Transport for NSW

Henry Lawson Drive Upgrade Stage 1B

Review of Environmental Factors

June 2023

NSW GOVERNMENT

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Acknowledgement of Country

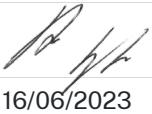
Transport for NSW acknowledges Darug and Eora People, the traditional custodians of the land on which the Henry Lawson Drive Upgrade Stage 1B is proposed.

We pay our respects to their Elders past and present and celebrate the diversity of Aboriginal people and their ongoing cultures and connections to the lands and waters of NSW.

Many of the transport routes we use today – from rail lines, to roads, to water crossings – follow the traditional Songlines, trade routes and ceremonial paths in Country that our nation's First Peoples followed for tens of thousands of years.

Transport for NSW is committed to honouring Aboriginal peoples' cultural and spiritual connections to the land, waters and seas and their rich contribution to society.

Approval and authorisation

Title	Henry Lawson Drive Upgrade Stage 1B Review of Environmental Factors
Accepted on behalf of Transport for NSW by:	Alex Lyle, Project Development Manager
Signed	
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Executive summary

The proposal

Transport for NSW (Transport) proposes to upgrade a 1.8-kilometre section of Henry Lawson Drive between Auld Avenue, Milperra and the approach to the M5 Motorway (known as the Henry Lawson Drive Upgrade Stage 1B) (the proposal). The proposal includes road widening to increase traffic capacity and improve travel time, as well as upgrades of key intersections to enhance capability and driver safety.

Key features of the proposal include:

- widening Henry Lawson Drive from two to four lanes between Auld Avenue, Milperra and the M5 Motorway, Milperra with a raised central median
- upgrading the Henry Lawson Drive / Bullecourt Avenue signalised intersection, including:
  - an additional right-turn lane from Henry Lawson Drive (northbound) to Bullecourt Avenue (two right-turn lanes total)
  - an additional right-turn lane from Bullecourt Avenue to Henry Lawson Drive (northbound) (two right-turn lanes total)
  - converting the existing dedicated left-turn lane from Bullecourt Avenue to Henry Lawson Drive (southbound) into a dedicated left-turn slip lane
  - maintaining the dedicated left-turn lane from Henry Lawson Drive (southbound) to Bullecourt Avenue
- upgrading the Henry Lawson Drive / Pozieres Avenue signalised intersection, including:
  - a new dedicated right-turn lane from Henry Lawson Drive (southbound) to Pozieres Avenue
  - a new dedicated left-turn lane from Henry Lawson Drive (northbound) to Pozieres Avenue and relocation of the existing bus stop north of the intersection
- providing a new two-lane local link road between Auld Avenue and Keys Parade (about 160 metres), crossing over Milperra Drain, providing access to / from southbound lanes of Henry Lawson Drive and Auld Avenue, and removing up to eight parking spaces on Auld Avenue to accommodate the link road
- extending Raleigh Road about 120 metres to connect with Keys Parade at a roundabout, and removing the direct connection between Raleigh Road and Henry Lawson Drive
- converting the Henry Lawson Drive intersections to be left-in left-out only, at:
  - Ruthven Avenue
  - Whittle Avenue
  - Amiens Avenue
  - Ganmain Crescent
  - Fromelles Avenue
  - Hermies Avenue
- modifying the Bullecourt Avenue / Ashford Avenue intersection to better accommodate heavy vehicle movements
- constructing a three-metre-wide shared path:
  - on the western/southern side of Henry Lawson Drive between Pozieres Avenue and Keys Parade
  - along Keys Parade, the new Auld Avenue local link road and the extended section of Raleigh Road
- reconstruction of some existing shared paths within the proposal area
- constructing a new footpath within the proposal area:
  - on the eastern side of Henry Lawson Drive between the Flower Power and Ingram Avenue
  - along the northern side of Ingram Avenue
  - along the eastern side of Fromelles Avenue

