents, resulting in accidental spills or leaks of chemicals, oils and fuels, which can cause contamination of groundwater, resulting in impacts to groundwater quality
- increases in impervious surfaces resulting in localised minor reductions to groundwater recharge

## 6.4.6 Safeguards and management measures

Table 6-19 describes the proposed safeguards and management measures that would be implemented to manage the potential water quality and soil impacts from the proposal.

**Table 6-19 Environmental safeguards and management measures for water quality and soil impacts**

Impact	Environmental safeguards	Responsibility	Timing	Reference
<p>Construction soil and water quality impacts</p>	<p>A Soil and Water Management Plan (SWMP) would be prepared as part of the CEMP in accordance with the requirements of RMS QA specification G38 prior to the commencement of construction. The SWMP would also address the following:</p> <ul style="list-style-type: none"> <li>• <i>RMS Code of Practice for Water Management, the RMS Erosion and Sedimentation Procedure</i></li> <li>• <i>The NSW Soils and Construction – Managing Urban Stormwater Volume 1 “the Blue Book” (Landcom, 2004) and Volume 2A (DECC, 2008)</i></li> <li>• <i>RMS Technical Guideline: Temporary Stormwater Drainage for Road Construction, 2011</i></li> <li>• <i>RTA Technical Guideline: Environmental Management of Construction Site Dewatering, 2011</i></li> </ul> <p>The SWMP is to be developed by suitably qualified soil conservationist and would detail the following as a minimum:</p> <ul style="list-style-type: none"> <li>• identification of catchment and sub-catchment areas, high risk areas and sensitive areas</li> <li>• sizing of each of the above areas and catchment</li> <li>• the likely volume of run-off from each road sub-catchment</li> <li>• direction of flow of on-site and off-site water</li> <li>• separation of on-site and off-site water</li> <li>• the direction of run-off and drainage points during each stage of construction</li> <li>• the locations and sizing of sediment traps such as sumps as well as associated drainage</li> </ul>	<p>Contractor</p>	<p>Detailed design/ pre-construction</p>	<p>Section 2.1 of <i>QA G38 Soil and Water Management</i></p>

Impact	Environmental safeguards	Responsibility	Timing	Reference
	<ul style="list-style-type: none"> <li>• dewatering plan which includes process for monitoring, flocculating, testing and dewatering water from site (i.e sumps)</li> <li>• the staging plans, location, sizing and details of creek alignment and realignment controls for scour protection and bank and bed stabilisation including those used during construction and for long-term stabilisation</li> <li>• progressive Erosion and Sedimentation Control Plans (ESCPs)</li> <li>• a process to routinely monitor the weather forecast</li> <li>• preparation of a wet weather (rain event) plan which includes a process for monitoring potential wet weather and identification of controls to be implemented in the event of wet weather</li> <li>• procedure for routine visual water quality monitoring</li> <li>• identification of the construction water source</li> <li>• provision of an inspection and maintenance schedule for ongoing maintenance of temporary and permanent erosion and sedimentation controls</li> </ul> <p>The SWMP is to identify all activities that have the potential to generate wastewater and include an assessment of the containment needs for each activity, including minimum requirements for impermeable containment setup.</p>			



Impact	Environmental safeguards	Responsibility	Timing	Reference
Construction erosion and sedimentation impacts	<p>The Construction SWMP is to include preparation of Environmental Work Method Statements for all activities it has identified as high risk. The EWMS must as a minimum include:</p> <ul style="list-style-type: none"> <li>• a description of the work activity including any plant and equipment to be used</li> <li>• an outline of the sequence of tasks for the activity including interfaces with other construction activities</li> <li>• identification of any sensitive areas or exclusion zones</li> <li>• identification of potential environmental risks/impacts due to the work activity</li> <li>• specific safeguards and environmental management measures to reduce the identified environmental risk, including assigned responsibilities to site management personnel</li> <li>• a process for assessing the performance of the implemented mitigation measures</li> <li>• figures showing the work activities and proposed mitigation measures</li> </ul>	Contractor	Detailed design/ pre-construction	Section 3.2.4 of QA G36
Construction erosion and sedimentation impacts	An Erosion and Sedimentation Control Plan (ESCP) is to be developed by suitably qualified soil conservationist. As a minimum, the ESCP must be in accordance with the requirements of QA G38 specification, Soil and Water Management.	Contractor	Detailed design/ pre-construction	Section 2.2 of QA G38 <i>Soil and Water Management</i>

Impact	Environmental safeguards	Responsibility	Timing	Reference
Construction erosion and sedimentation impacts	<p>A Stabilisation Plan is to be prepared and included in the SWMP. The stabilisation plan is to include but not be limited to the following:</p> <ul style="list-style-type: none"> <li>• identification and methodology of techniques for stabilisation of site</li> <li>• identification of area on site for progressive stabilisation</li> <li>• Identification of areas requiring stabilisation, including stockpiles and batters, exposed for a duration of two weeks or greater. For example covering with geotextile fabric, stabilised mulch, soil binder or spray grass.</li> <li>• identification of areas on site for progressive permanent stabilisation such as implementation of landscaping. Work areas are to be stabilised progressively during the works.</li> </ul>	Contractor	Pre-construction / construction	Additional safeguard
Construction accidental spills	<p>A site-specific emergency spill plan will be developed and included within the SWMP. This plan would be implemented during construction and include spill management measures in accordance with the Transport for NSW <i>Code of Practice for Water Management: Road Development Management</i> (RTA, 1999) and relevant EPA guidelines. The plan will address measures to be implemented in the event of a spill, including initial response and containment, notification of emergency services and relevant authorities (including Transport for NSW and EPA officers).</p>	Contractor	Pre-construction / construction	Section 4.3 of QA G36 <i>Environment Protection</i>
Construction accidental spills	<p>All works directly above the waterway including on the bridge and scaffolding will be subject to an approved EWMS including details of minimum containment requirements, protocol to inspect and approve containment setup, and identification of activities requiring impermeable containment setup to prevent accidental spills into the river.</p>	Contractor	Construction	Additional safeguard
Construction accidental spills	<p>Emergency wet and dry spill kits would be kept on site at all times and all staff would be made aware of the location of the spill kit and trained in its use.</p>	Contractor	Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
Construction erosion and sedimentation impacts	All stockpiles would be designed, established, operated and decommissioned in accordance with the <i>Roads and Maritime Services Stockpile Site Management Guideline</i> (EMS-TG-10).	Contractor	Construction	Additional safeguard
Construction water quality impacts	A procedure for refuelling and storage of fuels, chemicals and liquids, is to be detailed within the SWMP. As a minimum this is to identify nominated storage areas, spill kit provisions including provision for aquatic spills and boom, minimum double bunding requirements, weather restrictions, flood event preparedness and visual monitoring.	Contractor	Construction	Additional safeguard
Construction water quality impacts	The crossing design and any potential cofferdam set up will be refined during detailed design to maintain fish passage through continued consultation with DPI Fisheries.	Contractor	Detailed design	Additional safeguard
Construction contamination impacts	In the event that indications of contamination are encountered (known and unexpected, such as odorous or visually contaminated materials), work in the area would cease until a contamination assessment can be prepared to advise on the need for remediation or other action, as deemed appropriate.	Contractor	Construction	Additional safeguard
Risk of tannins	Any mulch stockpiling is to be in accordance with <i>Environmental Direction – Management of Tannins from Vegetation Mulch (RMS, 2012)</i>	Contractor	Construction	Additional safeguard
Operational drainage, soil and water quality impacts	Detailed design will seek to minimise water quality impacts by incorporating the following design principles: <ul style="list-style-type: none"> <li>• appropriate measures to mitigate any potential impacts to soil and water quality, including but not limited to scour protection, infiltration trenches, vegetated swales, geofabrics, lined channels</li> <li>• appropriate energy dissipation and scour prevention measures downstream of culverts and other drainage structures to minimise soil erosion.</li> </ul>	Contractor	Detailed design	Additional safeguard

## 6.5 Hydrology and flooding

This section describes the hydrology and flooding impacts that may occur when constructing and operating the proposal, and has been informed by a flooding investigation prepared by Transport for NSW (Transport for NSW, 2020g).

### 6.5.1 Methodology

The methodology for the hydrology and flooding assessment involved:

- reviewing publicly available hydrology and flooding information relevant to the proposal, including information on the catchment and previous flood studies
- calculating peak flow discharges within the proposal area for a range of storm events (from 1% AEP to 50% AEP events) using the Regional Flood Frequency Estimation Model 2016 v1
- predicting the existing 1% AEP flood levels below the Heathcote Road bridge using HEC-RAS computer software
- assessing the potential flooding impacts of the new bridge structure on the 1% AEP flood level
- assessing the potential hydraulic impacts of the temporary waterway crossing and crane pads within the Woronora River
- providing safeguards and management measures to manage the potential impacts on hydrology and flooding

### 6.5.2 Existing environment

The Heathcote Road bridge spans the Woronora River, which flows to the north until it joins the Georges River. The section of the Woronora River beneath the bridge is located about 7.5 kilometres downstream of the Woronora Dam (refer to Figure 6-14). The storage and release of water at the Woronora Dam upstream influences the levels of the Woronora River beneath the Heathcote Road bridge and the potential for flooding. Since the construction of the Woronora Dam, there have been no reports of flood water overtopping the bridge.

Table 6-20 presents the predicted flood levels beneath the Heathcote Road bridge during different storm events, ranging from relatively rare (1% AEP<sup>2</sup>) to frequent (50% AEP) events.

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<sup>2</sup> Annual exceedance probability (AEP) is a term used to describe flood size. It is a means of describing how likely a flood is to occur in a given year. For example, a 1% AEP flood is a flood that has a 1% chance of occurring, or being exceeded, in any **one** year.



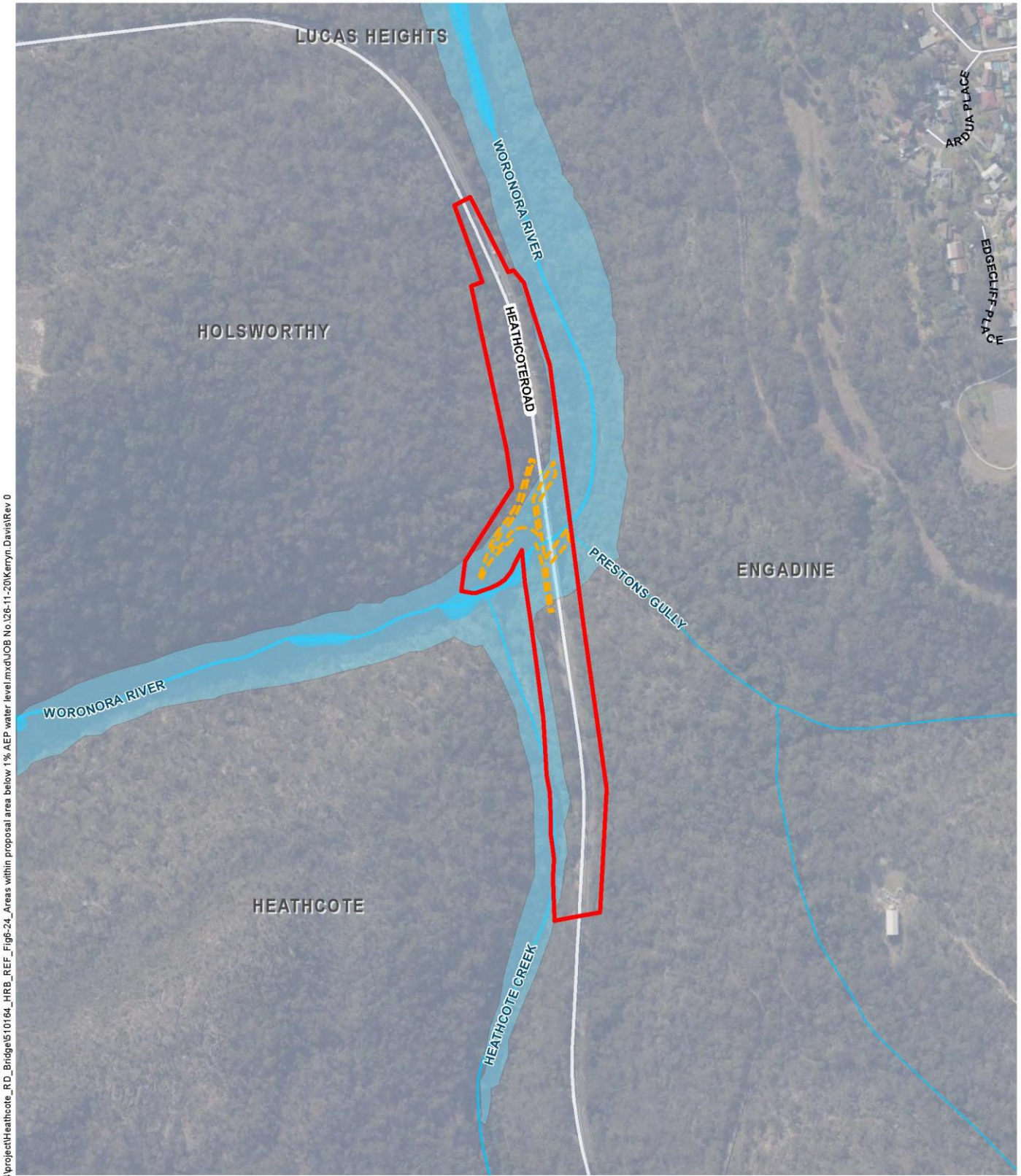
**Table 6-20 Predicted flood levels below the Heathcote Road bridge**

AEP	Predicted flood level (m AHD)		
	5% Lower limit	Adopted design criteria	95% Upper limit
1%	20.76	24.02	29.48
10%	19	20.62	23.45
20%	18.5	19.76	21.82
50%	17.77	18.64	20.1

The Sutherland Shire LEP defines the flood planning level as land at or below the level of a 1 in 100 year average recurrence interval (ARI) flood event (equivalent to a 1% AEP event) plus 0.5 metre freeboard (the distance between the waterline and the deck of a structure).

The existing bridge deck of the Heathcote Road bridge measures at 31.14 metres above Australian Height Datum (mAHD). The predicted flood levels during a 1% AEP flood event would be between 1.66 metres and 10.38 metres below the existing Heathcote Road bridge deck level. The design criteria for the proposal has adopted a 1% AEP flood level between these two limits of 7.54 metres below the bridge deck level. As a result, the existing bridge deck and approaches are considered to be outside the 1% AEP flood zone and at low risk of flooding.

However, the land located beneath the Heathcote Road bridge (including the proposed location of the temporary access track and laydown area) has the potential to flood during 1% AEP storm events (refer to Figure 6-24).

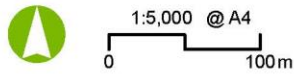


\aurecon.info\Shares\AUS\YD\Projects\GIS\Project-4\project\Heathcote\_RD\_Bridge\10164\_HRB\_REF\_Figs-24\_Areas within proposal area below 1% AEP water level.mxd\JOB No.128-11-20\Kerryn.Davis\Rev 0

- Proposal area
- Temporary access track
- 1% AEP water level
- Watercourses



Source: Aurecon, TfNSW, Spatial Services, Water NSW, Esri Topo



Projection: GDA 1994 MGA Zone 56

**Heathcote Road bridge widening REF**

**FIGURE 6-24:** Areas within the proposal area below the 1% AEP water level

### 6.5.3 Potential impacts

#### Construction

A temporary access track, laydown area, crane pads, and waterway crossing are proposed to be established in an area under the bridge near the Woronora River to provide access for construction equipment and temporary storage of construction materials. These ancillary facilities are required for construction due to the steep river valley and limited construction space surrounding the Heathcote Road bridge (refer to Sections 3.2.2 and 3.4.2). These ancillary facilities have the potential to alter localised hydrological regimes and flood patterns including due to:

- establishment and use of the new temporary waterway crossing, which would directly alter flow conditions within the Woronora River and has potential to cause:
  - changes in channel velocity and flooding conditions
  - localised erosion and scouring of channel banks and channel base
  - deposition of fine and coarse sediments near channel banks and within the main channel
  - degradation and/or changes to aquatic habitat
- changes to ground surface levels associated with the temporary access track and laydown area, which may change the flow paths of surface water runoff and drainage
- new areas of hardstand within laydown areas, which may increase surface water runoff

These potential impacts on hydrology and flooding would be temporary, as the waterway crossing structure would be removed and the access track and laydown area would be rehabilitated after construction to return the disturbed areas to pre-existing conditions.

In addition, potential impacts associated with establishment and use of the new temporary waterway crossing have been minimised by designing the waterway crossing to include appropriate pipe outlets, scour protection and flood immunity.

The crossing structure is proposed to include four 750 millimetre diameter pipes, which is the maximum number and size of pipes that can fit in the river channel, which is about four-metres wide and one metre deep, to allow for the flow of water through the structure. These pipes would minimise the potential obstruction to river flows and the associated changes to aquatic habitat and flooding patterns.

The temporary waterway crossing would be designed for a 50% AEP flood event (i.e. a temporary platform level of 18.64 mAHD – refer to Table 6-20), which would minimise impacts on hydrology and flooding when compared with structures designed to achieve flood immunity for larger storm events. This is because structures designed for larger storm events have been predicted to result in a higher pipe outlet velocity, which would increase potential for erosion and scour as well as waterway obstruction. For example, the pipe outlet velocity for a structure designed for a 50% AEP event is predicted to be 4.34 m/s (just prior to overtopping) compared to 5.59 m/s for a 20% AEP event and 6.38 m/s for a 10% AEP event. The potential erosion and scouring impacts would be further minimised through incorporating rock scour protection at the pipe outlets and downstream of the structure, which would mitigate the increased velocity and concentrated flow from the proposed pipes.

As the temporary access track, laydown area (including the storage of plant, equipment and materials), crane pads, scaffolding, and waterway crossing would be susceptible to flooding, several safeguards such as a flood action plan would be implemented during construction to minimise flood risks at these locations during construction (refer to Section 6.5.4).

Construction activities from the existing bridge deck or along the bridge approaches would be above the 1% AEP flood zone and occur largely within existing hardstand areas. As such, these activities are expected to result in negligible impacts to hydrology and flooding.

## Operation

The widening of the Heathcote Road bridge and approaches would result in minor changes to surface water flow patterns and runoff due to the increased impervious area from the new road pavement and altered topography from the earthworks and rock cutting. However, impacts associated with these hydrological changes would be negligible as the proposal includes provision of new and modified drainage structure along the bridge and approaches that would be suitable for the small increase in impervious area and changed flow patterns. This includes replacement and extension of existing cross culvert pipes on the approaches for the widened road pavement, improved drainage gutters along the base of the rock cuttings, new longitudinal drainage outlets at each abutment and scour protection at all discharge points.

Impacts on hydrology and flooding associated with the bridge widening are expected to be negligible as the widening of the existing bridge would be achieved using headstock expansion, which would avoid the need for new bridge piers in the waterway and would not change the existing bridge deck or soffit level.

As shown in Figure 6-25, the new bridge elements would be located above the 1% AEP level and therefore unlikely to flood.



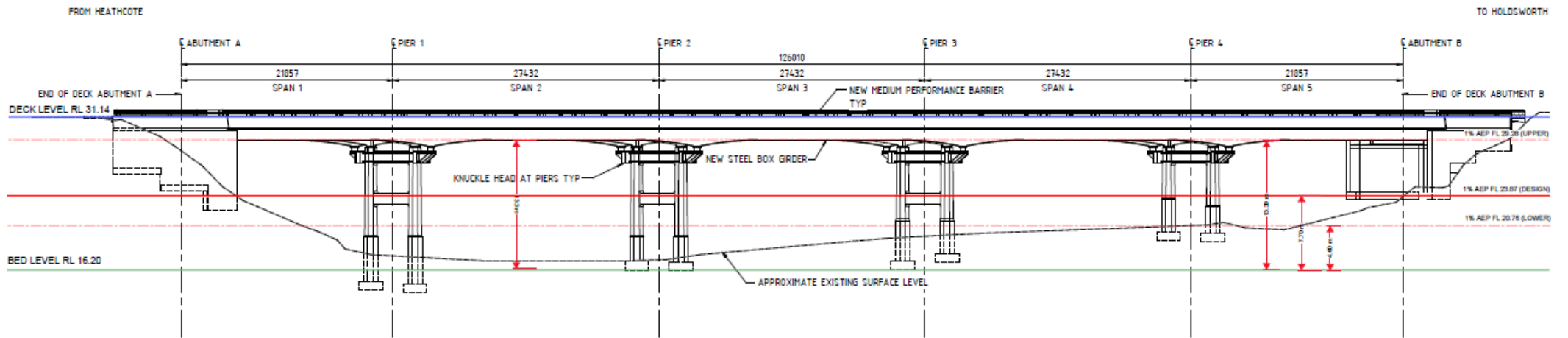


Figure 6-25 Elevation of proposed bridge structure compared to 1% AEP flood level

#### 6.5.4 Safeguards and management measures

Table 6-21 describes the proposed safeguards and management measures that would be implemented to manage the potential hydrology and flooding impacts from the proposal. Other safeguards and management measures that would address hydrology and flooding impacts are identified in Section 6.4.6.

**Table 6-21 Hydrology and flooding safeguards and management measures**

Impact	Environmental safeguards	Responsibility	Timing	Reference
Hydrology and flooding impacts from waterway crossing	The detailed design of the temporary waterway crossing will be developed in consultation with the Transport for NSW Senior Environmental Officer and include appropriate pipe outlets, scour protection and flood immunity to minimise impacts on hydrology and flooding.	Transport for NSW	Detailed design	Additional safeguard
Hydrology and flooding	The final layout and detail of the drainage system including scour protection and operational WSUD features will be refined during detailed design in consultation with the Transport for NSW Senior Environmental Officer.	Transport for NSW	Detailed design	Additional safeguard
Hydrology and flooding impacts from waterway crossing	<p>The Soil and Water Management Plan is to include but may not be limited to:</p> <ul style="list-style-type: none"> <li>• an outline of the works which are to occur in waterways including and temporary works</li> <li>• a profile of the waterways within which works are to occur eg ephemeral or permanent; creek or river</li> <li>• assessment of the flow regime of waterway such as flooding events</li> <li>• schedule and timing of works</li> <li>• work methodology including environmental controls</li> <li>• how Erosion and Sediment Control Plans would be managed and updated for the works in waterways</li> </ul>	Contractor	Pre-construction / construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
Hydrology and flooding impacts from waterway crossing	The temporary waterway crossing structure will be removed and the temporary access track and laydown areas will be rehabilitated as soon as practical to return the disturbed areas to pre-existing conditions.	Contractor	Construction	Additional safeguard
Flooding during construction	<p>A flood action plan will be prepared to manage a potential flood event during construction and included as part of the CEMP. This plan will be implemented during construction and outline:</p> <ul style="list-style-type: none"> <li>• procedures to monitor rainfall and dam water releases that may influence river levels</li> <li>• what flood event would trigger the plan</li> <li>• evacuation procedures including a map indicating the area that is flood prone and the locations where to evacuate</li> <li>• procedures to reduce risk during a flood event including removal of all plant/equipment and stabilising exposed areas</li> </ul>	Contractor	Pre-construction/ construction	Additional safeguard

## 6.6 Aboriginal cultural heritage

An Aboriginal archaeological survey report has been prepared for the proposal. The assessment is included in Appendix G and summarised in the following sections.

### 6.6.1 Methodology

The Aboriginal cultural heritage assessment methodology incorporated the following activities:

- consultation with key Aboriginal stakeholders
- review of relevant heritage registers and data bases
- review of previous archaeological investigations
- archaeological field surveys of the proposal area.

To ensure consistent and effective consultation is achieved with Aboriginal stakeholders, Transport for NSW has developed the Procedure for Aboriginal Cultural Heritage Consultation and Investigation (PACHCI). In line with the PACHCI, consultation with Local Aboriginal Land Councils and registered Native Title holders/claimants was carried out at the early stages of the project. Key Aboriginal stakeholders identified for the project, included the Gandangarra Local Aboriginal Land Council (GLALC), Tharawal Local Aboriginal Land Council (TLALC) and the registered Native Title claimant for the area, the South Coast People.

Field surveys of the proposal area were conducted by an archaeologist and a representative from GLALC. All identified stakeholders were invited, but only GLALC was able to provide a representative. GLALC attended the field survey of the proposal area on 25 May 2020 and 17 August 2020.

Desktop research was carried out to determine the cultural, ethnographic and archaeological context of the proposal area. An Aboriginal Heritage Information Management System (AHIMS) database search was conducted on 25 and 26 August 2020 to identify registered (or known) Aboriginal sites or declared Aboriginal places within or near to the proposal area. This search identified six sites within or near to the study area (one site was identified to occur in the proposal area). Other registers, databases and the Sutherland LEP 2015 were also searched, and identified the Commonwealth Cubbitch Barta National Estate Area heritage place (Place ID. 105405) within the proposal area.

Previous archaeological investigations developed to support large scale infrastructure projects in the area, local management plans and academic studies were also reviewed as part of the survey. These investigations provided a greater understanding of the Aboriginal heritage within the proposal area and the broader surrounds.

### 6.6.2 Existing environment

#### Landscape context

The study area is located on the Woronora Plateau, a geographic region of the Sydney Basin. Topography of the study area and the local topography is characterised by the steep gradient of the Woronora River valley. Two prominent ridgelines are present on the western side of the proposal area and include high points at Melinda Molong Mountain to the northwest and Scouters Mountain to the southwest. Woronora River crosses the study area from west to north to join the Georges River about nine kilometres north east of the proposal area.



Areas of remnant native vegetation comprising Sydney Sandstone Gully Forest and Sydney Sandstone Ridgetop Woodland border the slopes of the proposal area. The underlying geology of the study area comprises Hawkesbury Sandstone with shale lenses (Hawkesbury Sandstone Variant) capping the ridgetop beneath the Heathcote township.

### Regional character

Preservation of archaeological deposit in open contexts (i.e. artefact scatters and isolated finds) is relatively rare in the region. This is partially due to unfavourable environmental conditions.

Various resources that would have been valued by Aboriginal people are present within region, including various native plant and animal species, sources of fresh water, good views over the surrounding landscape from the ridgelines and spurs, exposed sandstone for grinding grooves and engravings, rock shelters suitable for use as campsites and elevated ridge corridors allowing for easier transit. Significant heritage values have also been identified within the Cubbitch Barta National Estate Area, with the listed heritage item present within the study area and further northwest.