- installing new drainage infrastructure and water quality controls within the proposal area, including:
  - an upgraded longitudinal and transverse drainage pits and pipes network along Henry Lawson Drive
  - a bioretention basin between Henry Lawson Drive, Bullecourt Avenue and Fleurbaix Avenue and maintenance access to this basin
  - swales along Henry Lawson Drive and Keys Parade and installation of Gross Pollutant Traps
  - relocation of an existing swale along the Auld Avenue link road
- construction activities and ancillary work, including:
  - relocation of utilities (including electrical, gas, water, and telecommunications)
  - civil earthworks, drainage work, water quality controls, and tie-in work to adjoining sections of Henry Lawson Drive and local roads
  - final roadworks including pavement, kerb and gutters, signs, road furniture, landscaping, lighting, and line marking
  - new traffic signals and intelligent transport systems including, but not limited to, closed-circuit television
  - establishment of temporary ancillary facilities to support construction, including compound sites, site offices, stockpile and laydown locations, temporary access tracks and water quality devices.

Access along Henry Lawson Drive would be maintained during construction, however, reduced speed limits may be implemented. Traffic switches and lane closures may be required during each stage of construction (refer to Section 3.3). Where possible, these lane closures would be timed during low traffic periods (such as at night or outside peak periods). Motorists would be informed of changed traffic conditions prior to the changes coming into effect. Access for emergency vehicles would be maintained, as well as emergency access from the Flower Power complex.

Temporary road closures would also be required as part of construction staging (refer to Section 3.3.1)

Construction is expected to start in 2026 and would take around two years to complete.

Need for the proposal

The proposal is needed to:

- alleviate traffic congestion, especially during peak hours
- improve road safety
- support projected large scale residential and commercial development in and around Milperra.

Without the development of the proposal, road and traffic conditions in the area would continue to deteriorate. The development of the proposal is consistent with the objectives, aims and strategic goals of existing Transport, land use and road safety planning documents.

Section 2.1 provides further details regarding the strategic need for the proposal.

Proposal objectives

The objectives of the proposal are to:

- improve travel times, journey time reliability and road safety outcomes for all road users
- improve freight efficiency and reduce vehicle operating costs on the road network
- support new developments in the precinct by improving traffic flow and connectivity to Bankstown Airport, Milperra Industrial Estate and proposed residential development in the area and the surrounding road network
- improve connectivity and safety for pedestrians and cyclists.

The proposal also aims to:

- minimise impacts to the environment
- minimise impacts to social amenity
- provide value for money.

Options considered

Four strategic options were considered to address the key issues of congestion, lack of future capacity, road closures due to flooding and other events, rat running in surrounding residential areas, and crash history along Henry Lawson Drive.

The following four strategic response options were considered:

- do-minimum – maintenance of Henry Lawson Drive only
- increase capacity – duplication of Henry Lawson Drive
- travel demand management – implementation of contra-flow arrangements on Henry Lawson Drive
- increase productivity – upgrade Henry Lawson Drive to a bus rapid transit or light rail corridor.

Of these strategic options, the 'increase capacity' option was selected as it is expected to address the identified key issues associated with Henry Lawson Drive. It was also acknowledged that the strategic options of 'travel demand management' and 'increase productivity' would be considered at a later stage (GTA Consultants, 2019).

A Value Management Workshop was held to assess ways of increasing capacity on Henry Lawson Drive. The following three alternatives were considered against a 'do minimum': option:

- alternative 1 – widening of Henry Lawson Drive to four lanes (two lanes in each direction)
- alternative 2 – widening of Henry Lawson Drive to four lanes (two lanes in each direction) with a widened median to allow for six lanes in the future
- alternative 3 – widening of Henry Lawson Drive to six lanes (three lanes in each direction).

Widening Henry Lawson Drive to four lanes (alternative 1) was the preferred option, as it provided the greatest benefits in terms of road safety, traffic performance, constructability, environmental outcomes and cost.

Section 2.4 details the options considered.

Statutory and planning framework

The proposal is a road upgrade to be carried out by Transport and can therefore be assessed under Division 5.1 of the *Environmental Planning and Assessment Act 1979*. Development consent from council is not required.

This Review of Environmental Factors (REF) has been prepared to meet the requirements of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). A referral to the Commonwealth Department of Agriculture, Water and the Environment is not required. A Biodiversity Assessment Report has been prepared and the outcome of the tests of significance and EPBC Act assessments of significance indicated there is a high level of certainty the impacts to threatened biodiversity are unlikely to be significant. Given the proposal is not likely to lead to a significant impact on threatened species, populations, ecological communities or their habitats, a Species Impact Statement (SIS) is not required under the *Biodiversity Conservation Act 2016* (BC Act) to support this proposal.