### Archaeological heritage

One previously recorded Aboriginal archaeological site known as 'Scouters Mountain Engadine' (AHIMS 52-2-0742) was identified in the proposal area during the archaeological field survey and is shown in Figure 6-26. Three other AHIMS sites were identified during the desktop search, but were not located within the proposal area. These sites included:

- WT21 (Two Shells Shelter) Campbelltown (AHIMS 52-2-3658) – located around 100 metres from the proposal area
- Woronora Pipeline PAD3 – WPLP3 (AHIMS 52-2-1787) – located around 125 metres from the proposal area
- Woronora River (AHIMS 52-2-0612) – located around 200 metres from the proposal area

The 'Scouters Mountain Engadine' site is a rockshelter site with art. The art includes a hand stencil in red stain, and a stick figure depicting a person in a running motion throwing a spear. Extensive graffiti damage was present across the rear wall of the rockshelter, limiting the visibility of the previously recorded motifs. Only the hand motif could be identified during the survey. The rockshelter floor contained exposed sandstone bedrock, with a thin layering of recent sand and sandstone blocky fragments. A recent circular fireplace was also recorded. No potential for archaeological deposits were identified across the shelter floor due to the proximity to the creek and the evidence of flash flooding.

The proposal area contains a portion of the Cubbitch Barta National Estate Area (also referred to as the Holsworthy Military Training Area) which is a listed place on the Commonwealth Heritage List (Place ID 105405). As a listed place on the Commonwealth Heritage List, the area is protected under the *Environment Protection and Biodiversity Conservation Act 1999*. The heritage place is listed for its Indigenous values. These values relate to archaeological, symbolic, cultural, educational and social associations. The Cubbitch Barta National Estate Area heritage place is of cultural significance due to the presence of over 500 Aboriginal archaeological sites within the Holsworthy Military Training Area. The Aboriginal sites located within the Cubbitch Barta National Estate Area are of particular significance as they have largely been preserved in good condition due to the historic land use of the site as a military training area. No previously recorded or registered AHIMS sites or potential archaeological deposit (PAD) areas associated with the listing were recorded within the proposal area.

The proposal area to the north of the bridge was assessed as containing low archaeological potential as a result of natural erosional processes, previous flood events and historic construction and upgrade works related to the bridge. The proposal area to the south of the bridge was assessed as containing no archaeological potential due to the topography and historic construction and upgrade works for the bridge.

*The figure showing the locations of Aboriginal heritage sites and places has been omitted from the public display version of the REF.*

**Figure 6-26 Aboriginal heritage sites and places within the proposal area**

### **6.6.3 Potential impacts**

#### **Construction**

The Aboriginal archaeological site known as 'Scouters Mountain Engadine' (AHIMS 52-2-0742) is located in the proposal area but will be avoided during construction. The exact location of the heritage site has been included in design drawings to along with a five metre exclusion zone (included as an attachment in Appendix G) to avoid any direct impacts by the proposal. Additionally, a Vibration Risk Assessment and a Ground Vibration Management Plan will be prepared to manage any indirect risk from vibration generating activities (refer to Section 6.2.5).

The proposal area covers a portion of the listed Cubbitch Barta National Estate heritage place. Natural landscapes which are tied to the cultural values of the site would be partially impacted by the proposal (through activities such as rock trimming and construction of the temporary access track). As no Aboriginal archaeological sites or areas of archaeological potential have been identified within this portion of the heritage place and the area has been subject to previous land use disturbance, the proposed works would have a minor impact on the Aboriginal heritage values identified in the heritage listing's statement of significance.

Overall, the project is not expected to impact any other known Aboriginal heritage items or areas where potential items may be present. Assessment as per the PACHCI requirements concluded that an AHIP would not be required for the proposal.

#### **Operation**

No Aboriginal heritage items or places are likely to be impacted during operation.

### **6.6.4 Safeguards and management measures**

Table 6-22 describes the proposed safeguards and management measures that would be implemented to manage the potential Aboriginal heritage impacts from the proposal. Other safeguards and management measures that would address vibration impacts to the Aboriginal archaeological site known as 'Scouters Mountain Engadine' (AHIMS 52-2-0742) are identified in Section 6.2.5.



**Table 6-22 Aboriginal heritage safeguards and management measures**

Impact	Environmental safeguards	Responsibility	Timing	Reference
Aboriginal heritage	The Aboriginal archaeological site known as 'Scouters Mountain Engadine' (AHIMS 52-2-0742) will be clearly identified on design drawings with a five metre exclusion zone. Review of the detailed design at 80% and 100% development will be carried out in consultation with the Transport for NSW Environment Manager to confirm no encroachment within the exclusion zone.	Transport for NSW	Detailed design/pre-construction	Additional
Aboriginal heritage	<p>An Aboriginal Heritage Management Plan will be prepared and incorporated into the CEMP. This plan would include but not be limited to the following:</p> <ul style="list-style-type: none"> <li>• a map identifying locations of no-go areas, items or sites which are to be protected and those which are to be impacted.</li> <li>• identification of potential environmental risks/impacts due to the works/activities</li> <li>• management measures to avoid or minimise potential impacts, including any management measures identified in the Ground Vibration Management Plan.</li> <li>• outline of the content to be included in toolbox talks regarding management of Aboriginal heritage, including identification of no-go areas, any relevant permits and any responsibilities specified under the <i>National Parks and Wildlife Act 1974</i>.</li> <li>• a stop works procedure in the event of actual or suspected potential harm to a heritage feature/place.</li> <li>• the requirement to comply with <i>RMS Standard Management Procedure -Unexpected Archaeological Finds, 2012</i>.</li> </ul>	Contractor	Detailed design/pre-construction/construction	Additional

Impact	Environmental safeguards	Responsibility	Timing	Reference
Aboriginal heritage	If Aboriginal heritage items are uncovered during the works, all works in the vicinity of the find must cease and the Transport for NSW Aboriginal cultural heritage officer and regional environment manager contacted immediately. Steps in the Roads and Maritime <i>Standard Management Procedure: Unexpected Heritage Items</i> (Roads and Maritime, 2015) must be followed.	Contractor	Construction	Section 4.9 of QA G36 <i>Environment Protection</i>

## 6.7 Non-Aboriginal heritage

A Statement of Heritage Impact (SOHI) has been prepared for the proposal. The assessment is included in Appendix H and summarised in the following sections.

### 6.7.1 Methodology

The SOHI was prepared in accordance with current heritage guidelines including *Assessing Heritage Significance*, *Assessing Significance for Historical Archaeological Sites and 'Relics'* and the *Burra Charter*, and provides an assessment of heritage items or relics that exist within or in the vicinity of the proposal area.

The SOHI methodology included:

- reviewing relevant heritage legislation and all available historical heritage registers
- carrying out a literature review including previous reports, local heritage studies, conservation management plans, as well as regional and local history documents where available
- carrying out field investigations of the study area to identify known historical heritage items, unrecorded historical heritage items and assess the potential for any unrecorded historical heritage items
- assessing the potential impacts to heritage items through statements of heritage impact
- recommending measures to avoid or mitigate any negative impacts on the heritage significance in the proposal area.

### 6.7.2 Existing environment

#### Historical context

A summary of the historical context of the study area is detailed below:

- Early exploration south of Georges River took place shortly after Europeans arrived in NSW. From 1811, Governor Hunter allocated land south of Botany Bay and Georges River. Settlement further south along the Woronora River occurred more slowly.
- Prior to 1830, early land grants in the Sutherland Shire were initially granted to encourage emancipated convicts and others into farming. In 1835, the parish of Heathcote was gazetted. Surveyors first mapped the area as they journeyed south for the original southern route from Sydney on the Illawarra Road in 1843.
- In 1879, the Lieutenant-Governor prescribed about 7000 hectares of Crown land as National Park under the *Crown Land Alienation Act of 1861*. This initial grant led to the later formation of the Royal National Park and the Heathcote National Park to the south-east of the study area.
- An 1886 plan of a feature survey of the Parish of Heathcote records some detail of the study area. Heathcote was further subdivided in 1886 in conjunction with construction of the railway in the same year.
- By 1910, Lord Kitchener, declared Holsworthy and much of the surrounding area including the proposal area to be a permanent army encampment. This was formalised in the Government Gazette in 1913.

- Major infrastructure projects were implemented in the lower Sutherland Shire and the proposal area in the early 1920s. The first of these was the Kolora Weir (known also as Kolora Weir, or Engadine Weir), positioned at the intersection of the Woronora River and Heathcote Creek, adjacent to the study area.
- Concerns during the World War II (WWII) in the early 1940s refocused the priorities of major infrastructure design. Roads and bridges were constructed to support the movement of troops and supplies if traditional routes were compromised.
- Woronora River Bridge was constructed at this time, associated with the construction of Heathcote Road in 1941. It provided an important route over the Woronora River to the Princes Highway. The bridge was a five span, two lane reinforced concrete bridge, approximately 130 metres long. The abutments were made of concrete but are faced with sandstone.
- Some modifications were made to Woronora River Bridge in 1990. These comprised new jersey kerb and rectangular steel rails, which superseded the original bridge railing system, and armco guard-railing which protected the approaches.
- The Cubbitch Barta Estate was formally gazetted in 2004. Although the Cubbitch Barta National Estate was long inhabited by Aboriginal people before European settlement, the large reserved national estate was not formally gazetted until 2004. Public access is largely restricted due to military use. The boundary of the Commonwealth listed area runs along the western edge of the northern bridge approach.

### Listed heritage items

A summary of heritage listings within, and in the vicinity of, the proposal area is presented in Table 6-23 and Figure 6-27. Heritage listings located within the proposal area are discussed in more detail below.

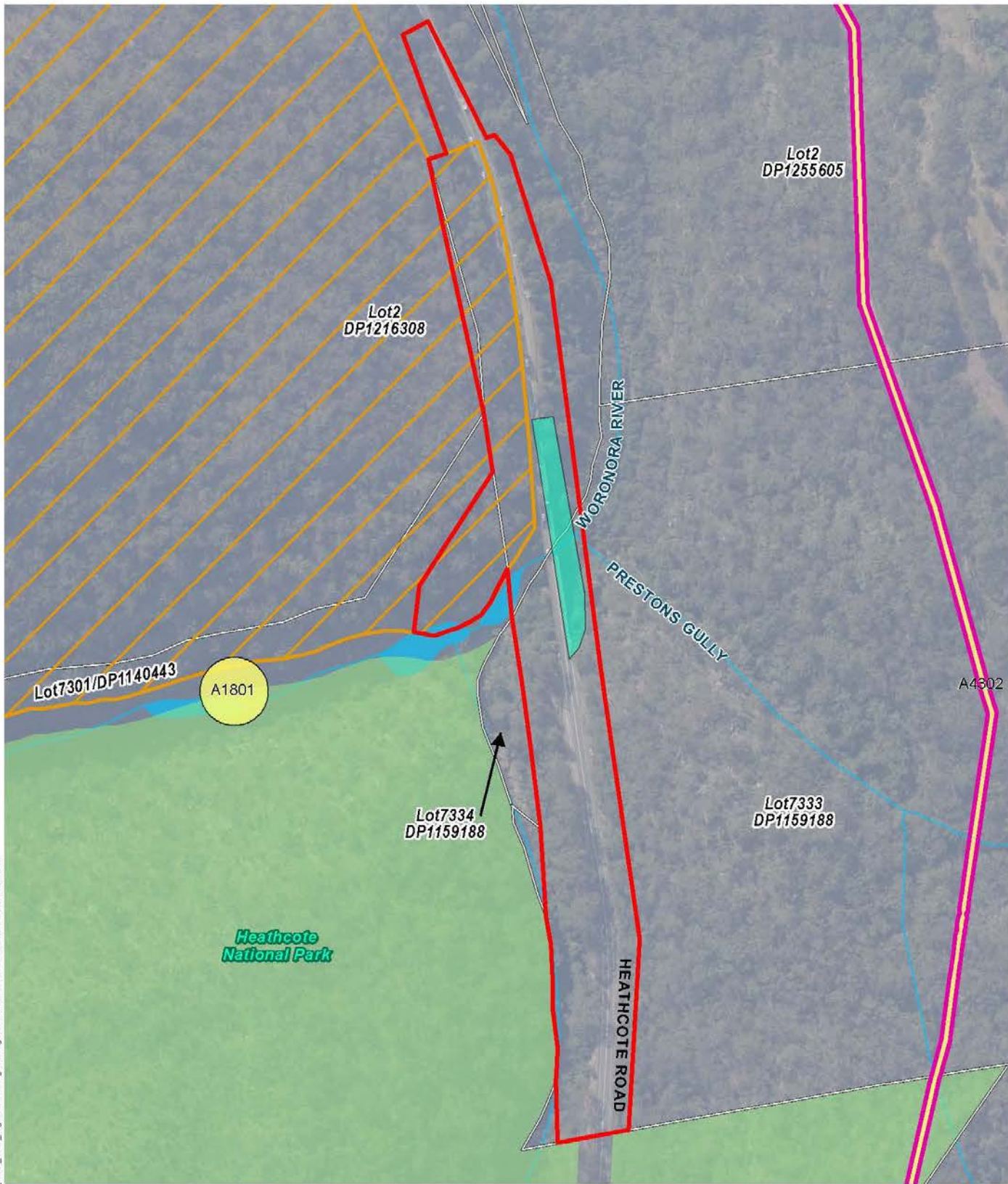


**Table 6-23 Heritage listings within and in the vicinity of the proposal area**

Heritage item (site number)	Description	Located within proposal area	Listings		Significance as designated by heritage listing
			Individual item	As a conservation area	
<b>Woronora River Bridge, RTA Bridge No. 152</b>	Five span, two lane reinforced concrete bridge. The deck is a continuous reinforced concrete structure with two longitudinal beams which curve down at the piers for increased strength. There are cross beams connecting the longitudinal beams, both in the centre and at the piers. The abutments are made of sandstone, with concrete end posts atop either side of the wall approaches.	Yes	RMS Section 170 Heritage and Conservation Register		Not designated
<b>Cubbitch Barta National Estate Area (105405)</b>	The area is an 18,000 hectare large tract of bushland within the Woronora Plateau. The bushland contains a multitude of Aboriginal sites, which reflect a substantial history of Aboriginal occupation.	Yes		Commonwealth Heritage List	Commonwealth
<b>Kolora Weir (A1801)</b>	Pump house (demolished), concrete abutments, access track, wall and concrete foundation remnants.	No  One hundred metres west of the proposal area	Sutherland Shire LEP 2015		Local

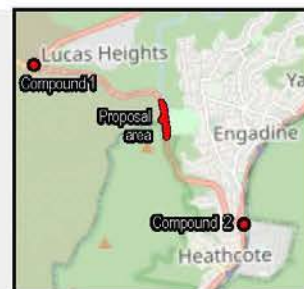
Heritage item (site number)	Description	Located within proposal area	Listings		Significance as designated by heritage listing
			Individual item	As a conservation area	
<b>Woronora-Penshurst Pipeline (A4302/4570509)</b>	The Woronora-Penshurst Pipeline was constructed in 1942 and is still in use today. The 27.1 kilometre long pipeline transports water from Woronora Dam to Penshurst reservoir and then to towns within the Sutherland Shire.	No  Two hundred metres east of the proposal area	Sutherland Shire LEP 2015  And  Sydney Water Section 170 Heritage and Conservation Register		Local
<b>Royal National Park and Garawarra State Conservation Area (3403-3421, A3422-A3448)</b>	Garawarra State Conservation Area is a protected conservation area (949 hectares) and abuts the Royal National Park. It was gazetted as a park in 1987.	No  Two kilometres south east of the proposal area	Sutherland Shire LEP 2015	National Heritage list	Local, National
<b>Royal National Park - Audley Group (3402)</b>	The Royal National Park is a protected national park (151 square kilometres). It was proclaimed a National Park in 1879.	No  Two kilometres east of the proposal area.	Sutherland Shire LEP 2015		State

Source: *Biosis*, 2020

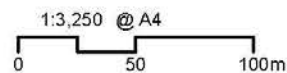


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- |  |   |
|--|---|
|  Proposal area                    |  Commonwealth heritage       |
|  National park and nature reserve | <b>Local Heritage</b>   |
|  Lot                              |  Item - Archaeological       |
|  Watercourses                     | <b>S170 Heritage</b>  |
|  Water bodies                     |  Woronora River bridge       |
|  |  Woronora-Penshurst pipeline |



Source: Aurecon, TfNSW, Spatial Services, Esri



Projection: GDA 1994 MGA Zone 56

**Heathcote Road bridge widening REF**

**FIGURE 6-27:** Heritage listings within and in the vicinity of the proposal area

### *Woronora River Bridge*

The Woronora River Bridge has historic, aesthetic and technical significance, and is an outstanding representative example of its class in NSW. The bridge has historic significance due to its strong association with strategic defence planning in World War Two in the south-eastern quarter of the wider Sydney area. The bridge also has significance because of its association with the history of transport to the Sutherland area, and with post war leisure activities in southern Sydney. The bridge is a large and impressive structure in a sandstone woodland landscape, and forms a landmark on Heathcote Road. The bridge has a high level of representative significance due to its size, as the only reinforced concrete beam bridge currently controlled by Transport for NSW and constructed in the period 1925-1948 to exceed eighty metres in length.

### *Cubbitch Barta National Estate Area*

The Cubbitch Barta National Estate Area is a large area with outstanding cultural and natural values. It is significant as a cultural and natural landscape which demonstrates relationships between the environment and human occupation through time. Its significance is emphasised by its proximity to Sydney, the Nation's largest metropolitan centre. Cubbitch Barta National Estate Area is an integral component of the Woronora Ramp area, stretching south-west from Sydney, together with Royal National Park, Heathcote National Park, the Woronora catchment and O'Hare's Creek Catchment. Major parts of the Woronora Ramp region are included in the Register of the National Estate. This region, together with the other tracts of undeveloped areas to the west and north of the metropolitan area, are essential in defining the character of the broader Sydney region. In the network of gullies which criss-cross the area, many of the natural values remain undisturbed and Aboriginal heritage is impressively retained. Over 500 Aboriginal sites provide a glimpse of the relationship between people and the land prior to 1788. The sites and the area's long-term and more recent connections with Aboriginal people, combine to form a landscape of great significance for its Aboriginal heritage. The landscape also provides important illustrations of European settlement, agriculture and Australia's military history. It is unusual to find landscapes in this region so intact.

### **Archaeological Potential**

Archaeological potential relates to the predicted level of preservation of archaeological resources within the proposal area. Archaeological potential is influenced by the geographical and topographical location, the level of development, subsequent impacts, levels of onsite fill and the factors influencing preservation such as soil type. Archaeological potential within the proposal is presented in Table 6-24.



**Table 6-24 Assessment of archaeological potential within the proposal area**

<b>Item</b>	<b>Probable feature(s)</b>	<b>Possible construction date</b>	<b>Archaeological potential</b>
<b>Heathcote Road</b>	Compacted layers of stone, gravels and soils, postholes	1941	Low
<b>Bridge over Woronora River</b>	Footings and/or foundations	1941	Low
<b>Vehicular track and bridge over Heathcote Creek</b>	Levelling deposits, road base, footing and foundations	Pre-1943	Low
<b>Bridge over Heathcote Creek</b>	Footings and foundations	Pre-1943	Low
<b>Amenities block</b>	Footings and foundations, floor surfaces, underfloor deposits, postholes, levelling deposits	1970	Low
<b>Infrastructure associated with Heathcote Road and Woronora River Bridge</b>	Culverts, retaining walls, cut and fill, sandstone materials	1941	Low
<b>Infrastructure associated with Kolara Weir</b>	Weir abutments, cut and fill, footings, construction materials	Post-1920	Low
<b>Landscape features associated with the public recreation centre</b>	Postholes, fencing, walls, footings, access tracks, recreational material	1960-1985	Low

Source: *Biosis*, 2020

Low archaeological potential means that it is unlikely that archaeological significant remains relating to this period, theme or event would occur within the proposal area.

### **6.7.3 Potential impacts**

There are two listed heritage items within the proposal area and would be subject to direct impacts from the construction of the proposal. These include:

- Woronora River Bridge, RTA Bridge No. 152
- Cubbitch Barta National Estate Area.(105405)

Other heritage items were outside the proposal area and too distant from construction works to experience any indirect impacts from vibration.

The likelihood of encountering archaeological material during construction has been assessed as low and is therefore unlikely.

The impacts to known heritage items in the proposal area are detailed below.

### *Woronora River Bridge*

The proposal would result in both direct and indirect impacts to the Woronora River Bridge, as a result of bridge widening works and repairs and maintenance. These works would include, but are not limited to, permanent frameworks and working platforms to support the bridge widening, replacement of decking, installation of drainage and maintenance work to the concrete spalling, expansion joints and bearings and the construction of headstock extensions and steel box girders to either side of the bridge and the existing concrete trestles. As there are so few, largely unmodified bridges dating between 1925-1948 remaining in NSW, the proposed works to the bridge would have an impact on its technical, aesthetic and representative values. However, as the bridge will not be demolished as part of the works, the proposed works should not significantly reduce the historical values of the item.

### *Cubbitch Barta National Estate Area*

The proposed works would also result in direct impacts to the Cubbitch Barta National Estate Area. These impacts include cutting back the rock slope face on the northern bridge approach to improve lane width, which is located within the curtilage for the Commonwealth Heritage Listed (CHL) Place. Although some of these impacts would not be reversible, they are not large enough to be classified as an adverse impact to the entirety of the Estate. On the assessment of the place's historical values, the proposed works are considered to be small scale, low intensity and localised to a small area, and the overall impact to the Estate is considered to be minor.

## **Operation**

### *Woronora River Bridge*

During operation, key features of the bridge would be obstructed and views to and from the bridge would be impacted, resulting in the diminishment of the aesthetic and representative values of the heritage item. Although public views of the bridge are currently limited, the aesthetic values of the bridge are not diminished as a result of these views and the bridge still provides a representative example of this type of bridge in NSW. While the proposed additions allow the bridge to continue to function, serve its original key transport purpose and remain in its existing landscape.

However, the detailed concept design of the bridge has attempted to reduce the direct physical impacts and indirect visual impacts to the item's heritage significance. The current detailed concept design reflects the aesthetics of the Woronora River Bridge in the new additions, while still remaining visually distinct from the original elements. This has been achieved through the use of a cantilever shape for the steel box girders which mirror the existing concrete girders, and the minimal nature of the headstock extension works. The steel would also be painted in a shade and texture that would complement the original concrete material, and it is proposed to salvage and reuse the sandstone block facing from the abutments as part of the project (design refinements related to heritage of the bridge are detailed in Section 2.5).

While there would still be impacts to the aesthetic and representativeness values, the detailed concept design has been able to mitigate these as much as possible through sympathetic designs based on heritage advice. While Woronora River Bridge would no longer be a largely unmodified bridge dating between 1925-1948 remaining in NSW, the proposed works do not diminish the item's heritage significance to the extent that the works are unacceptable from a heritage perspective or to an extent that would preclude it from the ability to be formally state heritage listed in future. Aesthetically and technically, the Woronora River Bridge remains a large and impressive structure featuring clean modern lines, curved beam profiles and octagonal piers, with its construction in rugged terrain, and at a high level above permanent water, constituting a technical achievement at a State level. Similarly, despite the aesthetic change the proposed works would bring, these key features of the item's design and construction remain, and are emphasised in the cantilevered steel box girders and echoed in the octagonal knuckle heads at the piers. The item would also remain the only Transport for NSW owned concrete bridge in NSW to exceed 80 metres in length, retaining its status as a rare example of high aesthetic and technical achievement at a State level. Similarly, the proposal does not alter the historical significance of the bridge and the role it played during WWII.

#### *Cubbitch Barta National Estate Area*

Impacts to the Cubbitch Barta National Estate including the cutting back of the rock slope would remain during operation of the new bridge. However, as noted above, these works are small in scale, not readily visible and localised to small area of the Estate, resulting in an overall minor impact.

#### **6.7.4 Safeguards and management measures**

Table 6-25 describes the proposed safeguards and management measures that would be implemented to manage the potential Non-Aboriginal heritage impacts from the proposal. Other safeguards and management measures that would address Aboriginal heritage impacts are identified in Section 6.6.4.