Community and stakeholder consultation

Transport has engaged with the community and other stakeholders during the development of the proposal in early concept design, concept design planning phases, and in preparing the REF.

The *Henry Lawson Drive Upgrade Stage 1B: Communication and Stakeholder Engagement Strategy* (consultation strategy) has been implemented during development of the proposal. The objective of this strategy is to ensure; local residents, businesses, and other stakeholders are aware of and are consulted during the proposal's development and construction phases.

Transport invited feedback on the proposal during a 'Have Your Say' consultation period from 31 October to 18 November 2022. The *Henry Lawson Drive Upgrade Stage 1B, Milperra Consultation Report* (Transport, 2022b) is included in Appendix C. The key themes raised included:

- traffic and transport impacts, including:
  - Henry Lawson Drive road conditions
  - local traffic and access changes
  - intersection upgrades
  - the new local link road between Auld Avenue and Keys Parade
  - freight routes
- active transport impacts, including:
  - shared paths and footpaths
  - pedestrian and cyclist safety
- biodiversity impacts
- hydrology, flooding, and surface water impacts
- noise and vibration impacts
- property and land use impacts.

Details of feedback provided and our response to feedback is outlined in section 5.2. Feedback received has informed the proposed design outlined in this REF (refer to Chapter 3).

Canterbury Bankstown Council and the State Emergency Service were also consulted under the State Environment Planning Policy (Transport and Infrastructure) 2021. The key themes raised included:

- support for the proposed design
- traffic and transport queries relating to the integration of the proposal with surrounding development, intersection upgrades, and the installation of traffic management devices throughout the proposal area
- active transport queries relating to safety and infrastructure upgrades
- environment and heritage queries relating to; vegetation removal, flood impacts, and heritage items
- the need for council to further investigate impacts of the proposal on garbage truck movements.

Transport will continue to consult with the community and relevant stakeholders during the detailed design and construction phases of the proposal.

Environmental impacts

The main environmental impacts of the proposal are summarised in the following sections.

Arboriculture

Henry Lawson Drive features two rows of trees along its western side and one row of trees on the eastern side. The development of the proposed design aimed to minimise tree removal by maximising the use of the existing cleared areas in the road reserve. However, this has resulted in trees in the row closest to the existing road on the western side of Henry Lawson Drive needing to be removed due to the creation of the additional trafficable lanes.

Transport then undertook a further Arboricultural Impact Assessment (AIA) to assess 109 trees along Henry Lawson Drive and the Auld Avenue to Keys Parade local link road to better understand impacts and whether there were opportunities to further retain trees. Of the trees assessed, 19 trees were identified for retention, but 90 trees would be subject to a large enough impact that would require removal. These 90 trees include:

- 83 trees in the second row of trees on the western side of Henry Lawson Drive
- three trees on the eastern side of Henry Lawson Drive near the Henry Lawson Drive / Bullecourt Avenue intersection
- the J Morrison Settler Tree on Henry Lawson Drive opposite Ruthven Avenue (the current assessment shows that this tree would need to be removed)

- three trees located near the new local link road between Auld Avenue and Keys Parade.

Throughout detailed design, opportunities to retain additional trees, including the J Morrison Settler Tree, would be explored to minimise the impacts of the proposal to nearby trees, particularly in relation to the shared path alignment and construction.

To minimise the long-term impacts of tree removal to the character of the area, a landscaping and replanting plan would be implemented in accordance with Safeguard V2. Replanting would occur within the Henry Lawson Drive corridor where possible. The landscaping plan can be found in Appendix G. Tree removal would be offset in consultation with Canterbury Bankstown Council. In addition, the impacts of the proposal to vegetation and threatened species habitat would be offset in line with Transport's Biodiversity Policy (Transport, 2022c).

Traffic and transport

During construction, there would be increased traffic, including heavy vehicles and light vehicles. While the construction traffic would be noticeable, the additional volume would be relatively small compared to the existing traffic volumes on Henry Lawson Drive. In addition, where possible, local roads would not be used by construction vehicles.