**Table 6-25 Non-Aboriginal heritage safeguards and management measures**

Impact	Environmental safeguards	Responsibility	Timing	Reference
Non-Aboriginal heritage - General	<p>A Non-Aboriginal Heritage Management Plan would be prepared and included in the CEMP. This plan would include but not be limited to the following:</p> <ul style="list-style-type: none"> <li>• a map identifying locations of no-go areas, items or sites (including curtilages) which are to be protected and those which are to be impacted</li> <li>• identification of potential environmental risks/impacts due to the works/activities</li> <li>• management measures to avoid or minimise potential impacts, including any management measures identified in the Ground Vibration Management Plan.</li> <li>• outline of the content to be included in toolbox talks regarding management of Non-Aboriginal heritage, including identification of no-go areas, any relevant permits and any responsibilities specified under the <i>National Parks and Wildlife Act 1974</i>.</li> <li>• a stop works procedure in the event of actual or suspected potential harm to a heritage feature/place.</li> <li>• the requirement to comply with <i>RMS Standard Management Procedure -Unexpected Archaeological Finds, 2012</i>.</li> </ul>	Contractor	Detailed design/ pre-construction/ construction	Additional
Non-Aboriginal heritage – Woronora River Bridge	Transport for NSW will continue to consult with Heritage NSW throughout the development of Heathcote Road Bridge Urban Design.	Transport for NSW	Detailed design	Additional



Impact	Environmental safeguards	Responsibility	Timing	Reference
Non-Aboriginal heritage – Woronora River Bridge	Heritage reviews will be incorporated into the design and development process. Heritage reviews will be carried out in consultation with TfNSW Environment Manager at 30%, 80% and 100% detailed design stages.	Transport for NSW/ contractor	Detailed design	Additional safeguard
Non-Aboriginal heritage – Woronora River Bridge	<p>A Conservation Management Plan (CMP) will be prepared for the Woronora River Bridge to outline how the heritage fabric of Woronora River Bridge should be managed on an ongoing basis.</p> <p>This CMP will also consider the establishment of an extended heritage precinct for Woronora River Bridge, Kolara Weir and former recreation area, and the extant remains of Heathcote Creek bridge as an area of local and State heritage significance.</p>	Transport for NSW/ contractor	Pre-construction/ operation	Additional safeguard
Non-Aboriginal heritage – Woronora River Bridge	<p>During the detailed design process the following will be considered to limit impacts to the Woronora River Bridge:</p> <ul style="list-style-type: none"> <li>• retain as much of the original fabric of Woronora River Bridge where possible.</li> <li>• use of sympathetic colour shades and textures for steel paint finishes of the box girders and headstock extensions.</li> <li>• carry out colour and material matching for repair and maintenance works.</li> <li>• an appropriately qualified structural engineer to carry out an assessment of structural integrity for each element to be removed and/or replaced prior to removal as part of repair and maintenance works. Only replace elements which are at risk of failing.</li> <li>• salvage sandstone block facing from abutments and incorporate their use into the project or potential heritage precinct.</li> <li>• use of discrete fencing with hoarding or fabric for Woronora River Bridge during works.</li> </ul>	Transport for NSW/ contractor	Detailed design/ operation	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
Non-Aboriginal heritage – Woronora River Bridge	Archival recording of the Woronora River Bridge and any associated infrastructure will be carried out prior to construction. To ensure total impacts are catalogued, an archival recording of the Woronora River Bridge is also recommended after the conclusion of works.	Contractor	Pre-construction/ operation	Additional safeguard
Non-Aboriginal heritage – Woronora River Bridge	If unexpected heritage item/s, archaeological remains or potential relics are uncovered during the works, all works would cease in the vicinity of the material/find and the <i>RMS Standard Management Procedure - Unexpected Archaeological Finds 2012</i> would be followed.	Contractor	Construction	Section 4.10 of QA G36 <i>Environment Protection</i>

## 6.8 Property and land use

### 6.8.1 Methodology

The assessment of potential property and land use impacts associated with the proposal involved:

- reviewing the property acquisition requirements for construction and operation of the proposal
- reviewing publicly available information including land zoning maps from the Sutherland Shire LEP, native title land claims, strategic plans and aerial photography to understand the land zoning and current and future land uses
- assessing the temporary and permanent public and private property and land use impacts from the proposal
- providing mitigation measures to manage the potential property and land use impacts

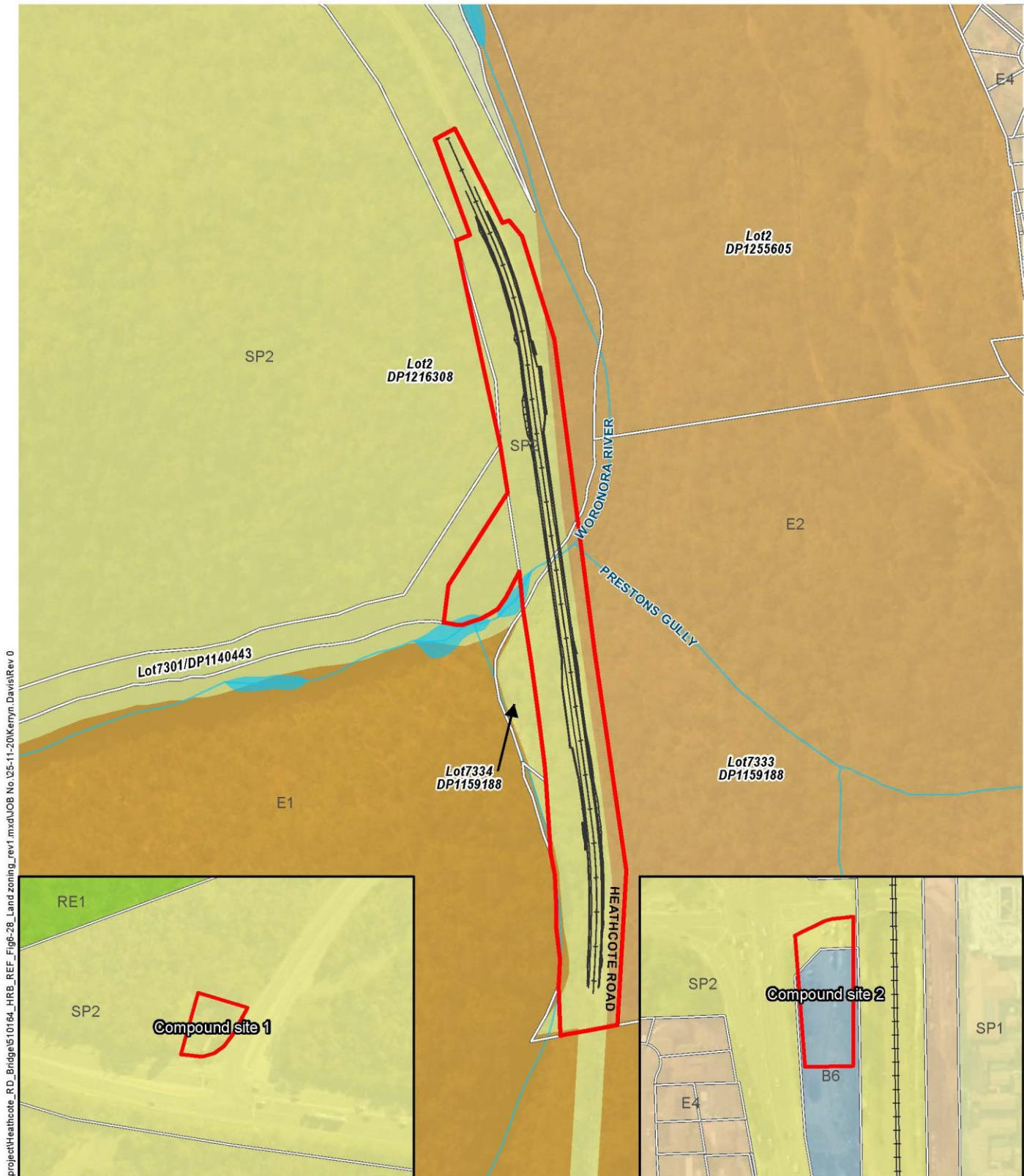
### 6.8.2 Existing environment

The proposal is located within the Sutherland Shire Council LGA. In accordance with the Sutherland Shire LEP, the construction footprint for the proposal is zoned 'SP2 Infrastructure (Classified Road)' except for the southern portion of Compound Location 2, which is zoned 'B6 Enterprise Corridor' (refer to Figure 6-28). Both of these land zonings permit the development of main roads.

The proposal area is comprised of Crown Land that is used for the existing Heathcote Road and Heathcote Road bridge as well as land owned by Transport for NSW for the Lucas Heights and Heathcote compounds, which are existing compound sites. There is no private property within the construction footprint.

Other notable land uses surrounding the proposal include (refer to Figure 1-1):

- Heathcote National Park, which is located next to the south-west portion of the construction footprint and is a protected area used for recreational activities such as bushwalking and camping
- Woronora River, which is located directly beneath Heathcote Road bridge and is a major tributary of the Georges River
- ANSTO, which is located in Lucas Heights about 1.3 kilometres north-west of the Heathcote Road bridge. It is a statutory body of the Australian government that is the centre of Australia's nuclear expertise and operates five nuclear research facilities
- Defence land associated with Holsworthy Military Barracks, which is located east of the construction footprint within Heathcote National Park, but also covers part of the northern approach to the Heathcote Road bridge
- Suez Lucas Heights Resource Recovery Park, which is accessed off New Illawarra Road in Lucas Heights, about one kilometre north-east of Compound Location 1, and includes a public drop-off area, organic resource recovery facility and the New Illawarra Landfill
- other key roads including New Illawarra Road, Princes Highway and Wilson Parade (refer to Section 6.1.2)



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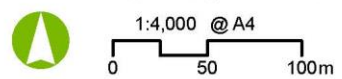


- Proposal area
- Indicative design (subject to detailed design)
- Lot
- Watercourses
- Water bodies

- Land Zoning**
- E1 National Parks and Nature Reserves
  - E2 Environmental Conservation
  - E4 Environmental Living
  - SP1 Special Activities
  - SP2 Infrastructure



Source: Aurecon, TfNSW, Spatial Services, DPIE, Esri



Projection: GDA 1994 MGA Zone 56

**Heathcote Road bridge widening REF**

**FIGURE 6-28:** Land zoning within and surrounding the proposal



The proposal is also subject to an undetermined Native Title claim (NC2017/003 – South Coast People), which covers the majority of NSW’s South Coast extending roughly from the Georges River at Holsworthy in the north to the town of Eden in the south. Transport for NSW have notified the Native Title claimant about the proposal (refer to Section 5.3).

### 6.8.3 Potential impacts

#### Construction

As outlined in Section 3.6, the proposal would require the acquisition of about 1.5 hectares of land, which would comprise partial acquisition of one Crown Land lot and one Crown Waterway from the NSW Government. Transport for NSW would lease an extra 0.4 hectares of Crown Land to provide the required space for establishment of the temporary access track, waterway crossing and crane pads under the Heathcote Road bridge during construction. No privately owned lots would be directly impacted by the proposal.

While the final land purchase requirements would be confirmed during detailed design, all land acquisition would be carried out in consultation with the relevant landowners in accordance with the requirements of the *Land Acquisition (Just Terms Compensation) Act 1991* and the supporting NSW Government Land Acquisition Reform 2016.

Transport for NSW would also need to abide by the requirements of the *Crown Lands Management Act 2016* and *Crown Land Legislation Amendment Act 2017* when seeking to acquire or lease Crown Land for construction of the proposal.

There would be temporary land use impacts during the proposed closure of a section of Heathcote Road, which would change the use of the land from an operational road to a construction site for the proposal. This land use change and loss of road access may impact visitors and staff of surrounding land uses such as Heathcote National Park, ANSTO and Suez Lucas Heights Resource Recovery Park, who may need to use longer alternate routes to access the properties. Transport for NSW has and would continue to consult with these key stakeholders to minimise impacts on surrounding land uses associated with the change in road access (refer to Section 5.5). Traffic and transport impacts are discussed in Section 6.1.3.

There would be no land use change associated with use of the Lucas Heights compound and Heathcote compound for the proposal, as they are existing compound sites that have previously been used to support road construction activities.

#### Operation

There is expected to be minimal fragmentation of properties associated with the partial acquisition of land by Transport for NSW for the proposal, as the land that is proposed to be acquired is generally located along the edge of a property boundary.

Any land use changes during operation of the proposal would be negligible, as the proposal involves the widening of road and bridge infrastructure within an existing road corridor and so its function would be unchanged. This land use is also consistent with the objectives of the land zoning.

### 6.8.4 Safeguards and management measures

Table 6-26 describes the proposed safeguards and management measures that would be implemented to manage the potential property and land use impacts from the proposal. Other safeguards and management measures that would address property and land use impacts are identified in Section 6.10.4 (Socio-economic).

**Table 6-26 Property and land use safeguards and management measures**

Impact	Environmental safeguards	Responsibility	Timing	Reference
Property acquisition	All property acquisition will be carried out in accordance with the <i>Land Acquisition Information Guide</i> (Roads and Maritime, 2012) and the <i>Land Acquisition (Just Terms Compensation) Act 1991</i> .	Transport for NSW	Pre-construction and construction	Standard safeguard
Property acquisition or lease of Crown Land	All property acquisition or leasing of Crown Land will be carried out in accordance with the <i>Crown Lands Management Act 2016</i> and <i>Crown Land Legislation Amendment Act 2017</i> .	Transport for NSW	Pre-construction	Additional safeguard

## 6.9 Landscape character and visual impacts

This section describes the landscape character and visual impacts that may occur when constructing and operating the proposal. This section summarises the *Heathcote Road Bridge Widening Urban Design Concept Report* prepared for the proposal by KI Studio and is provided in Appendix I.

### 6.9.1 Methodology

The assessment was carried out in accordance with the *Environmental Impact Assessment Practice Note - Guidelines for Landscape Character and Visual Impact Assessment (EIA-N04) Version 2.2* (TfNSW, 2020e) and urban design guideline *Beyond the Pavement* (TfNSW, 2020f).

The methodology for the landscape and visual impact assessment involved:

- identifying the visual catchment surrounding the proposal (i.e. the approximate area where it would be possible to see the proposal) by considering the surrounding topographical features, built structures and screening vegetation
- identifying and describing landscape character zones (LCZs), which identify areas of similar character within and surrounding the proposal area
- identifying representative viewpoints within the visual catchment
- determining the sensitivity of each LCZ and viewpoint to changes in the landscape, through consideration of the existing quality of the views and type of visual receivers. For example, a pristine natural environment or historic setting would be more sensitive to change than a built-up industrial area
- determining the potential magnitude of change from construction and operation of the proposal for each LCZ and viewpoint, by considering the scale, nature and duration of change
- assessing the potential impacts of the proposal for each LCZ and viewpoint, which combines the level of sensitivity and magnitude of change using a matrix (refer to Figure 6-29). The impact ratings are project specific as they are measured relative to each other rather than at an absolute scale and as such the ratings identify areas within the proposal area with the highest and lowest impacts
- recommending mitigation measures, including urban design principles, to minimise the potential landscape character and visual impacts identified

		Magnitude			
		high	moderate	low	negligible
Sensitivity	high	high impact	high-moderate	moderate	negligible
	moderate	high-moderate	moderate	moderate-low	negligible
	low	moderate	moderate-low	low	negligible
	negligible	negligible	negligible	negligible	negligible
		negligible	negligible	negligible	negligible

**Figure 6-29 Landscape character and visual impacts rating matrix**

## 6.9.2 Existing environment

### Overview of visual setting and catchment

The Heathcote Road bridge cuts across the steeply sided Woronora River valley, which features vertical sandstone cliffs, benches, overhangs and large boulders. The visual setting is one of natural beauty and scenery, featuring water, established vegetation and rocky outcrops, which is largely due to the remoteness of the proposal area and minimal human disturbance.

The visual catchment surrounding the proposal is limited due to the steep topography and dense bushland that screens potential views of the Heathcote Road bridge and its approaches. The proposal would be most noticeable along the road corridor and at the waterway near the bridge, although glimpses from various locations outside the road corridor are attainable (refer to Figure 6-30 and Figure 6-31).



**Figure 6-30** View looking towards the existing bridge showing screening effect of bushland



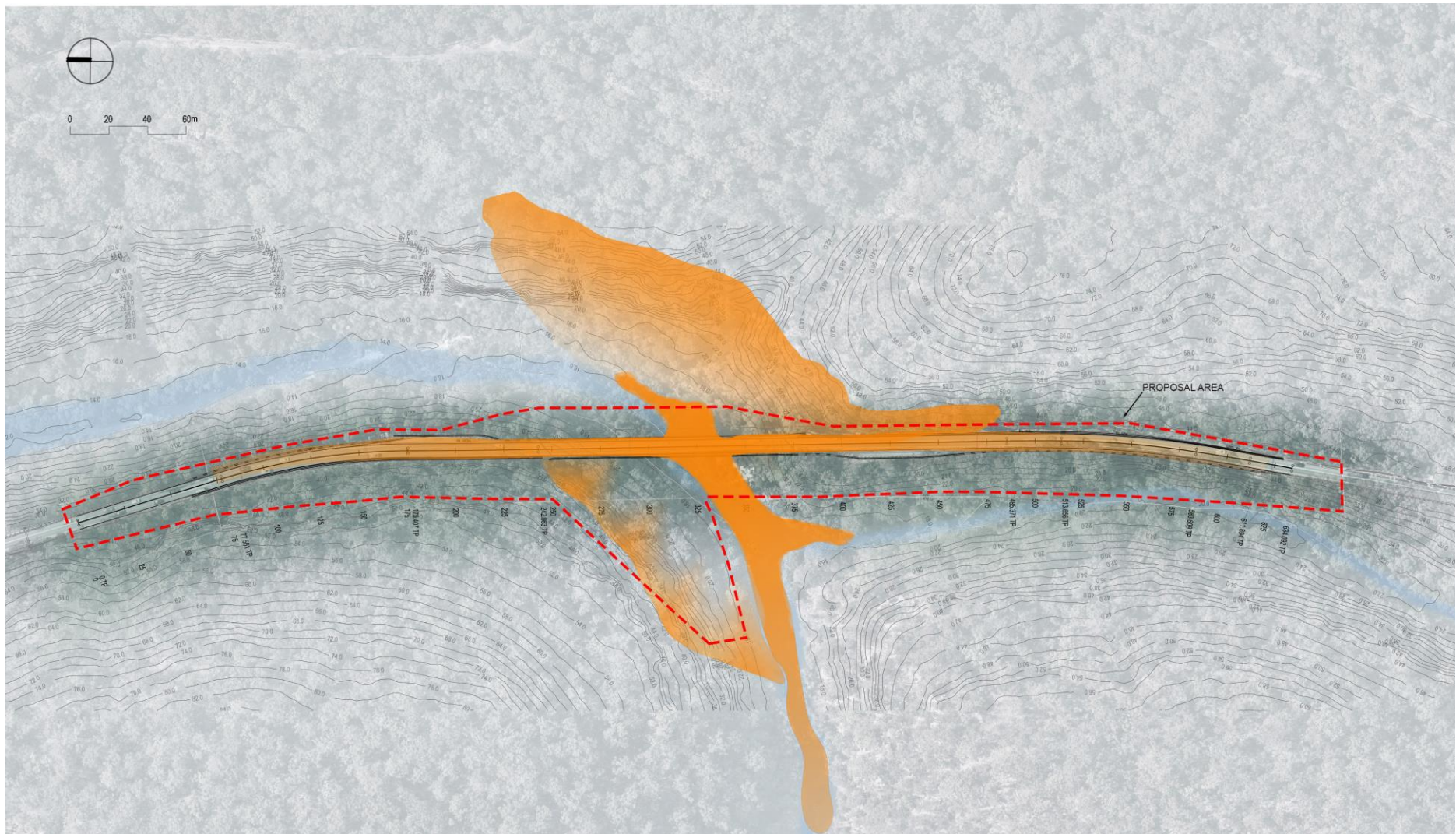


Figure 6-31 Visual catchment surrounding the proposal (shown in orange)

## Landscape character zones

Four LCZs have been identified surrounding the proposal:

- LCZ-1 Engadine Bushland
- LCZ-2 Holsworthy Military Reserve
- LCZ-3 Heathcote National Park
- LCZ-4 Heathcote Road

Table 6-27 describes the LCZs including their characteristics and sensitivity to change. Figure 6-32 shows the location of the LCZs. Although some of these LCZs have a similar visual quality, their use and access are different, which gives them different characteristics and sensitivity to change.

**Table 6-27 Summary of landscape character zones surrounding the proposal**

Zone	Zone characteristics	Sensitivity to change
LCZ-1 Engadine Bushland	Pristine bushland with a rugged topography and steep valleys that contain remnants of an abandoned historic road alignment, bridge and concrete causeway near the Woronora River.	<b>High</b> due to the relatively pristine bushland, waterways, mature endemic vegetation and scenic qualities.  This zone includes past human interventions which makes this zone slightly less sensitive compared to LCZ-2 and LCZ-3.
LCZ-2 Holsworthy Military Reserve	Dense bushland with dramatic sandstone outcrops overlooking the Woronora River within an area of Holsworthy Military Reserve, which is used as a training area for the military.	<b>High</b> due to its natural beauty and pristine environment, despite its restricted access.
LCZ-3 Heathcote National Park	Pristine dense bushland and sandstone woodland within Heathcote National Park, which includes walking tracks, picnic and camping facilities.	<b>High</b> due to its status as a National Park, which provides a recreational function for the community as well as offering habitat for wildlife, endemic vegetation and geological formations.
LCZ-4 Heathcote Road	Existing road corridor that winds along the landscape that provides highly scenic journeys for motorists with dramatic sandstone cuttings and panoramic vistas to the gully below.	<b>Moderate</b> as the roadway has a scenic quality that engages motorists with the bushland setting, on a short-term basis as motorists pass by.



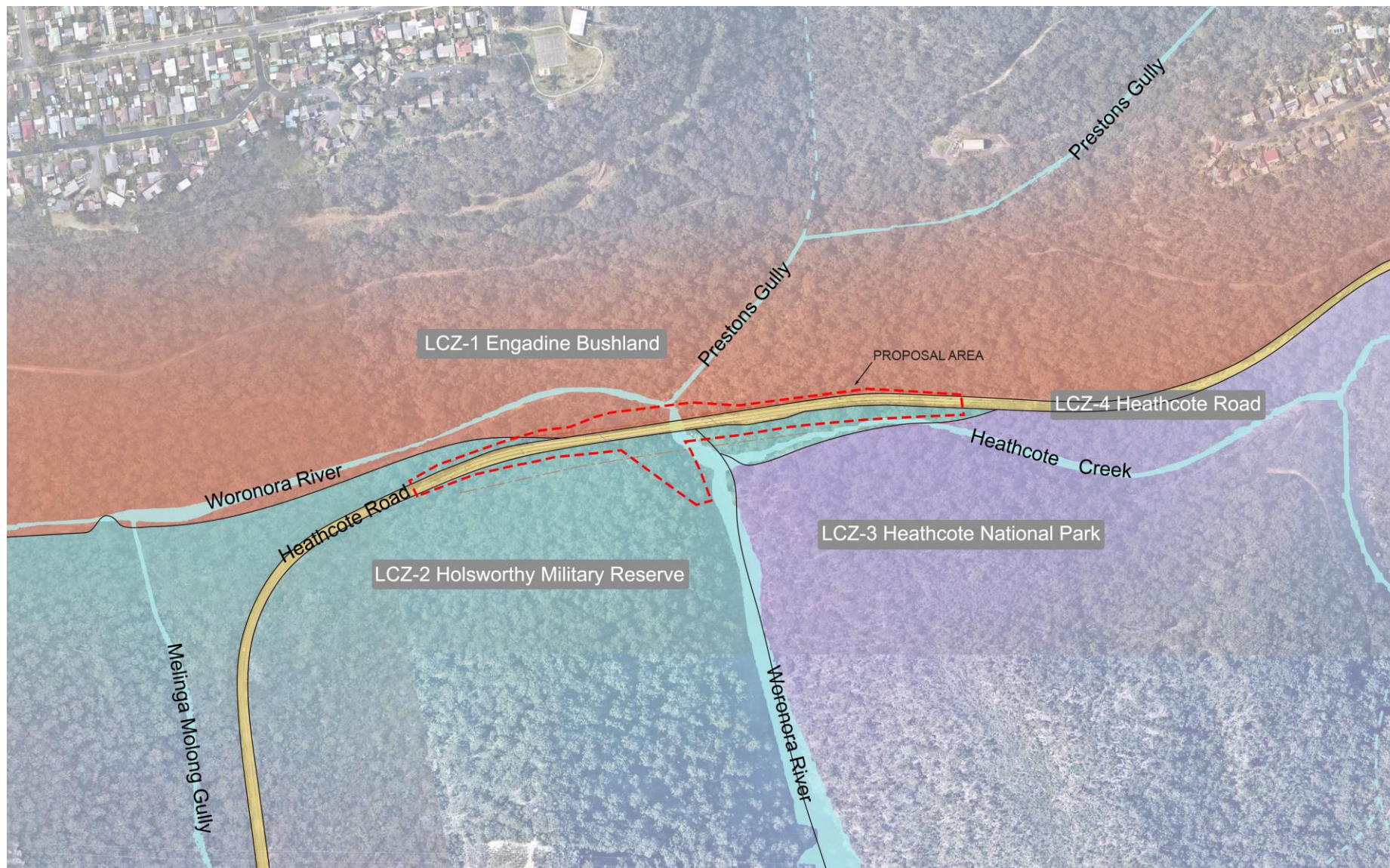


Figure 6-32 Landscape character zones surrounding the proposal

## Representative viewpoints

Table 6-28 describes the eight representative viewpoints surrounding the proposal that have been identified. Figure 6-33 shows the views from the viewpoints. Figure 6-34 shows the location of these viewpoints.

**Table 6-28 Summary of representative viewpoints for the proposal**

Viewpoint ID	Description	Sensitivity to change
V01	View of existing sandstone cutting along the northern approach of the bridge, travelling north. The cutting exposes the geology of the area and contributes to the identity of the motorway.	<b>Moderate</b> as the road is of high scenic quality, however the transient nature of the viewer reduces the sensitivity.
V02	View of the northern approach to the bridge travelling south, which is a highly scenic setting with dense bushland within a rugged terrain.	<b>Moderate</b> as the road is of high scenic quality, however the transient nature of the viewer reduces the sensitivity
V03	View of the Heathcote Road bridge looking south with open panoramic vistas towards the adjacent bushland, deep gully and exposed sandstone cliffs.	<b>High</b> as the bridge crossing provides elevated panoramic views to the adjacent landscape and is a key visual marker along the journey, despite its transient nature.
V04	View of the southern approach looking south towards a dramatic sandstone cutting.	<b>Moderate</b> as the road is of high scenic quality, however the transient nature of the viewer reduces the sensitivity
V05	View of river foreshore in a pristine bushland setting with wetland grasses, rock selves and sand banks. The bridge is clearly visible as a dominant feature.	<b>Moderate</b> as the scenic quality is reduced by the proximity of the bridge structure.
V06	View from under the bridge looking towards the northern abutment of the bridge with the bushland setting and riverscape in the foreground.	<b>Low</b> as the dominance of the bridge structure reduces the quality of the view as well as the transient nature of the viewer.
V07	View of the river foreshore looking towards the bridge overhead.	<b>Moderate</b> due to the scenic quality of the setting despite the bridge still being a dominant feature.
V08	View of the riverscape with rock shelves, dense bushland and the bridge in the mid-ground.	<b>High</b> due to the highly scenic setting and limited dominance of the bridge.





**Viewpoint 1**



**Viewpoint 2**



**Viewpoint 3**



**Viewpoint 4**



**Viewpoint 5**



**Viewpoint 6**



**Viewpoint 7**



**Viewpoint 8**

**Figure 6-33 Photos of the views from the representative viewpoints**



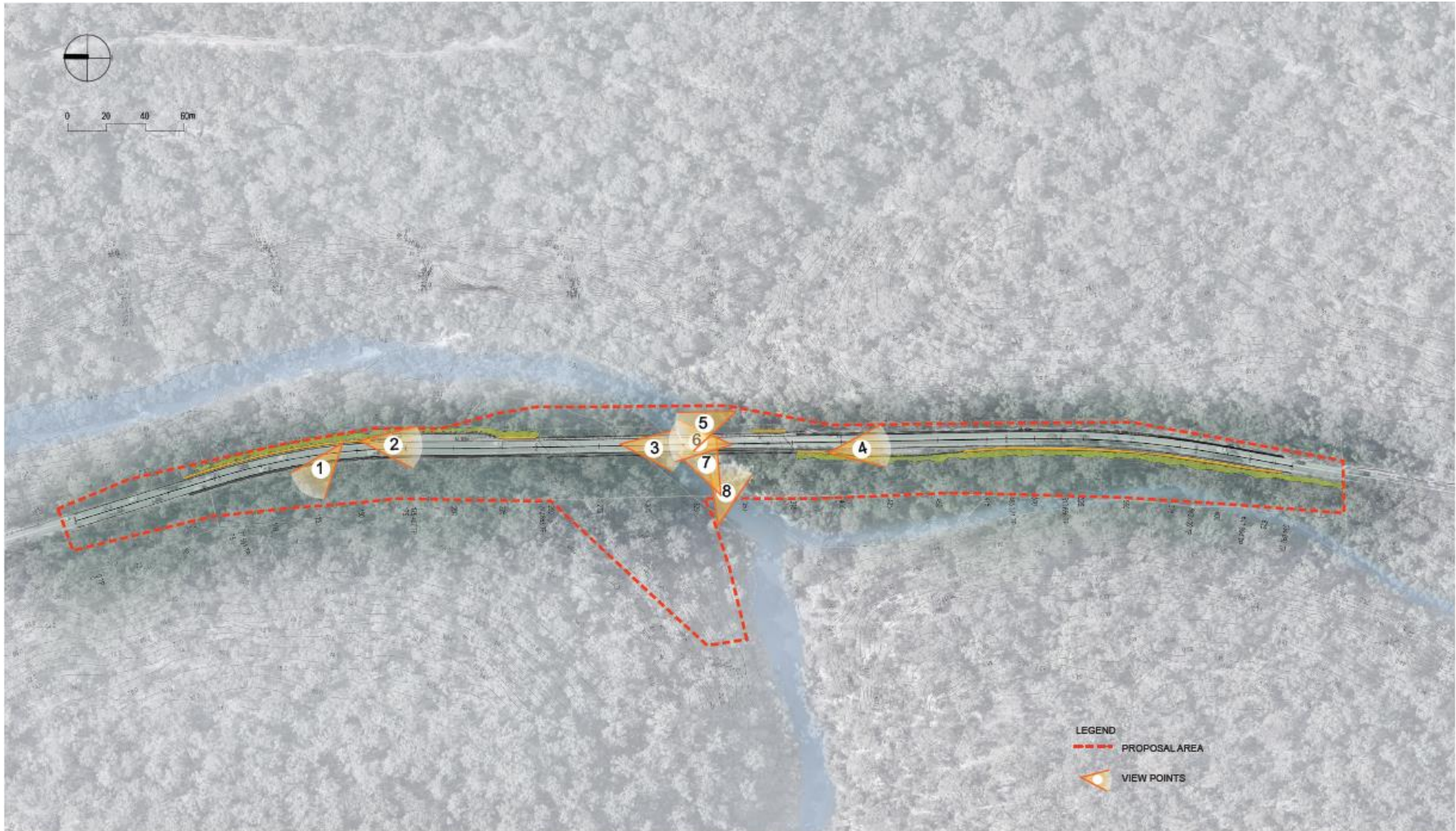


Figure 6-34 Location of representative viewpoints surrounding the proposal

### 6.9.3 Potential impacts

#### Construction

Construction of the proposal has the potential to result in temporary landscape character and visual impacts from the introduction of construction equipment, work platforms, temporary access track and crane pads within the proposal area as well as the removal of vegetation.

#### *Landscape character impacts*

Table 6-29 provides an assessment of potential impacts to each LCZ from construction of the proposal.

LCZ-1 and LCZ-4 would experience the highest visual impacts due to their proximity to the construction footprint. Impacts in these zones would be temporary.

**Table 6-29 Landscape character impacts during construction of the proposal**

Zone	Description of change	Sensitivity	Magnitude	Impact rating
LCZ-1 Engadine Bushland	Removal of vegetation and introduction of a temporary access track and hardstand laydown areas near the waterway for construction activities.	High	High	High
LCZ-2 Holsworthy Military Reserve	Some construction equipment and activities may be visible, however only minor portions of this zone would be impacted.	High	Low	Moderate
LCZ-3 Heathcote National Park	This zone would not be impacted and its sense of place and natural integrity would be retained.	High	Negligible	Negligible
LCZ-4 Heathcote Road	The road would become a construction site with laydown areas, plant and equipment contrasting with the desired character of the area. However, there would be limited access to Heathcote Road during construction.	Moderate	High	Moderate to high

#### *Visual impacts*

Although construction of the proposal would occur within an environment with high sensitivity and introduce new temporary elements into the landscape, the construction activities would have limited visibility (as the majority of construction activities would be completed during a full road closure) and only glimpses of the proposal area are attainable outside the road corridor (refer to Section 6.9.2). As such, given the limited visual receivers, visual impacts from construction of the proposal are considered to be negligible.

## Operation

### *Landscape character impacts*

Table 6-29 provides an assessment of potential impacts to each landscape character zone during operation of the proposal.

**Table 6-30 Landscape character impacts during construction of the proposal**

Zone	Description of change	Sensitivity	Magnitude	Impact rating
LCZ-1 Engadine Bushland	The removal of vegetation would have some impact to the scenic qualities of setting due to the visual change although the identity and sense of place of this zone would largely be retained.	High	Moderate	Moderate to high
LCZ-2 Holsworthy Military Reserve	This area is set back from the road corridor and would be barely impacted. The general setting and scenery of the area would be retained.	High	Negligible	Negligible
LCZ-3 Heathcote National Park	The general sense of place and identity of the national park would not be impacted. The scenic qualities, integrity and recreational values would not be compromised.	High	Negligible	Negligible
LCZ-4 Heathcote Road	Although the scenic quality of the journey would not change, the driver's experience would be enhanced. The wider roadway would make the bridge crossing much safer and enjoyable for travellers.  At the approaches to the bridge, rock bolts and netting would be visible on the rock cuttings, which would detract from the natural setting.	Moderate	Moderate	Moderate

### *Visual impacts*

The visual impact assessment has focused on key aspects of the proposal visible from various locations. These include rock cuttings, road vistas, the approach to the bridge, panoramic vistas from the waterway towards the bridge and views from under and nearby the structure.

Table 6-31 provides an assessment of potential visual impacts from operation of the proposal at the representative viewpoints.



**Table 6-31 Visual impacts during operation of the proposal**

<b>Viewpoint ID</b>	<b>Description of change</b>	<b>Sensitivity</b>	<b>Magnitude</b>	<b>Impact rating</b>
V01	Exposed rock cuttings and new verge treatment. Potentially minor sections of shotcrete, rock bolts, rock netting and removed vegetation visible. The visual impact would be reduced once the sandstone cutting face weathers.	Moderate	Moderate	Moderate adverse impact
V02	Widened road with shoulder and paved breakdown bay and minor changes to verge treatments would be visible, which contribute to the road being more dominant within the setting. Sections of shotcrete, rock bolts, rock netting and removed vegetation visible.	Moderate	High	Moderate to high adverse impact
V03	Widened bridge with new barriers would be visible, which would make the structure more visually dominant. The enhanced sense of safety would contribute to a better visual experience.	High	Moderate	Moderate to high impact, however the adverse nature of the impact would be lessened by the enhanced sense of safety
V04	View of the sandstone cutting south of the bridge and minor sections of shotcrete, rock bolts, rock netting and removed vegetation would be visible. The visual impact would be reduced once the sandstone cutting face weathers.	Moderate	Moderate	Moderate adverse impact

Viewpoint ID	Description of change	Sensitivity	Magnitude	Impact rating
V05	The widened bridge deck and headstock expansion would be clearly visible, including the new girders. The widened northern abutment wall may also be partially visible. The bridge structure would generally remain similar to the existing form and character (refer to Figure 6-35). The visual impact would be reduced once the riverscape vegetation recovers.	Moderate	Low	Low to moderate adverse impact
V06	The widened bridge deck and headstock expansion would be clearly visible, including the tendons and new girders. This bridge structure would have a more prominent visual dominance. Loss of vegetation would be noticeable and would expose the historic rock cutting in the background.	Low	High	Moderate adverse impact
V07	The widened bridge deck and headstock expansion would be clearly visible, including new girders. This would make the bridge structure slightly more visually dominant however the visual contrast is considered low. Loss of vegetation would be noticeable however the visual impact would be reduced once the foreshore vegetation recovers.	Moderate	Low	Low to moderate adverse impact
V08	The headstock expansion and new girders would be seen in elevation. However, the visual contrast and magnitude of change is considered minor. Loss of vegetation would be noticeable however the visual impact would be reduced once the foreshore vegetation recovers.	High	Low	Moderate adverse impact



**Figure 6-35 Indicative photo montage of the widened bridge deck**

#### 6.9.4 Safeguards and management measures

Table 6-32 describes the proposed safeguards and management measures that would be implemented to manage the potential landscape character and visual impacts from the proposal.

**Table 6-32 Landscape character and visual safeguards and management measures**

Impact	Environmental safeguards	Responsibility	Timing	Reference
Landscape character and visual impact	<p>The landscape and urban design strategy for the proposal will be reviewed during detailed design in consideration of the design principles and objectives as described in the <i>Heathcote Road Bridge Urban Design Concept</i> report prepared for the REF. An Urban Design Plan will be prepared to support the detailed design and will implemented as part of the CEMP. The preparation of the Urban Design plan must involve as a minimum:</p> <ul style="list-style-type: none"> <li>• investigating opportunities to re-use sandstone features</li> <li>• integrating recommendations for fauna habitat and connectivity features and developing standard design drawings in consultation with the Transport for NSW biodiversity officer</li> <li>• refining scour protection designs</li> <li>• reviewing slope stabilisation works at 20, 80 and 100% detailed design in consultation with Transport for NSW Urban Design team to achieve a balance of safety and good design outcomes</li> <li>• investigating opportunities for incorporating WSUD features such as swales and considering their location, size and treatment so that they blend into the landform and landscape character</li> <li>• outlining the location and identification of existing vegetation and proposed landscaped areas, including species to be used</li> <li>• considering design treatments for built elements including retaining walls and bridges, shotcrete and other slope stabilisation measures and fixtures such as fencing and signs</li> <li>• refining staging of landscape work taking account of related environmental controls such as erosion and sedimentation controls and drainage</li> </ul>	Transport for NSW	Detailed design	Standard safeguard



Impact	Environmental safeguards	Responsibility	Timing	Reference
	<ul style="list-style-type: none"> <li>outlining procedures for monitoring and maintaining landscaped or rehabilitated areas.</li> </ul>			
Landscape character and visual impact	<p>The Urban Design Plan will be prepared in accordance with relevant guidelines, including:</p> <ul style="list-style-type: none"> <li>Beyond the Pavement urban design policy, process and principles (TfNSW, 2020f)</li> <li>Landscape Guideline (RTA, 2008)</li> <li>Bridge Aesthetics (TfNSW, 2019)</li> <li>Shotcrete Design Guideline (Roads and Maritime, 2016).</li> </ul>	Transport for NSW	Detailed design	Standard safeguard

## **6.10 Socio-economic**

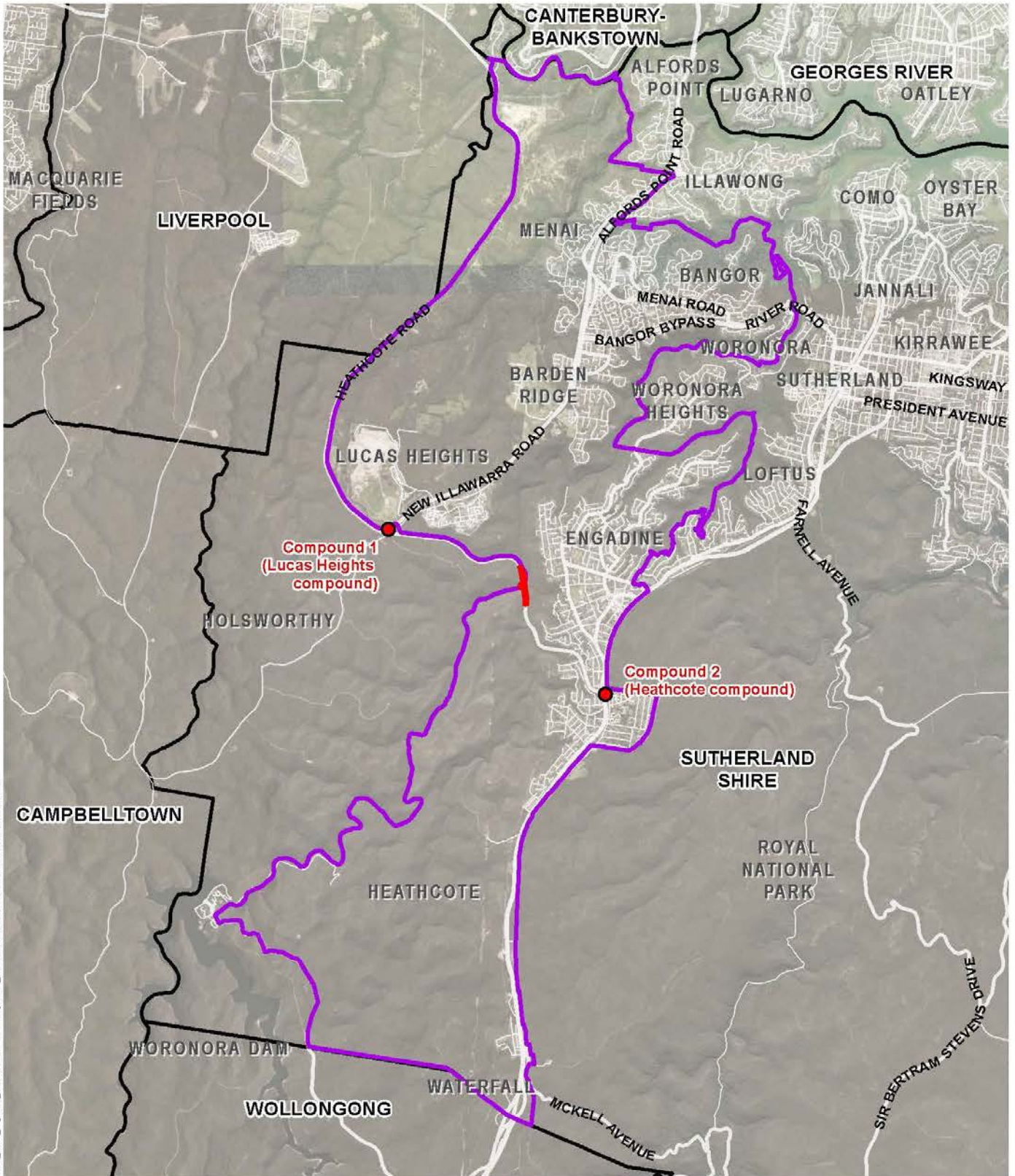
### **6.10.1 Methodology**

The methodology for the socio-economic assessment involved:

- description of the existing socio-economic environment of the socio-economic study area to establish the baseline, including:
  - analysis of key population and demographic indicators, including data from the Census of Population and Housing (Australian Bureau of Statistics (ABS), 2016).
  - analysis of data and information on local business and industry, employment and dwelling characteristics.
  - review of existing social infrastructure and community features near to the proposal, including recreation uses, educational facilities, places of worship, public transport and walking and cycling facilities.
- identification and assessment of the potential socio-economic impacts of the proposal's construction and operation on local amenity, social infrastructure and access.
- measures to manage or mitigate potential impacts on the socio-economic environment and maximise potential benefits of the proposal.

### **Socio-economic study area**

The proposal is located within the Sutherland Shire LGA, in southern Sydney. The socio-economic study area for this assessment is comprised of the ABS Statistical Area Level 2 (SA2) of Heathcote – Waterfall, Menai – Lucas Heights – Woronora and Engadine. These three areas intersect the proposal area and are shown in Figure 6-36 below.

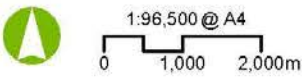


P:\GIS\Project-4\project\Heathcote\_RD\_Bridge\010164\_HRB\_REF\_Fig6-35\_Socio-economic study area\_rev2.mxd\JCB No15-11-20\Carman.BrazzRev 0

- Socio-economic study area
- Proposal area
- Local Government Area



Source: Aurecon, TfNSW, Spatial Services, ABS, Esri



Projection: GDA 1994 MGA Zone 56

Heathcote Road bridge widening REF

FIGURE 6-36: Socio-economic study area

### 6.10.2 Existing environment

In 2016, the socio-economic study area had a population of 44,627 people, which accounted for 20.4 per cent of Sutherland Shire's total population (ABS, 2016). A summary of the study area and Sutherland Shire LGA is provided below.

#### Population and demography

- In the socio-economic study area, the proportion of the population aged 14 years or younger was 21 per cent, which was slightly higher than the Sutherland Shire LGA at 19.1 per cent. The elderly population in the study area and Sutherland Shire LGA was lower, with 15.3 per cent of residents over the age of 65 in the study area, and 16.9 per cent of residents aged over 65 in the Sutherland Shire LGA.
- People who require help or assistance with self-care, mobility and communication, because of a long-term health condition, disability or old age (Core Activity Need for Assistance<sup>3</sup>), was slightly higher in the Sutherland Shire LGA than the socio-economic study area. Four per cent of the study area's population and 4.3 per cent of the Sutherland Shire LGA had a need for assistance. The lower proportion of people with a need for assistance may be attributed to the range of facilities available and/or lower proportion of elderly people living within the socio-economic study.
- 14.7 per cent of people in the socio-economic study area were born overseas, which was less than the overseas born population of the Sutherland Shire LGA, at 18.1 per cent. The lower proportion of people born overseas may reflect less cultural diversity within the socio-economic study area.

#### Housing and movement

- In 2016, the socio-economic study area comprised 18.5 per cent of the total private dwellings in the Sutherland Shire LGA.
- The socio-economic study area had 69.9 per cent of people with the same address as five years ago in 2016. This is substantially higher than the Sutherland Shire LGA with 62.3 per cent of people having the same address five years ago in 2016. This may represent a strong connection to place, with people residing in the study area for longer periods of time.
- The proportion of households with no vehicles in the socio-economic study area was less than households in the Sutherland Shire LGA. 3.4 per cent of households in the study area and 5.7 per cent of households in the Sutherland Shire LGA did not have vehicles. This may be reflective of public transport availability in the Sutherland Shire LGA and the reliance people in the study area have on private vehicles for travel.
- Average motor vehicles per dwelling within the study area ranged between 1.9 to 2.2 vehicles. The average motor vehicles per dwelling in the Sutherland Shire LGA was 1.9. The higher average number of vehicles per dwelling in parts of the study area may be attributed to the location of dwellings in relation to alternative transport options.

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<sup>3 3</sup> Core activity need for assistance, ABS 2016 Census Dictionary, ABS (2016). Accessed from: <https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/2901.0Chapter27102016>



- Travel to work data indicated that travel to work by car (single method) was the preferred mode of travel for people in the socio-economic study area and the Sutherland LGA. The second preferred method of travel in the study area and the Sutherland Shire LGA was travel to work by train. The Sutherland Shire LGA is serviced by the T4 Eastern Suburbs & Illawarra Line, which connects to the Sydney CBD and the NSW South Coast. It is likely that people in the Sutherland Shire LGA commute using the train based on the range of train stations located throughout the LGA.

### Social infrastructure

The proposal is located within a densely vegetated corridor, about 380 metres away from the residential boundary of Engadine. The socio-economic study area is made up of suburbs within the Sutherland Shire LGA which have educational, cultural and community facilities, town shopping centres and local shops, recreational and sporting facilities and places of worship. Table 6-33 provides an overview of social infrastructure located within 500 metres of the proposal. It is likely that people within the socio-economic study area would use Heathcote Road to access social infrastructure facilities within the study area and Sutherland LGA. More information about potential impacts to social infrastructure in the study area is provided in Section 6.10.3.

**Table 6-33 Social infrastructure near the proposal area**

Social infrastructure	Description
<b>Heathcote National Park, Heathcote</b>	The proposal is situated next to Heathcote National Park and near Royal National Park. These areas are used for active and passive recreation including walking, cycling and camping.
<b>Engadine Rural Fire Brigade, Engadine</b>	The Engadine Rural Fire Brigade is located about 430 metres east of the proposal area.
<b>Ferntree Reserve, Engadine</b>	Ferntree Reserve in Engadine is located about 440 metres east of the proposal area.
<b>Walking tracks in Engadine</b>	There are a range of informal walking tracks to the east of the proposal area, between Heathcote Road and the residential boundary of Engadine.

### Businesses, industry and tourism

Within the socio-economic study area, the top industries of employment are healthcare and social assistance and education and training. There are also high proportions of people working in construction and retail trade. This is similar to the Sutherland Shire LGA, with the top industries of employment made up of healthcare and social assistance, education and training, and construction. The high proportion of people working in healthcare and social assistance may be reflective of the proximity of the study area to Sutherland Hospital. Similarly, there are a range of education facilities located throughout the Sutherland Shire LGA where people within the study area may work, including primary, secondary and tertiary facilities (such as ANSTO, TAFE NSW – Gymea and University of Wollongong Southern Sydney, Loftus).

Desktop investigations indicate that there are no businesses located within 500 metres of the socio-economic study area. However, businesses are likely to use Heathcote Road for access and connectivity to surrounding areas. As stated in Section 2.2.1, Heathcote Road forms a primary connection between Sydney's north and south. This means that general traffic and freight operators would use Heathcote Road for connections between Sydney and the NSW South Coast.

Heathcote Road is also used by people travelling to Sydney's South Coast during holiday periods, connecting to the Princes Highway. The Royal National Park would be used by tourists and visitors.

The Holsworthy Military Barracks is located to the west of the proposal. This area is used by the Australian Defence Force to train and house members of the Australian Military.

ANSTO is located to the north-west of the proposal, which currently employs about 1200 staff with another 200 people from related businesses located on the site and hosts about 6500 research visits and 17,000 Australian and international visitors each year, on average. ANSTO is also planned to expand into a research and innovation precinct, which could create up to 3730 additional jobs (Sutherland Shire Council, 2020). Many of the staff and visitors, as well as material and equipment deliveries (including nuclear medicine) would use Heathcote Road to travel to and from this precinct.

### **Transport and access**

Heathcote Road is a two-lane road (one lane in each direction) that connects between Newbridge Road in the north and the Princes Highway in the south. The M5 Motorway and New Illawarra Road connect to Heathcote Road and provide access to other areas of Sydney. Heathcote Road does not provide direct access to residential areas within the socio-economic study area, but does provide connections to other arterial roads which facilitate access to residential areas.

Pedestrians are not permitted on Heathcote Road along most sections of the corridor, including between New Illawarra Road, Lucas Heights and the Princes Highway. Cyclists are permitted on Heathcote Road; however its use is deterred by safety concerns associated with the lack of safe shoulders, narrow lane widths and high traffic volumes including heavy vehicle use

Public transport within the socio-economic study area includes bus and train services. There are a range of local and school buses that service the local communities within the study area. Public bus services do not stop or travel along Heathcote Road in the vicinity of the bridge.

### **Community values**

The *Sutherland Shire Council Community Strategic Plan (CSP)* provides a ten year planning framework for the Sutherland Shire LGA. The CSP was developed based on community consultation and review of other local and State strategic planning documents (Sutherland Shire Council, 2017). Information relating to community values provided in the CSP is summarised below:

- The natural environment is valued by the community, particularly the access to beaches and national park areas.
- The community values their sense of community, identifying the Sutherland Shire as 'a place of locals'.
- The location of the Sutherland Shire in relation to distance from the city is important to the community.
- The quality of life and lifestyle (peace and quiet perception) associated with living in the Sutherland Shire is enjoyed by the community.
- Safety is identified as a high priority in the CSP, including safety in the design of spaces for recreation, transport and living areas.

### 6.10.3 Potential impacts

#### Construction

##### *Social infrastructure*

During construction, the proposal area would be restricted to the proposal area described in Chapter 3 (Description of the proposal). The proposal area is located next to the Heathcote National Park to the west and informal walking tracks in Engadine to the east. Construction activities may have minor indirect impact to the amenity of the areas surrounding the proposal, through increased noise and visual impacts.

Emergency services use Heathcote Road for access to areas within the socio-economic study area. These services may be impacted during closures of Heathcote Road during construction. Consultation with emergency services would be required in advance of any partial or full road closures to ensure alternative emergency routes or services within the study area are available to respond to emergencies.

Both proposed compound sites have been used previously as construction compounds. Compound Location 1 is located in Lucas Heights, surrounded by dense vegetation to the north and west, and bound by Heathcote Road to the south and New Illawarra Road to the east. There is a recreational BMX facility located about 150 metres north of the proposed compound site. The BMX facility would be screened from the compound site by vegetation. Noise generated at the compound is unlikely to impact users of the facility.

Compound Location 2 is located between the Princes Highway to the west and the rail corridor to the east, Wilson Parade is located to the north of the site. Sensitive receivers in proximity to the site, include the residential area to the west, McDonald's restaurant to the north and an aged care facility to the east (John Paul Village). A noise impact assessment indicated there may be some construction noise impacts associated with compound setup and operation which can be adequately managed with the implementation of proposed mitigation measures. It additionally noted that the existing environment is a high noise environment dominated by noise from both the Princes Highway and adjacent rail corridor.

##### *Business, industry and tourism*

Construction activities would mainly be limited to the bridge and its approaches on Heathcote Road and would have minimal direct impacts on local businesses and industry.

The proposal would indirectly impact businesses and that use Heathcote Road for travel. This includes freight operators and commuters that require north/south connectivity in the socio-economic study area.