Construction would also result in temporary changes in road and property access. While Henry Lawson Drive and local roads would remain open, there may be a need for temporary lane closures or detours for motorists, pedestrians or cyclists accessing the local road network at times during construction. This would be confirmed by the construction contractor and the community notified. The seven bus stops within the proposal area would also be temporarily relocated to safe locations to allow for continued access during construction.

During operation, the proposal would result in slightly improved performance compared to the 'without proposal' scenario in AM, PM and weekend peaks for both 2031 and 2041, due to improved network average speed. Travel times between Milperra Road and the M5 Motorway along Henry Lawson Drive are expected to decrease by the proposal in all modelled scenarios except the 2041 AM peak. This is due to queuing at the Henry Lawson Drive / Bullecourt Avenue intersection. Additionally, signalised intersection performance is largely expected to improve due to the proposal when compared to the 'without proposal' scenario. Some modelled scenarios saw a reduction in intersection performance, however this is largely due to future increases in traffic volumes.

The proposal would install a raised concrete median along Henry Lawson Drive within the proposal area which would convert the Henry Lawson Drive intersections of Ruthven Avenue, Whittle Avenue, Amiens Avenue, Ganmain Crescent, Fromelles Avenue and Hermies Avenue to be left-in left-out only. Local residents wishing to turn right from Henry Lawson Drive into these local roads would need to turn right at the signalised intersections of Keys Parade, Bullecourt Avenue or Pozieres Avenue to access these roads via the local road network. Alternate routes for access to affected intersections and properties are outlined in section 3.2.3.

A new shared path would be located along the western/southern side of Henry Lawson Drive between Pozieres Avenue and Borella Road and north of Raleigh Road, along the Raleigh Road extension to Keys Parade and along the new Auld Avenue to Keys Parade local link road. New footpaths would also be constructed along the eastern side of Henry Lawson Drive between the Flower Power complex and Ingram Avenue, and along the eastern side of Ingram Avenue and Fromelles Avenue. These new shared paths and footpaths would tie into existing paths and improve pedestrian and cyclist connectivity within the proposal area.

Transport would continue to investigate the construction and operational traffic and transport impacts of the proposal during detailed design. During construction, the contractor would implement a Traffic Management Plan and provide measures to maintain access to local roads, properties and pedestrian and cyclist access. Other measures to minimise traffic impacts from the proposal include limiting the movement of heavy vehicles during peak traffic periods and consultation with property owners affected by alternate access conditions. Relevant stakeholders would be notified of changed operational traffic conditions, including emergency services and bus service providers. In addition, measures would be further developed during detailed design to minimise operational parking impacts, including minimising the number of parking spaces required for removal near the intersection of Auld Avenue with the new link road.

Noise and vibration

A noise and vibration assessment was carried out to understand the construction noise and vibration impacts and the operational traffic noise impacts of the proposal. During construction, residential receivers closest to the proposal on Henry Lawson Drive, Bullecourt Avenue, Ashford Avenue, Raleigh Road, and Auld Avenue are expected to experience the greatest noise impacts. The highest construction noise levels to be experienced include:

- at the beginning of construction during preliminary work such as excavations, utility adjustments and the establishment of drainage infrastructure
- during night-time construction periods
- when noisy equipment is being used, which includes chainsaws, chippers, and concrete saws.

Sleep disturbance would only be experienced by residents when night-time activities of road widening, and pavement work are being carried out near their homes. As work would progress along the corridor, receivers would only be impacted for a period of time and not for the entire construction period.

High noise emitting equipment would only be required occasionally, and the noisiest works would be carried out during daytime hours, where possible, meaning high noise impacts would only be experienced occasionally and for short periods of time. Mitigation measures would be implemented in accordance with Transport's Construction Noise and Vibration Guideline (CNVG) (RMS, 2016).

Residential receivers along Henry Lawson Drive and near the Bullecourt Avenue / Ashford Avenue intersection are likely to experience the highest vibration impacts, but only when vibration intensive equipment, such as vibratory rollers and jackhammers, are in use.