Construction activities would mainly be limited to the bridge and its approaches on Heathcote Road and would have minimal direct impacts on local businesses and industry.

The proposal would indirectly impact businesses and that use Heathcote Road for travel. This includes freight operators and commuters that require north/south connectivity in the socio-economic study area.

Construction of the proposal is not expected to impact the operation of the Holsworthy Barracks due to the majority of training and procedures occurring closer to the centre of the facility away from public areas.

Depending on the timing of construction road closures, road closures may be required to overlap with holiday periods (subject to Traffic Management Centre approval). This may impact road users travelling to Sydney's South Coast during holiday periods. The communications strategy would include traffic alerts and an electronic signage strategy to inform road users of any planned road closures. Additionally, detailed design would include investigation into potential alternative construction methodologies to maximise night closures while traffic numbers are lower.

### ***Transport and access***

The proposal would restrict access for traffic travelling along Heathcote Road, during periods of full road closures. The provision of an alternative detour route would result in increased travel times and potential congestion on surrounding State roads. Increased travel times and congestion may lead to increased frustration for local road users as the proposed alternative route would be about 20 kilometres longer than the existing route via Heathcote Road.

There would be access restrictions for cyclists on Heathcote Road during construction. This impact is expected to be minor due to the very low levels of cyclist activity on Heathcote Road.

### ***Community values***

The community may experience feelings of severance during full road closures on Heathcote Road during construction. As stated in the *Environmental impact assessment practice note: socio-economic assessment (EIA-N05) Version 1.1*, community severance refers to reduced access and disruption of local networks caused by a physical barrier running through a community (TfNSW, 2020h). The closure would be up to six months in duration and would not run directly through the community of Engadine.

During construction amenity impacts would occur in the form of noise impacts. As discussed in Section 6.10.2, the community values the peaceful and quiet lifestyle of the Sutherland Shire, as well as the natural environment. Construction activities would generate noise due to the operation of plant and equipment, which may impact the amenity of local residents. However, most surrounding receivers would be largely shielded from construction noise due to vegetation and the difference in elevation to the main works area, which would reduce the construction noise levels experienced.

The noise assessment predicts that road traffic noise levels along Heathcote Road would reduce during construction due to the full road closure. In addition, surrounding receivers (nearest receiver located 390 metres to the east) are likely to be shielded from the construction noise due to the vegetation buffer and difference in elevation to the main works area.

Traffic detours and construction haulage routes would use state roads. As such construction is not anticipated to impact the amenity of the surrounding local road network. During periods of partial road closures, visual impacts for passing receivers would be experienced. Community concerns associated with general earthworks and the associated vegetation removal may also occur.

## **Operation**

### ***Social infrastructure***

Social infrastructure (walking tracks) in proximity to the site would not be impacted by operation of the proposal.

### ***Business and industry***

The proposal would improve network reliability along Heathcote Road. This would have an indirect positive impact on people using the road for access, including commuters travelling to work and freight operators travelling north and south through Sydney.

### ***Transport and access***

The proposal would have a positive impact on people travelling on Heathcote Road through improved road safety and network reliability from widening the bridge and approaches.



## Community values

The removal of vegetation required for the proposal would result in an adverse impact to community values. Around 3.12 hectares of vegetation would be removed for the proposal. This would result in reduced visual amenity for the local community and road users. Once operational, the proposal would improve safety on Heathcote Road. This would benefit all road users and the community who value safety within the Sutherland Shire LGA. The proposal would also improve network reliability which would benefit people living and travelling through the study area.

### 6.10.4 Safeguards and management measures

Table 6-34 describes the proposed safeguards and management measures that would be implemented to manage the potential socio-economic impacts from the proposal.

Environmental safeguards and management measures relating to traffic and transport and noise and vibration are outlined in Sections 6.1 and 6.2, respectively.

**Table 6-34 Environmental safeguards and management measures for socio-economic impacts**

Impact	Environmental safeguards	Responsibility	Timing	Reference
Socio-economic impact	<p>A Communication Plan (CP) will be prepared and implemented as part of the CEMP to help provide timely and accurate information to the community and key stakeholders during construction. The CP will include (as a minimum):</p> <ul style="list-style-type: none"> <li>mechanisms to provide details and timing of proposed activities to affected residents, including changed traffic and access conditions, including proposed detour routes</li> <li>contact name and number for complaints.</li> </ul> <p>The CP will be prepared in accordance with the <i>Community Involvement and Communications Resource Manual</i> (RTA, 2008).</p>	Contractor	Detailed design/pre-construction	Standard safeguard

## 6.11 Other impacts

### 6.11.1 Existing environment and potential impacts

Environmental factor	Existing environment	Potential impacts
Waste and resources	<p>The existing operation of Heathcote Road bridge generates small quantities of waste including roadside litter and excess materials from maintenance activities.</p> <p>The nearest waste disposal locations to the construction footprint are:</p> <ul style="list-style-type: none"> <li>• Suez Lucas Heights Resource Recovery Park, which is accessed off New Illawarra Road in Lucas Heights, about one kilometre north-east of Compound Location 1</li> <li>• VISY Recycling Material Recovery Facility, which is located in Taren Point about 12 kilometres north-east of Compound Location 2</li> </ul>	<p>Section 3.3 describes the resources that would be needed to build the proposal. These resources are common materials and their use would not result in any resource supply shortages in the region.</p> <p>Waste generated during construction would likely include:</p> <ul style="list-style-type: none"> <li>• excess building material (e.g. concrete, asphalt, steel) or excavated natural material</li> <li>• packing materials (pallets, crates, plastics)</li> <li>• food waste and general site waste and litter</li> <li>• general wastewater from facilities, vehicle wash down and dust suppression</li> <li>• wastewater from bridge hydro demolition, bridge washing activities, piling, grouting, geotechnical investigations, and rock drilling activities. This wastewater may potentially be alkaline and contain residual chemicals (oils, lubricants, waste fuels, batteries)</li> <li>• green waste (trees and other vegetation)</li> </ul> <p>The waste generated would either be recycled or disposed offsite in accordance with its relevant waste classification.</p> <p>Any impact associated with waste and resource use during operation of the proposal would be negligible and largely consistent with the existing operation of the road and bridge.</p>

Environmental factor	Existing environment	Potential impacts
Air quality	<p>The nearest location to the proposal where long-term ambient air quality is monitored is Liverpool, which is representative of south-west Sydney. The air quality at this location between September 2019 and September 2020 was assessed as (DPIE, 2020):</p> <ul style="list-style-type: none"> <li>• 'good' to 'very good' about 69 per cent of the time</li> <li>• 'fair' to 'poor' about 22 per cent of the time</li> <li>• 'very poor' to 'hazardous' about 9 per cent of the time.</li> </ul> <p>Likely contributions to poor air quality in the region are from road traffic emissions, particularly during idling of traffic in localised congestion, as well as natural effects such as bushfires. The substantial effect of bushfires on air quality is evident as all but one of the days with very poor to hazardous air quality readings were during the bushfire season between October 2019 and February 2020.</p>	<p>Temporary impacts on air quality may occur during construction, including:</p> <ul style="list-style-type: none"> <li>• generation of dust from earthworks</li> <li>• gaseous emissions from the operation of construction plant, equipment and vehicles</li> <li>• gaseous emissions from additional vehicles and congestion on the proposed detour route</li> </ul> <p>However, these impacts would be minor and localised and unlikely to be noticeable at surrounding receivers given the large distance from the construction footprint to sensitive receivers and the substantial existing traffic that use the roads that would comprise the detour route.</p> <p>During operation, the proposal is not anticipated to generate measurable changes in air quality.</p>

Environmental factor	Existing environment	Potential impacts
Greenhouse gases and climate change	<p>Climate change is caused by increases in greenhouse gas concentrations in the atmosphere, including those that have been emitted due to human activities, and is associated with several effects including the increased severity and frequency of extreme weather events.</p> <p>Transport emissions are currently the second largest component of the greenhouse gas emissions in NSW, comprising 21 per cent of total emissions. Road transport accounts for 85 per cent of these transport emissions (Adapt NSW, 2017). Vehicle idling and localised congestion generally increases the quantity of greenhouse gases emitted compared to when vehicles travel under free-flow conditions.</p>	<p>The proposal would result in minor greenhouse gas emissions through use of materials (including the embodied emissions in the production of materials) as well as use of construction equipment and vehicles and longer vehicle trips during use of the detour route. However, given the small scale of the proposal and the duration of the proposed detour route (up to six months), these emissions would have a negligible contribution to NSW's emissions. Opportunities to minimise emissions related to construction of the proposal would be further investigated during detailed design, including optimising the construction schedule to reduce the duration of full road closures, sourcing materials from local suppliers and using recycled and low embodied energy materials, where practical.</p> <p>The potential impacts of climate change on the proposal, such as the increased potential for localised flooding, would be considered during detailed design of the proposal.</p> <p>During operation, the proposal would improve network reliability, although any associated reductions in greenhouse gas emissions from vehicles travelling along the section of Heathcote Road are expected to be negligible.</p>
Utilities	Existing utilities within the construction footprint including optical fibre conduits and electrical infrastructure have been identified and located as part of the concept design (refer to Section 3.5).	The strategy for the protection or relocation of existing utilities within the construction footprint would be carried out in consultation with the relevant utility owner during detailed design to minimise the risk of damaging utilities, which may cause network outages or safety hazards. Access to utilities along Heathcote Road would be maintained for utility providers during construction (refer to Section 6.1.4).



Environmental factor	Existing environment	Potential impacts
<p>Hazards and risk management</p>	<p>The existing Heathcote Road bridge and its approaches are surrounded by steep cliffs and have narrow lane and shoulder widths that do not meet current safety standards and increase the potential for road incidents.</p> <p>The proposal is also located within Category 1 bushfire prone land, which is considered high risk for bushfire due to its location surrounded by mature vegetation.</p>	<p>Construction of the proposal would be associated with some hazards and risks including use of small quantities of potentially hazardous chemicals and materials such as anti-carbonation coating and fuels. The handling and storage of these chemicals and materials would be managed through implementation of standard safeguards and management measures to minimise the potential for spills and leaks (refer to Section 6.11.2).</p> <p>Construction activities that may have potential to increase bushfire risk during construction include mulch stockpiling, hot works such as welding, as well as fuel/chemical storage and plant operation within densely vegetated areas (i.e. exhaust fires).</p> <p>The A6 section of Heathcote Road is proposed to be closed for up to an estimated six months duration. Full road closure is required for certain activities due to the limited space available, to avoid potential safety hazards associated with working next to live traffic and rock fall risks. Access would be maintained for emergency vehicles and implementation of the proposed road closure and detour route would be carried out in consultation with the Transport Management Centre and Emergency Services (refer to Section 6.1.4) to minimise potential risks associated with reduced access during a bushfire event.</p> <p>The risks associated with handling of hazardous chemicals and materials and potential bushfire risk and events during construction would be managed in accordance with a Hazard Risk and Management Plan (refer to Section 6.11.2). The Hazard and Risk Management Plan would also include an Emergency Preparedness Plan to outline required measures to prepare for and respond to emergency situations.</p> <p>During operation, the increased lane and shoulder widths would improve road safety on the bridge and approaches to minimise the risk of road incidents. The proposal would not involve storage of hazardous chemicals or materials or increase bushfire risk during operation.</p>

### 6.11.2 Safeguards and management measures

Table 6-35 describes the proposed safeguards and management measures that would be implemented to manage the potential other impacts from the proposal identified in the section above.

**Table 6-35 Other impacts safeguards and management measures**

Impact	Environmental safeguards	Responsibility	Timing	Reference
Resource use	<p>The following resource management hierarchy principles would be followed:</p> <ul style="list-style-type: none"> <li>• avoid unnecessary resource consumption as a priority</li> <li>• avoidance would be followed by resource recovery (including reuse of materials, reprocessing, and recycling and energy recovery) disposal would be undertaken as a last resort (in accordance with the <i>Waste Avoidance and Resource Recovery Act, 2001</i>).</li> </ul>	Contractor	Detailed design/pre-construction	<i>G36 Environment Protection</i>
Resource use and waste	<p>A Resource and Waste Management Plan (RWMP) would be prepared, which would include the following (as a minimum):</p> <ul style="list-style-type: none"> <li>• the type, classification and volume of all materials to be generated and used on site including identification of recyclable and non-recyclable waste in accordance with <i>EPA Waste Classification Guidelines 2014</i></li> <li>• quantity and classification of excavated material generated as a result of the proposal</li> <li>• interface strategies for cut and fill on site to ensure re-use where possible</li> <li>• strategies to ‘avoid’, ‘reduce’, ‘reuse’ and ‘recycle’ materials</li> <li>• classification and disposal strategies for each type of material</li> <li>• destinations for each resource/waste type either for on-site reuse or recycling, offsite reuse or recycling, or disposal at a licensed waste facility</li> </ul>	Contractor	Detailed design/pre-construction	Section 4.2 of QA <i>G36 Environment Protection</i>

Impact	Environmental safeguards	Responsibility	Timing	Reference
	<ul style="list-style-type: none"> <li>• details of how material would be stored and treated on-site</li> <li>• identification of available recycling facilities on and off site</li> <li>• identification of suitable methods and routes to transport waste, including wastewater</li> <li>• procedures and disposal arrangements for unsuitable excavated material or contaminated material site clean-up for each construction stage</li> </ul>			
Waste	All waste would be managed in accordance with the <i>Protection of the Environment Operations Act 1997</i> .	Contractor	Detailed design/pre-construction	Additional safeguard
Waste	Types of waste collected, amounts, date/time and details of disposal are to be recorded in a waste register.	Contractor	Detailed design/pre-construction	Additional safeguard
Air quality	<p>An Air Quality Management Plan (AQMP) will be prepared and implemented as part of the CEMP. The AQMP will include, but not be limited to:</p> <ul style="list-style-type: none"> <li>• potential sources of air pollution</li> <li>• air quality management objectives consistent with any relevant published EPA and/or EES/DPIE guidelines</li> <li>• mitigation and suppression measures to be implemented</li> <li>• methods to manage work during strong winds or other adverse weather conditions</li> <li>• a progressive rehabilitation strategy for exposed surfaces.</li> </ul>	Contractor	Detailed design/pre-construction	Section 4.4 of QA G36 <i>Environment Protection</i>

Impact	Environmental safeguards	Responsibility	Timing	Reference
Climate change effects	The potential impacts of climate change on the proposal, such as the increased potential for localised flooding and need for resilience against more severe and frequent extreme weather events, will be considered during detailed design.	Transport for NSW	Detailed design	Additional safeguard
Greenhouse gas emissions from material use and transport	Ways to reduce construction material requirements, source materials from local suppliers, re-use materials on-site and choose recycled materials or materials with low-embodied energies will be investigated during detailed design.	Transport for NSW / Contractor	Detailed design/ construction	Additional safeguard
Greenhouse gas emissions from equipment and vehicle use	Minimise equipment and vehicle idling and switch off when not in use to minimise unnecessary emissions and fuel consumption.	Constructor	Construction	Additional safeguard
Utilities	<p>Prior to the commencement of work:</p> <ul style="list-style-type: none"> <li>the location of existing utilities and relocation details will be confirmed following consultation with the affected utility owners</li> <li>If the scope or location of proposed utility relocation work falls outside of the assessed proposal scope and footprint, further assessment will be carried out.</li> </ul>	Contractor	Detailed design/pre-construction	Standard safeguard



Impact	Environmental safeguards	Responsibility	Timing	Reference
Hazards and risks	<p>A Hazard and Risk Management Plan (HRMP) will be prepared and implemented as part of the CEMP. The HRMP will include, but not be limited to:</p> <ul style="list-style-type: none"> <li>• details of hazards and risks associated with the activity</li> <li>• measures to be implemented during construction to minimise these risks including (but not limited to): <ul style="list-style-type: none"> <li>○ weather restrictions for ‘hot works’ activities such as welding</li> <li>○ handling and storage procedures for potentially hazardous chemicals and materials</li> <li>○ measures to manage bushfire risk such as limitations on mulch stockpiling</li> <li>○ procedures and adequate resources to prepare for and instantly respond to a spot fire</li> </ul> </li> <li>• record keeping arrangements, including information on the materials present on the site, material safety data sheets, and personnel trained and authorised to use such materials</li> <li>• a monitoring program to assess performance in managing the identified risks</li> <li>• an Emergency Preparedness Plan that outlines contingency measures to be implemented in the event of unexpected hazards or risks arising, including emergency situations</li> <li>• procedures to routinely review and update the plan</li> </ul> <p>The HRMP will be prepared in accordance with relevant guidelines and standards, including relevant Safe Work Australia Codes of Practice, and EPA or DPIE publications.</p>	Contractor	Detailed design/pre-construction	Additional safeguard

## 6.12 Cumulative impacts

### 6.12.1 Study area

The study area for this assessment of cumulative impacts was defined by considering other projects within the Sutherland Shire LGA that would have the potential to contribute to cumulative impacts with the proposal, when considering their location, scale and timing. As such, this assessment includes regional projects of similar scale and excludes local residential developments or minor road works for local council roads. It also focuses on projects that would be built at a similar time to this proposal, which is expected to start construction in late 2021, subject to approvals, funding and weather.

A search of the following databases was completed to identify any projects which may result in a cumulative impact with the proposal:

- Department of Planning, Industry and Environment – Major Project Register
- Sydney South Joint Regional Planning Panel
- Sutherland Shire Council Development Application Register.

In addition, nearby projects that have been planned or recently completed by Transport for NSW have been considered.

### 6.12.2 Broader program of work

The strategic phase and concept design of the proposal has been funded by Transport for NSW’s “Gateway to the South Pinch Point program”, which aims to ease congestion and improve journey reliability on Sydney’s key southern corridors, as the Heathcote Road bridge was identified as a key pinch point along the A6 road corridor.

The proposal complements other nearby pinch point projects that have been delivered by Transport for NSW under this program, including the Heathcote Road intersection improvements project that involved upgrades to the intersections of Heathcote Road with Princes Highway at Engadine New Illawarra Road at Lucas Heights (refer to Figure 6-37) as well as the proposed upgrade to three intersections with Linden Street in Sutherland.

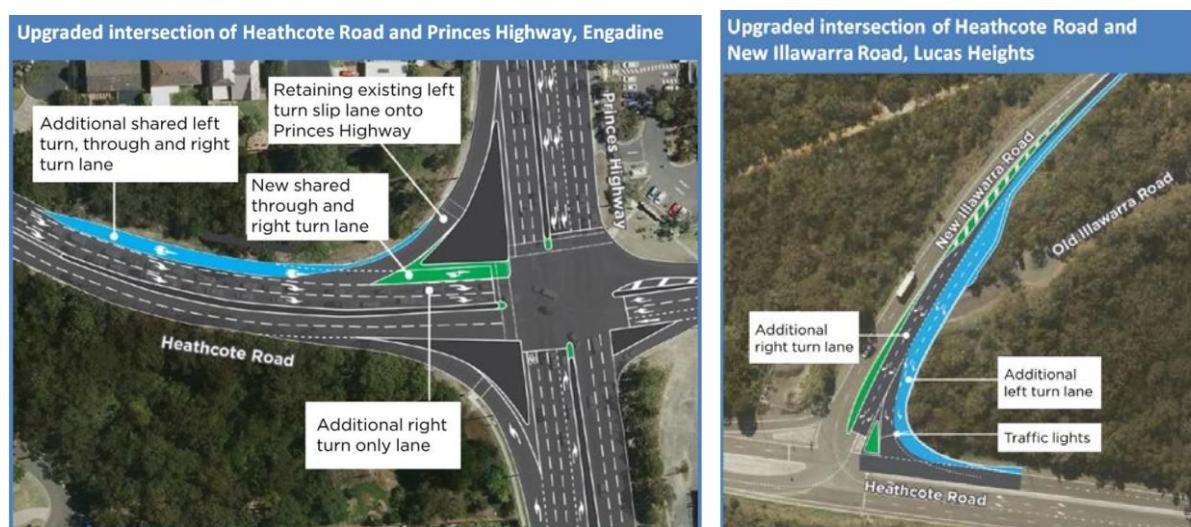


Figure 6-37 Heathcote Road intersection improvements

### 6.12.3 Other projects and developments

Table 6-36: Past, present and future projects

Project	Construction impacts	Operational impacts
<p><b>Heathcote Road intersection improvements project:</b></p> <ul style="list-style-type: none"> <li>involved upgrades to the intersections with Heathcote Road at the Princes Highway and New Illawarra Road near Compound Locations 1 and 2 for the proposal</li> <li>delivered by Transport for NSW as part of the Gateway to the South Pinch Point program</li> <li>construction was completed in 2019</li> </ul>	<p>Not relevant as construction has been completed.</p>	<p>Operational impacts of the project may include:</p> <ul style="list-style-type: none"> <li>reduced delays at the Princes Highway intersection by provision of increased queuing capacity and a right-turn only lane</li> <li>improved traffic flow along Heathcote Road</li> </ul>
<p><b>Heathcote Road upgrade:</b></p> <ul style="list-style-type: none"> <li>involves upgrade to a two-kilometre long section of Heathcote Road at Holsworthy about 10 kilometres north of the Heathcote Road bridge</li> <li>proposed by Transport for NSW</li> <li>currently in the detailed design stage with the construction dates yet to be confirmed</li> </ul>	<p>Construction impacts of the project may include:</p> <ul style="list-style-type: none"> <li>increased noise during construction for local residents</li> <li>potential traffic impacts and lane closures along Heathcote Road during construction</li> <li>clearing of vegetation including threatened ecological communities</li> </ul>	<p>Operational impacts of the project may include:</p> <ul style="list-style-type: none"> <li>reduced congestion, increased road capacity, improved reliability and improved road safety along a section of Heathcote Road</li> <li>potential impacts to the visual form and heritage significance of Holsworthy pedestrian bridge</li> <li>minor increased road noise during operation</li> <li>potential impacts on flooding along Heathcote Road</li> </ul>

Project	Construction impacts	Operational impacts
<p><b>Upgrading Linden Street, Sutherland:</b></p> <ul style="list-style-type: none"> <li>involves upgrades at three intersections with Linden Street including the River Road, Leonay Street and Grand Parade intersections</li> <li>located along the detour route proposed to be used during the full road closure of Heathcote Road for construction of the proposal</li> <li>proposed by Transport for NSW as part of the Gateway to the South Pinch Points program</li> <li>construction is expected to start in mid to late 2021 and take up to 24 months to complete</li> </ul>	<p>Construction impacts of the project may include:</p> <ul style="list-style-type: none"> <li>removal of planted native and exotic vegetation including mature trees, which would have a moderate visual impact</li> <li>construction traffic and partial lane closures within the proposal area, which may result in traffic delays</li> <li>construction noise during day and out-of-hours construction work that may exceed the adopted criteria for nearby residents</li> </ul>	<p>Operational impacts of the project may include:</p> <ul style="list-style-type: none"> <li>improved road safety, travel times and reduced traffic congestion along the Linden Street corridor</li> <li>changes to traffic movements at the Grand Parade/Linden Street intersection, which may slightly increase travel times</li> <li>increased traffic noise on Oakwood Street and Tamar Street due to increased traffic volumes</li> </ul>
<p><b>New residential flat building at 5 Prestons Avenue, Engadine:</b></p> <ul style="list-style-type: none"> <li>located about 1.5 kilometres south-east of the Heathcote Road bridge near the Princes Highway</li> <li>involves demolition and excavation of existing tavern carpark and construction of a residential flat development containing 60 units above a shared basement carpark with 150 spaces</li> <li>development application approved by Sydney South Planning Panel on 15 July 2020</li> </ul>	<p>Construction impacts of the project may include:</p> <ul style="list-style-type: none"> <li>noise and vibration impacts from construction activities</li> <li>minor additional heavy vehicle activity on the local road network including along the Princes Highway.</li> </ul>	<p>Operational impacts of the project may include:</p> <ul style="list-style-type: none"> <li>minor traffic generation from the additional residences and conversion of Geebung Lane to a one-way road</li> <li>visual impacts from the residential flat development</li> </ul>



Project	Construction impacts	Operational impacts
<p><b>Refurbishment Heathcote Hall and construction of 35 townhouses and 20 apartments:</b></p> <ul style="list-style-type: none"> <li>located at 1-21 Dillwynnia Grove, Heathcote about 800 metres south of Compound Location 2</li> <li>development application approved by Sydney South Planning Panel on 13 December 2019</li> </ul>	<p>Construction impacts of the project may include:</p> <ul style="list-style-type: none"> <li>noise and vibration impacts from construction activities</li> <li>minor additional heavy vehicle activity on the local road network including along Wilson Parade.</li> </ul>	<p>Operational impacts of the project may include:</p> <ul style="list-style-type: none"> <li>minor traffic generation from the additional residences on the local road network</li> <li>landscape character and visual impacts from the additional buildings</li> </ul>

#### 6.12.4 Potential impacts

Environmental factor	Construction	Operation
<p><b>Traffic</b></p>	<p>All nearby construction projects would generate additional construction traffic, including increased heavy vehicle activity on the surrounding road network. This is likely to affect main roads in the area including the Princes Highway, New Illawarra Road, Heathcote Road and Wilson Parade.</p> <p>In particular, there is potential for substantial cumulative traffic impacts if the lane closures for the upgrade of Linden Street occur at the same time as the full closure of Heathcote Road because the Linden Street corridor is part of the proposed detour route. To minimise this potential cumulative impact, Transport for NSW would coordinate with the project team for the Linden Street upgrade and the Transport Management Centre with regard to the proposed timing of the road and lane closures and identify alternate routes or additional safeguards and management measures, as required. This may include investigating works that can be completed during night shift road closures rather than continuous day/night closures where possible, to alleviate impacts during the day when traffic volumes are greater.</p> <p>The full closure of Heathcote Road may also impact the proposed haulage routes for the construction of other nearby projects and may increase the travel time to and from the construction sites.</p>	<p>The proposal would create cumulative benefits to the traffic flow, reliability and road safety along Heathcote Road and other key roads in Southern Sydney with the Heathcote Road intersection improvements project, Heathcote Road upgrade and Upgrading Linden Street project.</p>
<p><b>Noise</b></p>	<p>Construction of the proposal at the same time as other nearby projects would potentially lead to a short-term cumulative increase in construction noise levels (including construction traffic noise) experienced by sensitive receivers or result in construction fatigue.</p>	<p>Any cumulative noise impacts during operation are expected to be negligible.</p>

Environmental factor	Construction	Operation
<b>Other factors</b>	<p>Other minor cumulative construction impacts that may occur include:</p> <ul style="list-style-type: none"> <li>• clearance of native vegetation for the projects, which may have a minor cumulative impact on the biodiversity in the region</li> </ul>	<p>Other minor cumulative construction impacts that may occur include:</p> <ul style="list-style-type: none"> <li>• permanent minor changes to the form of the Heathcote Road corridor, which would be visible to motorists</li> <li>• minor cumulative changes to the flooding patterns along the Heathcote Road corridor</li> </ul>

### 6.12.5 Safeguards and management measures

It may not be possible to directly safeguard or manage impacts from other projects to minimise cumulative impacts. However, there would be an opportunity for Transport for NSW to work with the other developers to modify the proposal's detailed design, construction methodology and timing to consider the above cumulative effects. Table 6-37 lists the safeguards and management measures that would be implemented to account for the potential cumulative impacts.

**Table 6-37 Cumulative impact safeguards and management measures**

Impact	Environmental safeguards	Responsibility	Timing	Reference
Cumulative construction impacts	<p>Other developers will be consulted in accordance with the Community Stakeholder and Engagement Plan to:</p> <ul style="list-style-type: none"> <li>• obtain information about project timeframes and impacts</li> <li>• manage the interfaces of the proposal's staging and programming in combination with the other projects occurring in the area</li> <li>• identify and implement appropriate safeguards and management measures to minimise cumulative impacts</li> </ul>	Transport for NSW and Contractor	Pre-construction and construction	Additional safeguard
Cumulative traffic impacts	Transport for NSW will coordinate with the project team for the Linden Street upgrade and the Transport Management Centre with regard to the proposed timing of the road and lane closures and identify alternate routes or additional safeguards and management measures, as required.	Transport for NSW and Contractor	Pre-construction and construction	Additional safeguard
Cumulative construction impacts	The CEMP would consider potential cumulative construction impacts from known surrounding development activities (i.e. the Heathcote Road upgrade, Upgrading Linden Street, New residential flat building at 5 Prestons Avenue Engadine and Refurbishment of Heathcote Hall) as well as new planned development activities near the proposal, as they become known. This would include a process to regularly review and update mitigation measures as new works are identified that may lead to cumulative impacts or if complaints are received due to cumulative impacts.	Transport for NSW and Contractor	Pre-construction and construction	Additional safeguard



## 7 Environmental management

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This chapter describes how the proposal will be managed to reduce potential environmental impacts throughout detailed design, construction and operation. A framework for managing the potential impacts is provided. A summary of site-specific environmental safeguards is provided and the licence and/or approval requirements required prior to construction are also listed.

### 7.1 Environmental management plans (or system)

A number of safeguards and management measures have been identified in the REF in order to minimise adverse environmental impacts, including social impacts, which could potentially arise as a result of the proposal. Should the proposal proceed, these safeguards and management measures would be incorporated into the detailed design and applied during the construction and operation of the proposal.

A Construction Environmental Management Plan (CEMP) will be prepared to describe the safeguards and management measures identified. The CEMP will provide a framework for establishing how these measures will be implemented and who would be responsible for their implementation.

The CEMP will be prepared prior to construction of the proposal and must be reviewed and certified by the Transport for NSW Environment Officer prior to the commencement of any on-site work. The CEMP will be a working document, subject to ongoing change and updated as necessary to respond to specific requirements. The CEMP would be developed in accordance with the specifications set out in the QA Specification G36 – *Environmental Protection (Management System)*, QA Specification G38 – *Soil and Water Management (Soil and Water Plan)*, QA Specification G39 *Soil and Water Management (Erosion and Sediment Control Plan)*, QA Specification G40 – *Clearing and Grubbing* and QA Specification G10 – *Traffic Management*.

## 7.2 Summary of safeguards and management measures

Environmental safeguards and management measures outlined in this REF will be incorporated into the detailed design phase of the proposal and during construction and operation of the proposal, should it proceed. These safeguards and management measures will minimise any potential adverse impacts arising from the proposed work on the surrounding environment. The safeguards and management measures are summarised in Table 7-1.

**Table 7-1 Summary of safeguards and management measures**

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
GEN1	General - minimise environmental impacts during construction	<p>A CEMP will be prepared and submitted for review and endorsement of the Transport for NSW Environment Manager prior to commencement of the activity.</p> <p>As a minimum, the CEMP will address the following:</p> <ul style="list-style-type: none"> <li>any requirements associated with statutory approvals</li> <li>details of how the project will implement the identified safeguards outlined in the REF</li> <li>issue-specific environmental management plans</li> <li>roles and responsibilities</li> <li>communication requirements</li> <li>induction and training requirements</li> <li>procedures for monitoring and evaluating environmental performance, and for corrective action</li> <li>reporting requirements and record-keeping</li> <li>procedures for emergency and incident management</li> <li>procedures for audit and review.</li> </ul> <p>The endorsed CEMP will be implemented during the undertaking of the activity.</p>	Contractor/ Transport for NSW project manager	Pre-construction/ detailed design	Core standard safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
GEN2	General - notification	All businesses, residential properties and other key stakeholders (eg schools, local councils) affected by the activity will be notified at least five days prior to commencement of the activity.	Contractor/ Transport for NSW project manager	Pre-construction	Core standard safeguard
GEN3	General – environmental awareness	All personnel working on site will receive training to ensure awareness of environment protection requirements to be implemented during the project. This will include up-front site induction and regular ‘toolbox’ style briefings.  Site-specific training will be provided to personnel engaged in activities or areas of higher risk. These include: <ul style="list-style-type: none"> <li>• areas of Aboriginal and non-Aboriginal heritage sensitivity</li> <li>• threatened species habitat</li> <li>• noise and vibration management</li> </ul>	Contractor/ Transport for NSW project manager	Pre-construction/ detailed design	Core standard safeguard
TT1	Traffic and transport impacts	A Traffic Management Plan (TMP) will be prepared and implemented as part of the CEMP. The TMP will be prepared in accordance with the <i>Traffic Control at Work Sites Manual</i> (TfNSW, 2020d) and <i>QA Specification G10 Control of Traffic</i> (Roads and Maritime, 2008). The TMP will include: <ul style="list-style-type: none"> <li>• confirmation of haulage routes and any Transport Management Centre requirements</li> <li>• measures to maintain access to local roads and properties and minimise the potential for ‘rat-runs’ to form on local roads during road closures</li> <li>• site specific traffic control measures (including signage) to manage and regulate traffic movement</li> <li>• measures to maintain pedestrian and cyclist access</li> <li>• requirements and methods to consult and inform the local community of impacts on the local road network</li> </ul>	Contractor	Detailed design / pre-construction	Section 4.8 of QA G36 <i>Environment Protection</i>

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		<ul style="list-style-type: none"> <li>access to construction sites including entry and exit locations and measures to prevent construction vehicles queuing on public roads</li> <li>a response plan for any construction traffic incident</li> <li>consideration of other developments that may be under construction to minimise traffic conflict and congestion that may occur due to the cumulative increase in construction vehicle traffic</li> <li>monitoring, review and amendment mechanisms.</li> </ul>			
TT2	Travel time impacts	Transport for NSW will investigate alternate construction methodologies and design innovations to minimise the duration of road closures required during construction.	Transport for NSW	Detailed design	Additional safeguard
TT3	Changed traffic conditions	<p>The community will be notified in advance of any road closures and the likely disruptions to access in accordance with the Community and Stakeholder Engagement Plan.</p> <p>Adequate advisory and warning signage will be provided to inform motorists of the road conditions ahead including any road closure and/or detour route.</p>	Contractor	Construction	Additional safeguard
TT4	Emergency vehicle and key stakeholder access	Access will be maintained for emergency response vehicles, NPWS staff and utility providers at all times, where possible. If a stage of the work restricts access along Heathcote Road, alternative arrangements will be developed in consultation with the relevant stakeholders in advance.	Contractor	Construction	Additional safeguard
TT5	Road closures and detours	Temporary traffic diversions and road closures will be implemented in consultation with and in accordance with the Transport Management Centre requirements.	Contractor	Construction	Additional safeguard



No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
TT6	Road closures and detours	Prior to any proposed road closures Transport for NSW will consult with ANSTO to provide early notification of works and to investigate collaborative efforts to minimise impact to nuclear medicine deliveries.	Transport for NSW	Pre-construction	Additional safeguard
NV1	Noise and vibration impacts	<p>A Construction Noise Management Plan (CNMP) would be prepared as part of the CEMP. This plan would include but not be limited to:</p> <ul style="list-style-type: none"> <li>• a map indicating the locations of sensitive receivers including residential properties</li> <li>• a quantitative noise assessment based on the detailed design of the proposal in accordance with the EPA <i>Interim Construction Noise Guidelines</i> (DECC, 2009)</li> <li>• management measures to minimise the potential noise impacts from the quantitative noise assessment and for potential works outside of standard working hours (including implementation of EPA <i>Interim Construction Noise Guidelines</i> (DECC, 2009), including specific mitigation measures for truck movements</li> <li>• a risk assessment to determine potential risk for activities likely to affect receivers (for activities carried out during and outside of standard working hours)</li> <li>• a process for assessing the performance of the implemented mitigation measures such as a program of noise monitoring for sensitive receivers</li> <li>• a process for documenting and resolving issues and complaints</li> <li>• a construction staging program</li> </ul>	Contractor	Detailed design/pre-construction	Standard safeguard Section 4.6 of QA G36 <i>Environment Protection</i>

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		<ul style="list-style-type: none"> <li>a process for updating the plan when activities affecting construction noise and vibration change</li> <li>an outline of the content for toolbox talks regarding noise management</li> </ul>			
NV2	Noise and vibration impacts	<ul style="list-style-type: none"> <li>All sensitive receivers (i.e. local residents) likely to be affected will be notified at least seven days prior to commencement of any works associated with the activity that may have an adverse noise or vibration impact. The notification will provide details of: <ul style="list-style-type: none"> <li>the project</li> <li>the construction period and construction hours</li> <li>contact information for project management staff</li> <li>complaint and incident reporting</li> <li>how to obtain further information</li> </ul> </li> </ul>	Contractor	Detailed design / pre-construction	Noise and vibration
NV3	Vibration impacts	<p>During detailed design and pre-construction, a Vibration Risk Assessment is to be completed and as a minimum will involve:</p> <ul style="list-style-type: none"> <li>identifying construction ground vibration criteria, including applicable criteria for Aboriginal and Non-Aboriginal heritage features and ANSTO</li> <li>identifying the ground type and topography in the vicinity of the works location (in terms of its susceptibility to ground vibration)</li> <li>identifying and describing the potentially affected properties and heritage features which may be impacted by ground vibration during construction</li> <li>consulting with ANSTO to confirm the location of any vibration sensitive equipment</li> </ul>	Transport for NSW / Contractor	Detailed design/ pre-construction	Standard safeguard Section 4.6 of QA G36 <i>Environment Protection</i>

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		<ul style="list-style-type: none"> <li>• identifying the types of activities to be carried out, the machinery and equipment to be used, including the predicted vibration emission levels from each plant and their corresponding buffer distances</li> <li>• reviewing the construction methodology and identifying discrete work activities with the potential to affect identified buildings or heritage features</li> <li>• assessing the potential vibration impacts on building structures and heritage features.</li> <li>• reviewing predicted vibration emissions against construction criteria</li> <li>• providing a map indicating the heritage features / buildings on adjacent properties considered likely to be impacted by ground vibration</li> <li>• detailing which features of the natural and built environment require condition inspections</li> <li>• identifying mitigation measures to be incorporated during construction to address ground vibration impacts including assessment of 'at-source' mitigation measures</li> <li>• evaluating the potential reductions that could be achieved with the application of recommended measures</li> <li>• evaluating the use of a fixed vibration monitoring system which would appropriately warn plant operators (i.e. flashing light, audible alarm, SMS) when vibration levels approach established criteria limits</li> </ul>			

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
NV4	Vibration impacts	<p>A Ground Vibration Management Plan is to be prepared incorporating outcomes of the Vibration Risk Assessment and incorporated into the CEMP. As a minimum the plan must include:</p> <ul style="list-style-type: none"> <li>• identification of all potentially affected properties or features of the natural/built environment and show on a map</li> <li>• identification of all vibration generating tasks, duration and predicted vibration levels</li> <li>• a schedule of properties or features of the natural/built environment where condition inspections are required to be undertaken (based on the Vibration Risk Assessment)</li> <li>• locations and types of management measures to be implemented to reduce excessive ground vibration such as: <ul style="list-style-type: none"> <li>○ maximising the offset distance between high vibration plant items and nearby buildings</li> <li>○ substitution by alternative equipment, plant and processes</li> <li>○ screening or enclosures</li> <li>○ restricted times when work is being carried out;</li> <li>○ increased work setback distances</li> <li>○ consultation with affected receivers;</li> <li>○ orienting equipment away from vibration-sensitive areas</li> </ul> </li> </ul>	Transport for NSW/ Contractor	Pre-construction/ construction	Standard safeguard Section 4.6 of QA G36 <i>Environment Protection</i>



No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		<ul style="list-style-type: none"> <li>○ specific physical and managerial measures for controlling ground vibration to comply with the relevant OEH guidelines and best practice</li> <li>• a vibration trial to determine the dominant frequency of vibration</li> <li>• vibration monitoring, reporting and response procedures including a short and long term ground vibration monitoring program to assess compliance with the identified criteria</li> <li>• procedures for notifying any residents or business premises about vibration-generating activities likely to affect buildings on their property</li> <li>• contingency plans to be implemented in the event of non-compliances and/or vibration complaints</li> <li>• procedures for regularly reviewing the effectiveness of the Vibration Management Plan including specific review in response to any exceedance events and when activities affecting construction vibration change</li> <li>• outline of the content for toolbox talks regarding vibration management</li> </ul>			
B1	Biodiversity	<p>A Flora and Fauna Management Plan will be prepared in accordance with Transport for NSW 's <i>Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects</i> (Roads and Traffic Authority NSW (RTA), 2011) and implemented as part of the CEMP. It will include, but not be limited to:</p> <ul style="list-style-type: none"> <li>• plans showing areas to be cleared and areas to be protected, including exclusion zones, protected habitat features and revegetation areas</li> </ul>	Contractor	Detailed design/ pre-construction	Section 4.8 of QA G36 <i>Environment Protection</i>

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		<ul style="list-style-type: none"> <li>• requirements set out in the <i>Landscape Guideline</i> (RTA, 2008)</li> <li>• pre-clearing survey requirements</li> <li>• procedures for unexpected threatened species finds and fauna handling</li> <li>• procedures addressing relevant matters specified in the <i>Policy and guidelines for fish habitat conservation and management</i> (DPI Fisheries, 2013)</li> <li>• protocols to manage weeds and pathogens.</li> <li>• procedures for retention and reuse of felled timber</li> <li>• identification of trees to be cut to base to avoid grubbing</li> <li>• an outline of the content to be included in toolbox talks including exclusion zones and stop work procedures</li> <li>• a procedure to routinely review and update the plan</li> </ul>			
B2	Biodiversity	<p>A Microbat Management Plan is to be developed by a suitably qualified microbat ecologist in consultation with Transport for NSW Biodiversity Officer. The Microbat Management Plan would be incorporated into the Flora and Fauna Management Plan. As a minimum, the plan is to include:</p> <ul style="list-style-type: none"> <li>• demonstrated consideration of the roosting and breeding season requirements of the target species</li> <li>• pre-clearing requirements for artificial habitat during pre-construction</li> <li>• requirements for changes to artificial habitat during each phase of bridge work</li> <li>• a detailed methodology for pre-clearing surveys to identify microbats within the bridge structure</li> </ul>	Transport for NSW	Detailed design/pre-construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		<ul style="list-style-type: none"> <li>• a protocol for identification, capture, and relocation of microbats</li> <li>• a protocol for microbat exclusion</li> <li>• references to examples to demonstrate proven effectiveness of proposed management measures</li> <li>• reporting requirements including species identification, number, relocation actions, exclusion methods</li> <li>• a protocol to routinely review and update the plan</li> </ul>			
B3	Biodiversity	Measures to further avoid and minimise the construction footprint and native vegetation or habitat removal (including design refinements to retain hollow bearing trees) will be investigated during detailed design.	Contractor	Detailed design/ pre-construction	Additional safeguard
B4	Biodiversity	TfNSW will consult with relevant experts within DPIE to develop a site specific management plan for the newly described but as yet unlisted <i>Hibbertia woronorana</i> .	Transport for NSW	Detailed design/ pre-construction	Additional safeguard
B5	Biodiversity/ fauna connectivity	During detailed design, the design of fauna connectivity features including arboreal fauna furniture, tie-in fencing, and landscape species selection would be further refined in consultation with suitably qualified ecologist and Transport for NSW Biodiversity officer. Design is to include consideration of landscaping, refuge areas, and natural substrate.	Transport for NSW	Detailed design/ pre-construction	Additional safeguard
B6	Biodiversity	The applicability of Koala signage within the local road corridor would be subject to further review during detailed design in consultation with Transport for NSW Biodiversity Officer.	Transport for NSW	Detailed design/ pre-construction	Consultation with NPWS

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
B7	Weed management	<p>A weed management plan would be prepared in accordance with <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA, 2011) and incorporated into the Flora and Fauna Management Plan and would:</p> <ul style="list-style-type: none"> <li>• outline the requirement for a pre-clearing inspection by an ecologist identify the weeds on site</li> <li>• outline weed management priorities and objectives</li> <li>• identify sensitive environmental areas within or adjacent to the site</li> <li>• identify the location of weed infested areas</li> <li>• provide weed control methods including machinery hygiene procedures and disposal requirements</li> <li>• outline a monitoring program to measure the success of weed management</li> <li>• requirements for communication with local Council noxious weed representative</li> </ul>	Transport for NSW	Detailed design/pre-construction	Additional safeguard
B8	Maintaining fish passage	TfNSW will consult with DPI Fisheries during the development of detailed design and notify DPI Fisheries prior to the commencement of construction of the temporary waterway crossing.	Transport for NSW / Contractor	Detailed design/construction	Additional safeguard
SW1	Construction soil and water quality impacts	<p>A Soil and Water Management Plan (SWMP) would be prepared as part of the CEMP in accordance with the requirements of RMS QA specification G38 prior to the commencement of construction. The SWMP would also address the following:</p> <ul style="list-style-type: none"> <li>• <i>RMS Code of Practice for Water Management, the RMS Erosion and Sedimentation Procedure</i></li> </ul>	Contractor	Detailed design/pre-construction	Section 2.1 of QA G38 <i>Soil and Water Management</i>



No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		<ul style="list-style-type: none"> <li>• The <i>NSW Soils and Construction – Managing Urban Stormwater Volume 1 “the Blue Book”</i> (Landcom, 2004) and Volume 2A (DECC, 2008)</li> <li>• <i>RMS Technical Guideline: Temporary Stormwater Drainage for Road Construction, 2011</i></li> <li>• <i>RTA Technical Guideline: Environmental Management of Construction Site Dewatering, 2011</i></li> </ul> <p>The SWMP is to be developed by suitably qualified soil conservationist and would detail the following as a minimum:</p> <ul style="list-style-type: none"> <li>• identification of catchment and sub-catchment areas, high risk areas and sensitive areas</li> <li>• sizing of each of the above areas and catchment</li> <li>• the likely volume of run-off from each road sub-catchment</li> <li>• direction of flow of on-site and off-site water</li> <li>• separation of on-site and off-site water</li> <li>• the direction of run-off and drainage points during each stage of construction</li> <li>• the locations and sizing of sediment traps such as sumps as well as associated drainage</li> <li>• dewatering plan which includes process for monitoring, flocculating, testing and dewatering water from site (i.e sumps)</li> <li>• the staging plans, location, sizing and details of creek alignment and realignment controls for scour protection and bank and bed stabilisation including those used during construction and for long-term stabilisation</li> </ul>			

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		<ul style="list-style-type: none"> <li>• progressive Erosion and Sedimentation Control Plans (ESCPs)</li> <li>• a process to routinely monitor the weather forecast</li> <li>• preparation of a wet weather (rain event) plan which includes a process for monitoring potential wet weather and identification of controls to be implemented in the event of wet weather</li> <li>• procedure for routine visual water quality monitoring</li> <li>• identification of the construction water source</li> <li>• provision of an inspection and maintenance schedule for ongoing maintenance of temporary and permanent erosion and sedimentation controls</li> </ul> <p>The SWMP is to identify all activities that have the potential to generate wastewater and include an assessment of the containment needs for each activity, including minimum requirements for impermeable containment setup.</p>			
SW2	Construction erosion and sedimentation impacts	<p>The Construction SWMP is to include preparation of Environmental Work Method Statements for all activities it has identified as high risk. The EWMS must as a minimum include:</p> <ul style="list-style-type: none"> <li>• a description of the work activity including any plant and equipment to be used</li> <li>• an outline of the sequence of tasks for the activity including interfaces with other construction activities</li> <li>• identification of any sensitive areas or exclusion zones</li> <li>• identification of potential environmental risks/impacts due to the work activity</li> </ul>	Contractor	Detailed design/pre-construction	Section 3.2.4 of QA G36

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		<ul style="list-style-type: none"> <li>specific safeguards and environmental management measures to reduce the identified environmental risk, including assigned responsibilities to site management personnel</li> <li>a process for assessing the performance of the implemented mitigation measures</li> <li>figures showing the work activities and proposed mitigation measures</li> </ul>			
SW3	Construction erosion and sedimentation impacts	An Erosion and Sedimentation Control Plan (ESCP) is to be developed by suitably qualified soil conservationist. As a minimum, the ESCP must be in accordance with the requirements of QA G38 specification, Soil and Water Management.	Contractor	Detailed design/ pre-construction	Section 2.2 of QA G38 <i>Soil and Water Management</i>
SW4	Construction erosion and sedimentation impacts	<p>A Stabilisation Plan is to be prepared and included in the SWMP. The stabilisation plan is to include but not be limited to the following:</p> <ul style="list-style-type: none"> <li>identification and methodology of techniques for stabilisation of site</li> <li>identification of area on site for progressive stabilisation</li> <li>Identification of areas requiring stabilisation, including stockpiles and batters, exposed for a duration of two weeks or greater. For example covering with geotextile fabric, stabilised mulch, soil binder or spray grass.</li> <li>identification of areas on site for progressive permanent stabilisation such as implementation of landscaping. Work areas are to be stabilised progressively during the works.</li> </ul>	Contractor	Pre-construction / construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
SW5	Construction accidental spills	A site-specific emergency spill plan will be developed and included within the SWMP. This plan would be implemented during construction and include spill management measures in accordance with the Transport for NSW <i>Code of Practice for Water Management: Road Development Management</i> (RTA, 1999) and relevant EPA guidelines. The plan will address measures to be implemented in the event of a spill, including initial response and containment, notification of emergency services and relevant authorities (including Transport for NSW and EPA officers).	Contractor	Pre-construction / construction	Section 4.3 of QA G36 <i>Environment Protection</i>
SW6	Construction accidental spills	All works directly above the waterway including on the bridge and scaffolding will be subject to an approved EWMS including details of minimum containment requirements, protocol to inspect and approve containment setup, and identification of activities requiring impermeable containment setup to prevent accidental spills into the river.	Contractor	Construction	Additional safeguard
SW7	Construction accidental spills	Emergency wet and dry spill kits would be kept on site at all times and all staff would be made aware of the location of the spill kit and trained in its use.	Contractor	Construction	Additional safeguard
SW8	Construction erosion and sedimentation impacts	All stockpiles would be designed, established, operated and decommissioned in accordance with the <i>Roads and Maritime Services Stockpile Site Management Guideline</i> (EMS-TG-10).	Contractor	Construction	Additional safeguard
SW9	Construction water quality impacts	A procedure for refuelling and storage of fuels, chemicals and liquids, is to be detailed within the SWMP. As a minimum this is to identify nominated storage areas, spill kit provisions including provision for aquatic spills and boom, minimum double bunding requirements, weather restrictions, flood event preparedness and visual monitoring.	Contractor	Construction	Additional safeguard



No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
SW10	Construction water quality impacts	The crossing design and any potential cofferdam set up will be refined during detailed design to maintain fish passage through continued consultation with DPI Fisheries.	Contractor	Detailed design	Additional safeguard
SW11	Construction contamination impacts	In the event that indications of contamination are encountered (known and unexpected, such as odorous or visually contaminated materials), work in the area would cease until a contamination assessment can be prepared to advise on the need for remediation or other action, as deemed appropriate.	Contractor	Construction	Additional safeguard
SW12	Risk of tannins	Any mulch stockpiling is to be in accordance with <i>Environmental Direction – Management of Tannins from Vegetation Mulch (RMS,2012)</i>	Contractor	Construction	Additional safeguard
SW13	Operational drainage, soil and water quality impacts	Detailed design will seek to minimise water quality impacts by incorporating the following design principles: <ul style="list-style-type: none"> <li>• appropriate measures to mitigate any potential impacts to soil and water quality, including but not limited to scour protection, infiltration trenches, vegetated swales, geofabrics, lined channels</li> <li>• appropriate energy dissipation and scour prevention measures downstream of culverts and other drainage structures to minimise soil erosion.</li> </ul>	Contractor	Detailed design	Additional safeguard
HF1	Hydrology and flooding impacts from waterway crossing	The detailed design of the temporary waterway crossing will be developed in consultation with the Transport for NSW Senior Environmental Officer and include appropriate pipe outlets, scour protection and flood immunity to minimise impacts on hydrology and flooding.	Transport for NSW	Detailed design	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
HF2	Hydrology and flooding	The final layout and detail of the drainage system including scour protection and operational WSUD features will be refined during detailed design in consultation with the Transport for NSW Senior Environmental Officer.	Transport for NSW	Detailed design	Additional safeguard
HF3	Hydrology and flooding impacts from waterway crossing	The Soil and Water Management Plan is to include but may not be limited to: <ul style="list-style-type: none"> <li>• an outline of the works which are to occur in waterways including and temporary works</li> <li>• a profile of the waterways within which works are to occur eg ephemeral or permanent; creek or river</li> <li>• assessment of the flow regime of waterway such as flooding events</li> <li>• schedule and timing of works</li> <li>• work methodology including environmental controls</li> <li>• how Erosion and Sediment Control Plans would be managed and updated for the works in waterways</li> </ul>	Contractor	Pre-construction/ construction	Additional safeguard
HF4	Hydrology and flooding impacts from waterway crossing	The temporary waterway crossing structure will be removed and the temporary access track and laydown areas will be rehabilitated as soon as practical to return the disturbed areas to pre-existing conditions.	Contractor	Construction	Additional safeguard
HF5	Flooding during construction	A flood action plan will be prepared to manage a potential flood event during construction and included as part of the CEMP. This plan will be implemented during construction and outline: <ul style="list-style-type: none"> <li>• procedures to monitor rainfall and dam water releases that may influence river levels</li> </ul>	Contractor	Pre-construction/ construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		<ul style="list-style-type: none"> <li>• what flood event would trigger the plan</li> <li>• evacuation procedures including a map indicating the area that is flood prone and the locations where to evacuate</li> <li>• procedures to reduce risk during a flood event including removal of all plant/equipment and stabilising exposed areas</li> </ul>			
AH1	Aboriginal heritage	The Aboriginal archaeological site known as 'Scouters Mountain Engadine' (AHIMS 52-2-0742) will be clearly identified on design drawings with a five metre exclusion zone. Review of the detailed design at 80% and 100% development will be carried out in consultation with the Transport for NSW Environment Manager to confirm no encroachment within the exclusion zone.	Transport for NSW	Detailed design/pre-construction	Additional
AH2	Aboriginal heritage	<p>An Aboriginal Heritage Management Plan will be prepared and incorporated into the CEMP. This plan would include but not be limited to the following:</p> <ul style="list-style-type: none"> <li>• a map identifying locations of no-go areas, items or sites which are to be protected and those which are to be impacted.</li> <li>• identification of potential environmental risks/impacts due to the works/activities</li> <li>• management measures to avoid or minimise potential impacts, including any management measures identified in the Ground Vibration Management Plan.</li> </ul>	Contractor	Detailed design/pre-construction/construction	Additional

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		<ul style="list-style-type: none"> <li>outline of the content to be included in toolbox talks regarding management of Aboriginal heritage, including identification of no-go areas, any relevant permits and any responsibilities specified under the <i>National Parks and Wildlife Act 1974</i>.</li> <li>a stop works procedure in the event of actual or suspected potential harm to a heritage feature/place.</li> <li>the requirement to comply with <i>RMS Standard Management Procedure -Unexpected Archaeological Finds, 2012</i>.</li> </ul>			
	Aboriginal heritage	If Aboriginal heritage items are uncovered during the works, all works in the vicinity of the find must cease and the Transport for NSW Aboriginal cultural heritage officer and regional environment manager contacted immediately. Steps in the Roads and Maritime <i>Standard Management Procedure: Unexpected Heritage Items</i> (Roads and Maritime, 2015) must be followed.	Contractor	Construction	Section 4.9 of QA G36 <i>Environment Protection</i>
NH1	Non-Aboriginal heritage - General	<p>A Non-Aboriginal Heritage Management Plan would be prepared and included in the CEMP. This plan would include but not be limited to the following:</p> <ul style="list-style-type: none"> <li>a map identifying locations of no-go areas, items or sites (including curtilages) which are to be protected and those which are to be impacted</li> <li>identification of potential environmental risks/impacts due to the works/activities</li> <li>management measures to avoid or minimise potential impacts, including any management measures identified in the Ground Vibration Management Plan.</li> </ul>	Contractor	Detailed design/ pre-construction/ construction	Additional



No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		<ul style="list-style-type: none"> <li>outline of the content to be included in toolbox talks regarding management of Non-Aboriginal heritage, including identification of no-go areas, any relevant permits and any responsibilities specified under the <i>National Parks and Wildlife Act 1974</i>.</li> <li>a stop works procedure in the event of actual or suspected potential harm to a heritage feature/place.</li> <li>the requirement to comply with <i>RMS Standard Management Procedure -Unexpected Archaeological Finds, 2012</i>.</li> </ul>			
NH2	Non-Aboriginal heritage – Woronora River Bridge	Transport for NSW will continue to consult with Heritage NSW throughout the development of Heathcote Road Bridge Urban Design.	Transport for NSW	Detailed design	Additional
NH3	Non-Aboriginal heritage – Woronora River Bridge	Heritage reviews will be incorporated into the design and development process. Heritage reviews will be carried out in consultation with TfNSW Environment Manager at 30%, 80% and 100% detailed design stages.	Transport for NSW/ contractor	Detailed design	Additional safeguard
NH4	Non-Aboriginal heritage – Woronora River Bridge	<p>A Conservation Management Plan (CMP) will be prepared for the Woronora River Bridge to outline how the heritage fabric of Woronora River Bridge should be managed on an ongoing basis.</p> <p>This CMP will also consider the establishment of an extended heritage precinct for Woronora River Bridge, Kolara Weir and former recreation area, and the extant remains of Heathcote Creek bridge as an area of local and State heritage significance.</p>	Transport for NSW/ contractor	Pre-construction/ operation	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
NH5	Non-Aboriginal heritage – Woronora River Bridge	<p>During the detailed design process the following will be considered to limit impacts to the Woronora River Bridge:</p> <ul style="list-style-type: none"> <li>• retain as much of the original fabric of Woronora River Bridge where possible.</li> <li>• use of sympathetic colour shades and textures for steel paint finishes of the box girders and headstock extensions.</li> <li>• carry out colour and material matching for repair and maintenance works.</li> <li>• an appropriately qualified structural engineer to carry out an assessment of structural integrity for each element to be removed and/or replaced prior to removal as part of repair and maintenance works. Only replace elements which are at risk of failing.</li> <li>• salvage sandstone block facing from abutments and incorporate their use into the project or potential heritage precinct.</li> <li>• use of discrete fencing with hoarding or fabric for Woronora River Bridge during works.</li> </ul>	Transport for NSW/ contractor	Detailed design/ operation	Additional safeguard
NH6	Non-Aboriginal heritage – Woronora River Bridge	Archival recording of the Woronora River Bridge and any associated infrastructure will be carried out prior to construction. To ensure total impacts are catalogued, an archival recording of the Woronora River Bridge is also recommended after the conclusion of works.	Contractor	Pre-construction/ operation	Additional safeguard
NH7	Non-Aboriginal heritage – Woronora River Bridge	If unexpected heritage item/s, archaeological remains or potential relics are uncovered during the works, all works would cease in the vicinity of the material/find and the <i>RMS Standard Management Procedure - Unexpected Archaeological Finds 2012</i> would be followed.	Contractor	Construction	Section 4.10 of QA G36 <i>Environment Protection</i>

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
LP1	Property acquisition	All property acquisition will be carried out in accordance with the <i>Land Acquisition Information Guide</i> (Roads and Maritime, 2012) and the <i>Land Acquisition (Just Terms Compensation) Act 1991</i> .	Transport for NSW	Pre-construction and construction	Standard safeguard
LP2	Property acquisition or lease of Crown Land	All property acquisition or leasing of Crown Land will be carried out in accordance with the <i>Crown Lands Management Act 2016</i> and <i>Crown Land Legislation Amendment Act 2017</i> .	Transport for NSW	Pre-construction	Additional safeguard
V1	Landscape character and visual impact	<p>The landscape and urban design strategy for the proposal will be reviewed during detailed design in consideration of the design principles and objectives as described in the <i>Heathcote Road Bridge Urban Design Concept</i> report prepared for the REF. An Urban Design Plan will be prepared to support the detailed design and will implemented as part of the CEMP. The preparation of the Urban Design plan must involve as a minimum:</p> <ul style="list-style-type: none"> <li>• investigating opportunities to re-use sandstone features</li> <li>• integrating recommendations for fauna habitat and connectivity features and developing standard design drawings in consultation with the Transport for NSW biodiversity officer</li> <li>• refining scour protection designs</li> <li>• reviewing slope stabilisation works at 20, 80 and 100% detailed design in consultation with Transport for NSW Urban Design team to achieve a balance of safety and good design outcomes</li> </ul>	Transport for NSW	Detailed design	Standard safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		<ul style="list-style-type: none"> <li>• investigating opportunities for incorporating WSUD features such as swales and considering their location, size and treatment so that they blend into the landform and landscape character</li> <li>• outlining the location and identification of existing vegetation and proposed landscaped areas, including species to be used</li> <li>• considering design treatments for built elements including retaining walls and bridges, shotcrete and other stope stabilisation measures and fixtures such as fencing and signs</li> <li>• refining staging of landscape work taking account of related environmental controls such as erosion and sedimentation controls and drainage</li> <li>• outlining procedures for monitoring and maintaining landscaped or rehabilitated areas.</li> </ul>			
V2	Landscape character and visual impact	<p>The Urban Design Plan will be prepared in accordance with relevant guidelines, including:</p> <ul style="list-style-type: none"> <li>• Beyond the Pavement urban design policy, process and principles (TfNSW, 2020f)</li> <li>• Landscape Guideline (RTA, 2008)</li> <li>• Bridge Aesthetics (TfNSW, 2019)</li> <li>• Shotcrete Design Guideline (Roads and Maritime, 2016).</li> </ul>	Transport for NSW	Detailed design	Standard safeguard



No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
SE1	Socio-economic impact	<p>A Communication Plan (CP) will be prepared and implemented as part of the CEMP to help provide timely and accurate information to the community and key stakeholders during construction. The CP will include (as a minimum):</p> <ul style="list-style-type: none"> <li>mechanisms to provide details and timing of proposed activities to affected residents, including changed traffic and access conditions, including proposed detour routes</li> <li>contact name and number for complaints.</li> </ul> <p>The CP will be prepared in accordance with the <i>Community Involvement and Communications Resource Manual</i> (RTA, 2008).</p>	Contractor	Detailed design/pre-construction	Standard safeguard
RW1	Resource use	<p>The following resource management hierarchy principles would be followed:</p> <ul style="list-style-type: none"> <li>avoid unnecessary resource consumption as a priority</li> <li>avoidance would be followed by resource recovery (including reuse of materials, reprocessing, and recycling and energy recovery) disposal would be undertaken as a last resort (in accordance with the <i>Waste Avoidance and Resource Recovery Act, 2001</i>).</li> </ul>	Contractor	Detailed design/pre-construction	<i>G36 Environment Protection</i>
RW2	Resource use and waste	<p>A Resource and Waste Management Plan (RWMP) would be prepared, which would include the following (as a minimum):</p> <ul style="list-style-type: none"> <li>the type, classification and volume of all materials to be generated and used on site including identification of recyclable and non-recyclable waste in accordance with <i>EPA Waste Classification Guidelines 2014</i></li> <li>quantity and classification of excavated material generated as a result of the proposal</li> </ul>	Contractor	Detailed design/pre-construction	Section 4.2 of QA G36 <i>Environment Protection</i>

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		<ul style="list-style-type: none"> <li>interface strategies for cut and fill on site to ensure re-use where possible</li> <li>strategies to 'avoid', 'reduce', 'reuse' and 'recycle' materials</li> <li>classification and disposal strategies for each type of material</li> <li>destinations for each resource/waste type either for on-site reuse or recycling, offsite reuse or recycling, or disposal at a licensed waste facility</li> <li>details of how material would be stored and treated on-site</li> <li>identification of available recycling facilities on and off site</li> <li>identification of suitable methods and routes to transport waste, including wastewater</li> <li>procedures and disposal arrangements for unsuitable excavated material or contaminated material site clean-up for each construction stage</li> </ul>			
RW3	Waste	All waste would be managed in accordance with the <i>Protection of the Environment Operations Act 1997</i> .	Contractor	Detailed design/pre-construction	Additional safeguard
RW4	Waste	Types of waste collected, amounts, date/time and details of disposal are to be recorded in a waste register.	Contractor	Detailed design/pre-construction	Additional safeguard
AQ1	Air quality	<p>An Air Quality Management Plan (AQMP) will be prepared and implemented as part of the CEMP. The AQMP will include, but not be limited to:</p> <ul style="list-style-type: none"> <li>potential sources of air pollution</li> <li>air quality management objectives consistent with any relevant published EPA and/or EES/DPIE guidelines</li> </ul>	Contractor	Detailed design/pre-construction	Section 4.4 of QA G36 <i>Environment Protection</i>

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		<ul style="list-style-type: none"> <li>mitigation and suppression measures to be implemented</li> <li>methods to manage work during strong winds or other adverse weather conditions</li> <li>a progressive rehabilitation strategy for exposed surfaces.</li> </ul>			
CC1	Climate change effects	The potential impacts of climate change on the proposal, such as the increased potential for localised flooding and need for resilience against more severe and frequent extreme weather events, will be considered during detailed design.	Transport for NSW	Detailed design	Additional safeguard
CC2	Greenhouse gas emissions from material use and transport	Ways to reduce construction material requirements, source materials from local suppliers, re-use materials on-site and choose recycled materials or materials with low-embodied energies will be investigated during detailed design.	Transport for NSW / Contractor	Detailed design/ construction	Additional safeguard
CC3	Greenhouse gas emissions from equipment and vehicle use	Minimise equipment and vehicle idling and switch off when not in use to minimise unnecessary emissions and fuel consumption.	Constructor	Construction	Additional safeguard
U1	Utilities	<p>Prior to the commencement of work:</p> <ul style="list-style-type: none"> <li>the location of existing utilities and relocation details will be confirmed following consultation with the affected utility owners</li> <li>If the scope or location of proposed utility relocation work falls outside of the assessed proposal scope and footprint, further assessment will be carried out.</li> </ul>	Contractor	Detailed design/ pre-construction	Standard safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
HR1	Hazards and risks	<p>A Hazard and Risk Management Plan (HRMP) will be prepared and implemented as part of the CEMP. The HRMP will include, but not be limited to:</p> <ul style="list-style-type: none"> <li>• details of hazards and risks associated with the activity</li> <li>• measures to be implemented during construction to minimise these risks including (but not limited to): <ul style="list-style-type: none"> <li>○ weather restrictions for ‘hot works’ activities such as welding</li> <li>○ handling and storage procedures for potentially hazardous chemicals and materials</li> <li>○ measures to manage bushfire risk such as limitations on mulch stockpiling</li> <li>○ procedures and adequate resources to prepare for and instantly respond to a spot fire</li> </ul> </li> <li>• record keeping arrangements, including information on the materials present on the site, material safety data sheets, and personnel trained and authorised to use such materials</li> <li>• a monitoring program to assess performance in managing the identified risks</li> <li>• an Emergency Preparedness Plan that outlines contingency measures to be implemented in the event of unexpected hazards or risks arising, including emergency situations</li> <li>• procedures to routinely review and update the plan</li> </ul> <p>The HRMP will be prepared in accordance with relevant guidelines and standards, including relevant Safe Work Australia Codes of Practice, and EPA or DPIE publications.</p>	Contractor	Detailed design/ pre-construction	Additional safeguard



No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
CU1	Cumulative construction impacts	<p>Other developers will be consulted in accordance with the Community Stakeholder and Engagement Plan to:</p> <ul style="list-style-type: none"> <li>• obtain information about project timeframes and impacts</li> <li>• manage the interfaces of the proposal's staging and programming in combination with the other projects occurring in the area</li> <li>• identify and implement appropriate safeguards and management measures to minimise cumulative impacts</li> </ul>	Transport for NSW and Contractor	Pre-construction and construction	Additional safeguard
CU2	Cumulative traffic impacts	Transport for NSW will coordinate with the project team for the Linden Street upgrade and the Transport Management Centre with regard to the proposed timing of the road and lane closures and identify alternate routes or additional safeguards and management measures, as required.	Transport for NSW and Contractor	Pre-construction and construction	Additional safeguard
CU3	Cumulative construction impacts	The CEMP would consider potential cumulative construction impacts from known surrounding development activities (i.e. the Heathcote Road upgrade, Upgrading Linden Street, New residential flat building at 5 Prestons Avenue Engadine and Refurbishment of Heathcote Hall) as well as new planned development activities near the proposal, as they become known. This would include a process to regularly review and update mitigation measures as new works are identified that may lead to cumulative impacts or if complaints are received due to cumulative impacts.	Transport for NSW and Contractor	Pre-construction and construction	Additional safeguard

### 7.3 Licensing and approvals

Table 7-2 Summary of licensing and approvals required

Instrument	Requirement	Timing
<i>Crown Land Management Act 2016</i> (Division 3.4, 5.5 and 5.6)	Lease or licence to occupy areas of Crown land.	Prior to start of the activity
<i>Roads Act 1993</i> (Section 138)	A road occupancy licence would be obtained from the Transport Management Centre	Prior to start of the activity

## 8 Conclusion

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This chapter provides the justification for the proposal taking into account its biophysical, social and economic impacts, the suitability of the site and whether or not the proposal is in the public interest. The proposal is also considered in the context of the objectives of the EP&A Act, including the principles of ecologically sustainable development as defined in Schedule 2 of the Environmental Planning and Assessment Regulation 2000.

### 8.1 Justification

#### 8.1.1 Social factors

The proposal would result in positive long-term social impacts during operation through providing improved road safety and network reliability along the A6 section of Heathcote Road by widening the Heathcote Road bridge and its approaches to achieve compliance with current road safety standards. These safety improvements would address the existing community concern for motorist safety when crossing the Heathcote Road bridge.

However, construction of the proposal would result in traffic disruptions during the proposed full closure of Heathcote Road between New Illawarra Road and the Princes Highway, which may be up to six months in duration. During this period, local community, businesses and industry may experience feelings of severance or reduced access. To minimise this potential disruption, further consultation with key stakeholders and the local community would be carried out as well as a review of the construction methodology to identify alternate methodologies and staging that may be able to reduce the duration of the full road closure.

Construction noise and vibration generated by the proposal may also temporarily impact the amenity of local residents, however, these impacts would be further reduced through review of the construction methodology and consideration of alternative equipment during detailed design. These potential noise impacts would be minimised and managed in accordance with Transport for NSW's CNVG.

The new elements that would be attached to Heathcote Road bridge to achieve a widened crossing may also result in impacts on non-Aboriginal heritage (as the bridge is listed on the Roads and Maritime Services Section 170 Heritage and Conservation Register) and visual impacts. However, these potential impacts would be minimised through urban design considerations during detailed design and continued consultation with Heritage NSW.

Overall, the social benefits of the proposal associated with the increased road safety and network reliability are considered to outweigh the potential adverse social impacts identified.

#### 8.1.2 Biophysical factors

The proposal may result in some minor adverse biophysical impacts, which are largely limited to impacts during the construction phase of the proposal and are not expected to significantly impact the biophysical environment.

The proposal would involve removal of up to 3.08 hectares of native vegetation, of which 0.05 hectares is consistent with an EEC listed under the BC Act (Sydney Freshwater Wetlands in the Sydney Basin Bioregion), which could lead to a reduction of threatened fauna habitat within the proposal area. There may also be a risk of fauna injury and mortality from construction movements and disturbance to aquatic habitat during establishment and use of the temporary waterway crossing. However, it is unlikely that any threatened fauna species would be reliant on the habitat within the proposal area considering the extensive high-quality habitat nearby within Heathcote National Park and Holsworthy Military Reserve.

The proposal has the potential to impact the roosting habitat of Southern Myotis (*Myotis macropus*), which is listed as vulnerable under the BC Act and was recorded within the proposal area during field surveys. A Microbat Management Plan is proposed to manage potential construction impacts on this species. Opportunities to incorporate microbat roosting provisions into the bridge structure would also be investigated during detailed design.

An analysis of relevant literature and koala records indicates that the proposal area is used as a north-south movement corridor for koalas. The proposal provides an opportunity to provide fauna connectivity features under the bridge such as fauna furniture to facilitate Koala crossing beneath the bridge. The final design solution would be confirmed during detailed design in consultation with specialist ecologists.

Overall, the proposal is not likely to significantly impact threatened species, populations, ecological communities or their habitats.

A temporary access track, laydown area and waterway crossing are proposed to be established in an area under the bridge near the Woronora River to provide access for construction equipment and temporary storage of construction materials. Use of these ancillary facilities has the potential to result in minor impacts on soil and water quality as well as water flows and flooding patterns. However, these potential impacts would be temporary, as the waterway crossing structure would be removed and the access track and laydown area would be rehabilitated after construction to return the disturbed areas to pre-existing conditions.

### **8.1.3 Economic factors**

The proposal would improve road safety and network reliability along the A6 section of Heathcote Road. This would have an indirect positive impact on the local economy in the area, as it would reduce the likelihood of traffic delays from road incidents along Heathcote Road and therefore would contribute to improved productivity and reduced costs associated with traffic delays for road users. This is expected to benefit commuters travelling to work, surrounding businesses and industry such as ANSTO and the Suez Lucas Heights Resource Recovery Park as well as freight operators travelling north and south through Sydney. These benefits for road transportation in the long-term are considered to outweigh the short-term inconvenience on the local community and businesses during the proposed full road-closure for construction of the proposal.

### **8.1.4 Public interest**

The proposal is justified to be in the public interest on the basis that it improves the safety and network reliability of Heathcote Road to address community concern without any significant negative long-term impacts on society, the biophysical environment or the local economy. The proposal is also aligned with several strategic policies and government strategies, such as *Future Transport Strategy 2056* (TfNSW, 2018a) and *Road Safety Plan 2021 – Towards Zero* (NSW Government, 2018a).



## 8.2 Objects of the EP&A Act

Table 8-1 describes how the proposal is consistent with or furthers the objects of the EP&A Act.

**Table 8-1 Consideration of objects of the EP&A Act for the proposal**

Object	Comment
1.3(a) To promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources.	The proposal would contribute to improved road safety and traffic flow along Heathcote Road, which would promote the social and economic welfare of the community.
1.3(b) To facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment.	The principles of ecologically sustainable development are considered with respect to the proposal in Section 8.2.1 below.
1.3(c) To promote the orderly and economic use and development of land.	The proposal would improve an important section of road infrastructure within NSW and is aligned with several State and local policies and strategies that identify the need for upgrades to the Heathcote Road bridge to realise future transport planning goals for Greater Sydney (refer to Section 2.1). The proposal is also within an existing road corridor and consistent with the land zoning provisions of the Sutherland Shire LEP.
1.3(d) To promote the delivery and maintenance of affordable housing.	Not relevant to the proposal.
1.3(e) To protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats.	The need to minimise impacts on the environment, including threatened and native species has been considered during development of the proposal. Where potential impacts have been identified on native animals and plants, ecological communities and their habitats, safeguards and management measures have been proposed to avoid or minimise the impacts (refer to Section 6.3.4).
1.3(f) To promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage).	The need to minimise impacts on built and cultural heritage has been considered during development of the proposal. Where potential impacts have been identified on heritage, safeguards and management measures have been proposed to avoid or minimise the impact (refer to Sections 6.6 and 6.7).
1.3(g) To promote good design and amenity of the built environment.	Urban design objectives have been developed for the proposal to promote good design and amenity of the built environment (refer to Section 2.3.3).

Object	Comment
1.3(h) To promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants.	Not relevant to the proposal.
1.3(i) To promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State.	Not relevant to the proposal.
1.3(j) To provide increased opportunity for community participation in environmental planning and assessment.	<p>Chapter 5 (Consultation) outlines the extensive community consultation that has been carried out in the lead up to preparing this REF.</p> <p>The community will be invited to provide a submission on the proposal during the public display of this REF, which provides an opportunity to participate in the environmental planning and assessment process. Transport for NSW would review and respond to the community submissions before determining whether to proceed with the proposal.</p>

### 8.2.1 Ecologically sustainable development

Ecologically sustainable development (ESD) is development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends. The principles of ESD have been an integral consideration throughout the development of the project.

ESD requires the effective integration of economic and environmental considerations in decision-making processes. The four main principles supporting the achievement of ESD are discussed below.

#### The precautionary principle

The precautionary principle deals with reconciling scientific uncertainty about environmental impacts with certainty in decision-making. It provides that where there is a threat of serious or irreversible environmental damage, the absence of full scientific certainty should not be used as a reason to postpone measures to prevent environmental degradation.

The proposal has sought to take a precautionary approach to minimise environmental impacts, including through assessing impacts based on the 'worst-case' or conservative scenarios. This has also been applied in the development of safeguards and management measures using best available technical information, environmental standards and guidelines.

As discussed in Section 2.5.5, the proposal area and construction methodology was also refined to minimise the potential for direct and indirect damage to a known item of Aboriginal cultural heritage significance (Scouters Mountain Engadine Aboriginal heritage site) through incorporation of an exclusion zone and management measures to minimise risks associated with vibration.

### **Intergenerational equity**

Social equity is concerned with the distribution of economic, social and environmental costs and benefits. Inter-generational equity introduces a temporal element with a focus on minimising the distribution of costs to future generations.

The proposal has integrated both short and long-term economic, social and environmental considerations so that any likely impacts are not left to be addressed by future generations.

For example, although the proposal was required to be implemented in the short-term to address key safety and network reliability concerns, the options assessment for the proposal considered whether the design would allow for the Heathcote Road bridge to be further upgraded to an 'ultimate' option with two lanes in each direction in the future, so as not to preclude this opportunity.

In addition, issues that have potential long-term implications were minimised or avoided, such as removal of vegetation, impacts on Aboriginal and non-Aboriginal heritage, consumption of non-renewable resources, greenhouse emissions and changes to hydrology during operation, through design refinement and application of appropriate environmental safeguards and management measures .

### **Conservation of biological diversity and ecological integrity**

Preserving biological diversity and ecological integrity requires that ecosystems, species, and biological diversity are maintained to ensure their survival.

As discussed in Section 6.3.3, the proposal would involve removal of up to:

- 0.05 hectares of PCT 781, which is associated with an EEC listed under the BC Act (Sydney Freshwater Wetlands in the Sydney Basin Bioregion)
- 0.5 hectares of PCT 1292
- 2.53 hectares of PCT 1250
- 0.04 hectares of non-native vegetation

However, the area of vegetation removal is relatively small compared to the extent of habitat in the locality and therefore is unlikely to impact the abundance or diversity of flora and fauna in the region in the long-term. It is also unlikely that any threatened fauna species would be solely reliant on the habitat within the proposal area considering the proximity of Heathcote Road and the extensive high-quality habitat nearby within Heathcote National Park and Holsworthy Military Reserve.

Additionally, the proposal may contribute to a net benefit to fauna connectivity through the provision of fauna furniture in response to the existing vehicle strike threat, particularly to koalas. These measures are proposed at both bridge abutments and have been demonstrated to be effective at facilitating Koala movement on other Transport for NSW road projects. Final design of the fauna connectivity features, including tie-in fencing details and landscape species selection, would be developed during detailed design in consultation with a suitably qualified ecologist and Transport for NSW biodiversity officer.

Similarly, the proposal may also contribute to a net biodiversity benefit by incorporating microbat roosting provisions on the bridge, including within the new elements of the bridge structure. Such features, including small gaps beneath the parapet, have been demonstrated to be effective at generating roosting habitat for the Southern Myotis (*Myotis macropus*) on other Transport for NSW bridge projects. Final design of the microbat habitat features would be developed during detailed design in consultation with a suitably qualified ecologist and Transport for NSW biodiversity officer.

### **Improved valuation, pricing and incentive mechanisms**

The principle of internalising environmental costs into decision making requires consideration of all environmental resources which may be affected by the carrying out of a project, including air, water, land and living things.

Environmental issues were considered as key matters in the options selection process and in the economic and financial feasibility assessments for the proposal. The value of the proposal to the community in terms of improved safety was also recognised.

Environmental safeguards and management measures for the avoidance, reuse, recycling and management of waste during construction and operation are to be implemented.

## **8.3 Conclusion**

The proposed Heathcote Road bridge widening is subject to assessment under Division 5.1 of the EP&A Act. The REF has examined and taken into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the proposed activity.

This has included consideration (as relevant) of conservation agreements and plans of management under the NPW Act, biodiversity stewardship sites under the BC Act, wilderness areas, areas of outstanding value, impacts on threatened species and ecological communities and their habitats and other protected fauna and native plants. It has also considered potential impacts to matters of national environmental significance listed under the EPBC Act.

A number of potential environmental impacts from the proposal have been avoided or reduced during the concept design development and options assessment. The proposal as described in the REF best meets the project objectives but would still result in some temporary impacts on traffic, noise and vibration, water quality, hydrology and flooding during construction, as well as some longer term biodiversity, non-Aboriginal heritage, property and visual impacts. Environmental safeguards and management measures as detailed in this REF would ameliorate or minimise these expected impacts. The proposal would also improve road safety and network reliability to alleviate community concern and reduce likelihood of road incidents. On balance the proposal is considered justified and the following conclusions are made.

### **Significance of impact under NSW legislation**

The proposal would be unlikely to cause a significant impact on the environment. Therefore it is not necessary for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning and Public Spaces under Division 5.2 of the EP&A Act. A Biodiversity Development Assessment Report or Species Impact Statement is not required. The proposal is subject to assessment under Division 5.1 of the EP&A Act. Consent from Council is not required.

### **Significance of impact under Australian legislation**

The proposal is not likely to have a significant impact on matters of national environmental significance or the environment of Commonwealth land within the meaning of the *Environment Protection and Biodiversity Conservation Act 1999*. A referral to the Australian Government Department of Agriculture, Water and Environment is not required.



## 9 Certification

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This review of environmental factors provides a true and fair review of the proposal in relation to its potential effects on the environment. It addresses to the fullest extent possible all matters affecting or likely to affect the environment as a result of the proposal.



Michael Drowley  
Associate Environmental Consultant  
Aurecon  
Date: 2/12/2020

I have examined this review of environmental factors and accept it on behalf of Transport for NSW.



Cameron Jordan  
Project Development Manager  
Transport for NSW Greater Sydney Program Office  
Date: 4/12/2020

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## Terms and acronyms used in this REF

Term/ Acronym	Description
A6 road corridor	A major arterial road corridor that includes the section of Heathcote Road between New Illawarra Road and the Princes Highway
ABS	Australian Bureau of Statistics
AEP	annual exceedance probability
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
Alignment	The vertical and horizontal location of the road
ANSTO	Australian Nuclear Science and Technology Organisation
AQMP	Air Quality Management Plan
ASRIS	Australian Soil Resource Information System
ASS	acid sulfate soil
Aurecon	Aurecon Australasia Pty Ltd
approaches	The sections of road that join either side of a bridge
BAM	Biodiversity Assessment Methodology
BC Act	<i>Biodiversity Conservation Act 2016</i> (NSW).
Capacity	Maximum number of vehicles which has a reasonable expectation of passing over a given section of a lane or a road in one direction during a given time period under prevailing road and traffic conditions.
CEMP	Construction Environmental Management Plan
Compound Location 1	Lucas Heights compound, which is located at the corner of Heathcote Road and New Illawarra Road
Compound Location 2	Heathcote compound, which is located at the corner of Princes Highway and Wilson Parade
CMP	Conservation Management Plan
CSP	<i>Sutherland Shire Council Community Strategic Plan</i>
CNMP	Construction Noise Management Plan
CNVG	<i>Construction Noise and Vibration Guideline</i> (Roads and Maritime Services, 2016)
CP	Communication Plan
CSEP	Community and Stakeholder Engagement Plan
DIN4150-3	<i>DIN4150-3:2016 Vibrations in buildings – Part 3: Effects on structures</i> (German Institute for Standardisation, 1999)
DPI	Department of Primary Industries
DPIE	NSW Department of Planning, Industry and the Environment
EEC	endangered ecological community

Term/ Acronym	Description
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i> (NSW). Provides the legislative framework for land use planning and development assessment in NSW
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Commonwealth). Provides for the protection of the environment, especially matters of national environmental significance, and provides a national assessment and approvals process.
ESD	Ecologically sustainable development. Development which uses, conserves and enhances the resources of the community so that ecological processes on which life depends, are maintained and the total quality of life, now and in the future, can be increased
EPA	NSW Environment Protection Authority
EPL	environmental protection licence
ESCP	Erosion and sedimentation control plan
EWMS	Environmental work method statements
FM Act	<i>Fisheries Management Act 1994</i> (NSW)
GDE	groundwater dependent ecosystems
Georges River Catchment REP	<i>Greater Metropolitan Regional Environmental Plan No 2 – Georges River Catchment</i>
GLALC	Gandangarra Local Aboriginal Land Council
GMA	Greater Metropolitan Area
Heathcote Road bridge	Bridge No. 152 over the Woronora River
Heritage Act	<i>Heritage Act 1977</i> (NSW)
HGL	Hydrogeological landscape
HRC	Healthy Rivers Commission
HRMP	Hazard and Risk Management Plan
ICNG	<i>Interim Construction Noise Guideline</i> (DECC, 2009)
ISEPP	State Environmental Planning Policy (Infrastructure) 2007
KFH	key fish habitat
LALC	Local Aboriginal Land Council
LCZ	landscape character zone
LEP	Local Environmental Plan. A type of planning instrument made under Part 3 of the EP&A Act.
LGA	Local government area
LoS	Level of Service. A qualitative measure describing operational conditions within a traffic stream and their perception by motorists and/or passengers.
LSPS	Local Strategic Planning Statement



Term/ Acronym	Description
mAHD	Metres above the Australian Height Datum
MNES	Matters of national environmental significance under the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> .
NCA	Noise catchment area
NMLs	Noise management levels
NPW Act	<i>National Parks and Wildlife Act 1974</i> (NSW)
NPWS	National Parks and Wildlife Service (a directorate of the DPIE)
NSW	New South Wales
NVMP	Noise and Vibration Management Plan
NWQMS	National Water Quality Management Strategy
OEH	NSW Office of Environment and Heritage
OOHW	Out of hours work
PACHCI	<i>Procedure for Cultural Heritage Consultation and Investigation</i> (PACHCI) (Roads and Maritime, 2011a)
PAD	potential archaeological deposit
PCT	plant community types
PFAS	per- and polyfluoroalkyl substances
POEO Act	<i>Protection of the Environment Operations Act 1997</i> (NSW)
PPV	peak particle velocity
proposal area	<p>The 'proposal area' refers to the area that may be directly impacted by construction and operation of the proposal (shown in Figures 1-1 and 1-2). The proposal area includes both the:</p> <ul style="list-style-type: none"> <li>• construction footprint, which is the area where construction activities would occur for the proposal and includes land that would be temporarily impacted for the construction compound sites, temporary access track, waterway crossing and crane pads</li> <li>• operational footprint, which includes the areas that would be permanently impacted by the proposal including the widened bridge and approaches and supporting infrastructure</li> </ul>
QA Specifications	Specifications developed by Transport for NSW for use with road work and bridge work contracts let by Transport for NSW.
RBL	Rating background levels
REF	Review of environmental factors
Roads and Maritime or RMS	NSW Roads and Maritime Services, now known as Transport for NSW
RFOs	River Flow Objectives
RUSLE	Revised universal soil loss equation

Term/ Acronym	Description
RWMP	Resource and Waste Management Plan
s170 heritage register	Roads and Maritime Services Section 170 Heritage and Conservation Register
SA2	Statistical Area Level 2
SEED	NSW Government's sharing and enabling environmental data datasets
SEPP	State Environmental Planning Policy. A type of planning instrument made under Part 3 of the EP&A Act.
SOHI	Statement of Heritage Impact
study area	The 'study area' consists of land in the vicinity of, and including, the proposal area. The study area is the wider area surrounding the proposal area, including land that has the potential to be indirectly impacted by the proposal beyond the immediate works area (for example, as a result of any noise or traffic diversions). The scope of the study area varies depending on the environmental factor being assessed.
SWMP	Soil and Water Management Plan
TEC	threatened ecology community
the proposal	Heathcote Road bridge widening
TLALC	Tharawal Local Aboriginal Land Council
TMP	Traffic Management Plan
WARR Act	<i>Waste Avoidance and Resource Recovery Act 2001 (NSW)</i>
WM Act	<i>Water Management Act 2000 (NSW)</i>
WQOs	Water Quality Objectives
WSUD	water sensitive urban design

## Appendix A

Consideration of clause 228(2) factors and matters of national environmental significance and Commonwealth land

## Clause 228(2) Checklist

In addition to the requirements of the *Is an EIS required?* guideline (DUAP 1995/1996) and the *Roads and Related Facilities EIS Guideline* (DUAP 1996) as detailed in the REF, the following factors, listed in clause 228(2) of the Environmental Planning and Assessment Regulation 2000, have also been considered to assess the likely impacts of the proposal on the natural and built environment.

Factor	Impact
<p>a) <i>Any environmental impact on a community?</i></p> <p>The proposal would result in the following environmental impacts on the community:</p> <ul style="list-style-type: none"> <li>• improved road safety and network reliability during operation</li> <li>• traffic delays and increased travel time during the proposed full road closure and detour route for construction of the proposal</li> <li>• potential noise and vibration impacts to surrounding sensitive receivers during construction of the proposal</li> </ul>	<p>Long-term moderate positive impact</p> <p>Short-term moderate negative impacts</p>
<p>b) <i>Any transformation of a locality?</i></p> <p>The proposal is unlikely to result in any transformation of a locality as it would not change the current land use within the proposal footprint, as the proposal involves upgrading an existing bridge and section of road.</p>	<p>Nil</p>
<p>c) <i>Any environmental impact on the ecosystems of the locality?</i></p> <p>The proposal would involve removal of up to 3.12 hectares of vegetation, of which 0.05 hectares is consistent with an EEC listed under the BC Act (Sydney Freshwater Wetlands in the Sydney Basin Bioregion, which could lead to a reduction of threatened fauna habitat within the proposal area. Safeguards and mitigation measures have been proposed in Section 6.3.4, to manage and minimise these impacts where possible.</p>	<p>Long-term minor negative impact</p>
<p>d) <i>Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality?</i></p> <p>The proposal may result in a temporary reduction in the aesthetic and recreational quality of the area during the construction phase in the form of noise and visual impacts. The proposal may also result in temporary reduction environmental quality due to water quality and hydrological impacts during construction. Safeguards and mitigation measures have been proposed to manage and minimise these impacts where possible.</p>	<p>Short-term minor negative impact</p>



Factor	Impact
<p><i>e) Any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations?</i></p> <p>The new elements that would be attached to Heathcote Road bridge to achieve widening may result in impacts on non-Aboriginal heritage (as the bridge is listed on the Roads and Maritime Services Section 170 Heritage and Conservation Register). The design has been able to mitigate these impacts as much as possible through sympathetic designs based on heritage advice so as not to diminish the item's heritage significance to the extent that the works are unacceptable from a heritage perspective or to preclude it from the ability to be formally state heritage listed in future.</p> <p>The proposal area also covers a portion of the listed Cubbitch Barta National Estate heritage place. Natural landscapes which are tied to the cultural values of the site would be partially impacted by the proposal (through activities such as rock trimming and construction of the temporary access track).</p>	<p>Long-term minor negative impact</p> <p>Short-term minor negative impact</p>
<p><i>f) Any impact on the habitat of protected fauna (within the meaning of the Biodiversity Conservation Act 2016)?</i></p> <p>The proposal would involve removal of up to 3.12 hectares of vegetation, of which 0.05 hectares is consistent with an EEC listed under the BC Act (Sydney Freshwater Wetlands in the Sydney Basin Bioregion, which could lead to a reduction of threatened fauna habitat within the proposal area. Safeguards and mitigation measures have been proposed in Section 6.3.4, to manage and minimise these impacts where possible.</p>	<p>Long-term minor negative impact</p>
<p><i>g) Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air?</i></p> <p>The proposal may result in a potential for wildlife injury or mortality throughout the construction phase due to vehicle and equipment movements within the proposal area. However, this would not be a major impact or endanger any species.</p>	<p>Short-term minor negative impact</p>
<p><i>h) Any long-term effects on the environment?</i></p> <p>The proposal would result in loss of vegetation due to the works, however this would not result in a significant impact to the environment.</p>	<p>Long-term minor negative impact</p>
<p><i>i) Any degradation of the quality of the environment?</i></p> <p>Providing the mitigation measures outlined in this REF are implemented (refer to Section 7.2), the proposal is not expected to result in noticeable degradation of the quality of the environment.</p>	<p>Nil</p>
<p><i>j) Any risk to the safety of the environment?</i></p> <p>The proposal would result in increased safety for road users of the Heathcote Road bridge and approaches through provision of increased lane and shoulder widths that meet current road safety standards.</p>	<p>Long-term major positive impact</p>

Factor	Impact
<p><i>k) Any reduction in the range of beneficial uses of the environment?</i></p> <p>The proposal would not result in a reduction in the range of beneficial uses of the environment.</p>	Nil
<p><i>l) Any pollution of the environment?</i></p> <p>Providing the mitigation measures outlined in this REF are implemented (refer to Section 7.2), the proposal is not expected to result in any pollution of the environment.</p>	Nil
<p><i>m) Any environmental problems associated with the disposal of waste?</i></p> <p>The proposal is not likely to cause environmental problems associated with the disposal of waste. Standard mitigation measures have been proposed in Section 6.11.2.</p>	Nil
<p><i>n) Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply?</i></p> <p>The proposal is not likely to result in increased demands on resources which are or are likely to become in short supply.</p>	Nil
<p><i>o) Any cumulative environmental effect with other existing or likely future activities?</i></p> <p>The proposal may result in cumulative adverse traffic impacts with other nearby future activities during construction, including the Linden Street upgrade, such as increased traffic on the proposed detour route. Mitigation measures have been proposed in Section 6.12.5, to avoid or minimise these impacts, where possible.</p> <p>During operation, the proposal would result in cumulative positive traffic impacts with other future upgrades proposed to improve the reliability, safety and efficiency of the A6 road corridor such as the Heathcote Road intersection improvements project.</p>	<p>Short-term minor negative impact</p> <p>Long-term minor positive impact</p>
<p><i>p) Any impact on coastal processes and coastal hazards, including those under projected climate change conditions?</i></p> <p>The proposal would not impact on coastal processes or hazards, including those under projected climate change conditions.</p>	Nil

## Matters of National Environmental Significance and Commonwealth land

Under the environmental assessment provisions of the EPBC Act, the following matters of national environmental significance and impacts on the Commonwealth land are required to be considered to assist in determining whether the proposal should be referred to the Australian Government Department of Agriculture, Water and Environment.

A referral is not required for proposed actions that may affect nationally listed threatened species, endangered ecological communities and migratory species. Impacts on these matters are still assessed as part of the REF in accordance with Australian Government significant impact criteria and taking into account relevant guidelines and policies.

Factor	Impact
<p>a) Any impact on a World Heritage property?</p> <p>There are no World Heritage properties within or near the proposal area.</p>	<p>Nil</p>
<p>b) Any impact on a National Heritage place?</p> <p>The proposal would involve a minor impact to a small portion of the Cubbitch Barta National Estate Area (Aboriginal and Non-Aboriginal heritage significance), which is a Commonwealth Heritage Place.</p> <p>The closest National Heritage place is the Royal National Park, which is located about 100 metres north-east of the Heathcote compound. However, no direct or indirect impacts are expected on the Royal National Park.</p>	<p>Minor direct impact on Cubbitch Barta National Estate Area</p>
<p>c) Any impact on a wetland of international importance?</p> <p>There are no wetlands of international importance within or near the proposal area.</p>	<p>Nil</p>
<p>d) Any impact on a listed threatened species or communities?</p> <p>Assessments of significance for threatened species listed under the EPBC Act were carried out for:</p> <ul style="list-style-type: none"> <li>• flora species: <ul style="list-style-type: none"> <li>○ Thick-leaf Star-hair <i>Astrotricha crassifolia</i> (Vulnerable)</li> <li>○ Small-flower <i>Grevillea parviflora subsp. parviflora</i> (Vulnerable)</li> <li>○ Woronora Beard-heath <i>Leucopogon exolasius</i> (Vulnerable)</li> <li>○ Deane's Paperbark <i>Melaleuca deanei</i> (Vulnerable)</li> </ul> </li> <li>• fauna species: <ul style="list-style-type: none"> <li>○ Broad-headed Snake <i>Hoplocephalus bungaroides</i> (Vulnerable)</li> <li>○ Large-eared Pied Bat <i>Chalinolobus dwyeri</i> (Vulnerable)</li> <li>○ Grey-headed Flying-fox <i>Pteropus poliocephalus</i> (Vulnerable)</li> </ul> </li> </ul>	<p>Minor direct and indirect impacts may occur for listed threatened species.</p> <p>No significant impact on threatened species would occur as a result of the proposal, provided appropriate safeguards and management measures are implemented.</p>

Factor	Impact
<ul style="list-style-type: none"> <li>○ Koala <i>Phascolarctos cinereus</i> (combined populations of Qld, NSW and the ACT) (Vulnerable)</li> <li>○ Australian Bittern <i>Botaurus poiciloptilus</i> (Endangered)</li> </ul> <p>. These assessments are provided in Appendix D of the <i>Biodiversity Assessment Report</i> provided in Appendix D of this REF. Overall, the assessments of significance concluded that a significant impact on threatened species is not considered to be likely providing safeguards and management measures are implemented (refer to Section 6.3.4).</p>	
<p>e) Any impacts on listed migratory species?</p> <p>The biodiversity assessment concluded two of the listed migratory species may occur within the study area on occasion: Black-faced Monarch <i>Monarcha melanopsis</i> and Rufous Fantail <i>Rhipidura rufifrons</i>.</p> <p>The proposal would involve the removal of up to 3.12 hectares of vegetation, which is considered a small amount compared to other potentially suitable habitat surrounding the proposal. Overall, a significant impact is considered unlikely on these species as no important habitat will be substantially modified, destroyed, or isolated, the risk of invasive species establishment can be mitigated, and no serious disruptions to the lifecycle of these migratory species is anticipated.</p>	<p>Minor direct and indirect impacts may occur for listed migratory species.</p>
<p>f) Any impact on a Commonwealth marine area?</p> <p>There are no Commonwealth marine areas within or near the proposal area.</p>	<p>Nil</p>
<p>g) Does the proposal involve a nuclear action (including uranium mining)?</p> <p>The proposal would not involve any nuclear action.</p>	<p>Nil</p>
<p>h) Additionally, any impact (direct or indirect) on the environment of Commonwealth land?</p> <p>The proposal is located near Commonwealth Land associated with the Holsworthy Military Barracks and the Australian Nuclear Science &amp; Technology Organisation. The proposal has been designed to avoid any direct impacts on Commonwealth land. However, the proposal may involve short-term indirect impacts on Commonwealth Land associated with noise and vibration during construction, however these impacts would be minor and minimised through safeguards and management measures.</p>	<p>Minor indirect impacts on Commonwealth land</p>



# Appendix B

## Statutory consultation checklists

# Infrastructure SEPP

## Certain development types

Development type	Description	Yes/No	If 'yes' consult with	ISEPP clause
Car Park	Does the project include a car park intended for the use by commuters using regular bus services?	No	Sutherland Shire Council	ISEPP cl. 95A
Bus Depots	Does the project propose a bus depot?	No	Sutherland Shire Council	ISEPP cl. 95A
Permanent road maintenance depot and associated infrastructure	Does the project propose a permanent road maintenance depot or associated infrastructure such as garages, sheds, tool houses, storage yards, training facilities and workers' amenities?	No	Sutherland Shire Council	ISEPP cl. 95A

## Development within the Coastal Zone

Issue	Description	Yes/No/NA	If 'yes' consult with	ISEPP clause
Development with impacts on certain land within the coastal zone	Is the proposal within a coastal vulnerability area and is inconsistent with a certified coastal management program applying to that land?	No	Sutherland Shire Council	ISEPP cl. 15A

## Council related infrastructure or services

Issue	Potential impact	Yes/No	If 'yes' consult with	ISEPP clause
Stormwater	Is the work likely to have a <i>substantial</i> impact on the stormwater management services which are provided by council?	No	Sutherland Shire Council	ISEPP cl.13(1)(a)
Traffic	Is the work likely to generate traffic to an extent that will <i>strain</i> the capacity of the existing road system in a local government area?	No	Sutherland Shire Council	ISEPP cl.13(1)(b)

Issue	Potential impact	Yes/No	If 'yes' consult with	ISEPP clause
Sewerage system	Will the work involve connection to a council owned sewerage system? If so, will this connection have a <i>substantial</i> impact on the capacity of any part of the system?	No	Sutherland Shire Council	ISEPP cl.13(1)(c)
Water usage	Would the work involve connection to a council owned water supply system? If so, would this require the use of a <i>substantial</i> volume of water?	No	Sutherland Shire Council	ISEPP cl.13(1)(d)
Temporary structures	Would the work involve the installation of a temporary structure on, or the enclosing of, a public place which is under local council management or control? If so, would this cause more than a <i>minor</i> or <i>inconsequential</i> disruption to pedestrian or vehicular flow?	No	Sutherland Shire Council	ISEPP cl.13(1)(e)
Road & footpath excavation	Would the work involve more than <i>minor</i> or <i>inconsequential</i> excavation of a road or adjacent footpath for which council is the roads authority and responsible for maintenance?	No	Sutherland Shire Council	ISEPP cl.13(1)(f)

## Local heritage items

Issue	Potential impact	Yes/No	If 'yes' consult with	ISEPP clause
Local heritage	Is there is a local heritage item (that is not also a State heritage item) or a heritage conservation area in the study area for the work? If yes, does a heritage assessment indicate that the potential impacts to the heritage significance of the item/area are more than <i>minor</i> or <i>inconsequential</i> ?	No	Sutherland Shire Council	ISEPP cl.14

## Flood liable land

Issue	Potential impact	Yes/No	If 'yes' consult with	ISEPP clause
Flood liable land	Is the work located on flood liable land? If so, would the work change flood patterns to more than a <i>minor</i> extent?	No	Sutherland Shire Council	ISEPP cl.15
Flood liable land	Is the work located on flood liable land? (to any extent). If so, does the work comprise more than minor alterations or additions to, or the demolition of, a building, emergency work or routine maintenance	No	State Emergency Services	ISEPP cl.15AA

Note: Flood liable land means land that is susceptible to flooding by the probable maximum flood event, identified in accordance with the principles set out in the manual entitled *Floodplain Development Manual: the management of flood liable land* published by the New South Wales Government.

## Public authorities other than councils

Issue	Potential impact	Yes/No	If 'yes' consult with	ISEPP clause
National parks and reserves	Is the work adjacent to a national park or nature reserve, or other area reserved under the <i>National Parks and Wildlife Act 1974</i> , or on land acquired under that Act?	Yes	Environment, Energy and Science, DPIE	ISEPP cl.16(2)(a)



Issue	Potential impact	Yes/No	If 'yes' consult with	ISEPP clause
National parks and reserves	Is the work on land in Zone E1 National Parks and Nature Reserves or in a land use zone equivalent to that zone?	No	Environment, Energy and Science, DPIE	ISEPP cl. 16(2)(b)
Aquatic reserves	Is the work adjacent to an aquatic reserve or a marine park declared under the <i>Marine Estate Management Act 2014</i> ?	No	DPIE	ISEPP cl.16(2)(c)
Sydney Harbour foreshore	Is the work in the Sydney Harbour Foreshore Area as defined by the <i>Place Management NSW Act 1998</i> ?	No	Property NSW	ISEPP cl.16(2)(d)
Bush fire prone land	Is the work for the purpose of residential development, an educational establishment, a health services facility, a correctional centre or group home in bush fire prone land?	No	Rural Fire Service	ISEPP cl.16(2)(f)
Artificial light	Would the work increase the amount of artificial light in the night sky and that is on land within the dark sky region as identified on the dark sky region map? (Note: the dark sky region is within 200 kilometres of the Siding Spring Observatory)	No	Director of the Siding Spring Observatory	ISEPP cl.16(2)(g)
Defence communications buffer land	Is the work on buffer land around the defence communications facility near Morundah? (Note: refer to Defence Communications Facility Buffer Map referred to in clause 5.15 of Lockhardt LEP 2012, Narrandera LEP 2013 and Urana LEP 2011).	No	Secretary of the Commonwealth Department of Defence	ISEPP cl. 16(2)(h)

Issue	Potential impact	Yes/No	If 'yes' consult with	ISEPP clause
Mine subsidence land	Is the work on land in a mine subsidence district within the meaning of the <i>Mine Subsidence Compensation Act 1961</i> ?	No	Mine Subsidence Board	ISEPP cl. 16(2)(i)