During operation, most homes and businesses throughout the proposal area are not expected to experience increases in traffic noise levels from existing conditions. However, there would be 3 residential properties on Henry Lawson Drive that would experience an increase in traffic noise levels of greater than 2dB due to the proposal.

In total, 116 residential properties (a conservative estimate) would be eligible to be considered for additional noise mitigation treatment based on the current proposal. Further assessment and refinement would be undertaken during detailed design to consider those eligible for treatment, taking into account additional noise verification, existing building structure, and any prior noise treatment. At-property treatments are preferred for the proposal as noise mounds/barriers were not deemed to be feasible or reasonable due to the character of the road corridor, stormwater flow patterns and residential property access constraints. Noise and vibration safeguards and management measures can be found in section 6.3.5.

Hydrology and flooding

Due to the constrained nature of the proposal area, and the nearby Georges River, ancillary facilities have the potential to be impacted if a mid to large sized flood event were to occur during construction. Stockpiling of materials would only be carried out at ancillary facilities which would not be impacted in flood events. Construction in flood prone areas would need to be managed and scheduled so that works would not be carried out during potential rain and flood events. A Flood Management Plan would be developed and implemented to manage residual flood impacts during construction and the potential for construction activities to adversely impact on flood behaviour. Consultation with the NSW SES about any anticipated flood risks would continue during the detailed design and construction phases of the proposal.

During operation, flood conditions in the proposal area are expected to be slightly worse than existing flood conditions during flooding of the Milperra Catchment. Slight increases in flood levels are anticipated in the proposed environment during a 100-year, 10-year and 5-year ARI flooding of the Milperra Catchment. However, no new properties would be impacted by increases in flood levels. In all cases, flood level increases would be minor in comparison with existing flooding for already affected properties. Flood level increases would be as follows:

- 100-year ARI flood event: increases in flood levels of between 20-25 millimetres are anticipated for properties with existing flood levels of between 0.6 metres and 2.4 metres
- 10-year ARI flood event: increases in flood levels of between 15-18 millimetres are anticipated for properties with existing flood levels of between 0.3 metres and 1 metre

- 5-year ARI flood event: increases in flood levels of around 23 millimetres are anticipated for properties with an existing flood level of 0.3 metres.

No increase in flow velocities or flood hazard is anticipated in any of these flood events for the Milperra Catchment. For Georges River flood events, no worsening of flood level, velocity or hazard is anticipated as a result of the proposal. Further design refinements to minimise flooding impacts would be considered during detailed design. Hydrology and flooding safeguards and management measures can be found in section 6.4.4.

Landscape character and visual impacts

The proposal area is surrounded by urban residential development and recreational reserves. On the western side of Henry Lawson Drive, avenue tree plantings separate the urban area from the existing road. Existing street signage is located throughout the proposal area, which features the names of early soldier settlers. Of note is the Milperra Soldier Settlement sign, located at the Henry Lawson Drive / Amiens Avenue intersection. For assessing landscape character impacts, the proposal area was divided into four separate landscape character zones, including a 'residential' zone, a 'commercial/light industrial' zone, the road corridor and an 'open space' zone.

General construction activities would result in temporary visual impacts on views within the proposal area. These include the movement and operation of various machinery and light and heavy vehicles, and the construction of temporary structures such as fencing and ancillary facilities. Lighting, especially during nightworks, would result in temporary visual impacts for households along Henry Lawson Drive and near the Ashford Avenue / Bullecourt Avenue intersection. Visual impacts would be experienced from vegetation removal and earthworks, particularly along Henry Lawson Drive where tree clearing would be carried out. The construction contractor would be required to rehabilitate all work sites by the end of the construction period.

During operation, there would be moderate-high landscape character impacts to the existing road corridor, due to the proposal increasing the width of the road corridor as well as removing a high number of existing trees. The proposal would have the most impact on the edges of the existing road corridor, which includes bounding open spaces and properties, which both have a high sensitivity to change. Impacts to the landscape character of these areas would largely be through the removal of existing mature street trees along Henry Lawson Drive which form an important part of the landscape character of the area. There would also be moderate landscape character impacts to the residential areas and open space corridor surrounding the proposal area due to the increased road infrastructure and removal of mature trees.

Viewpoints throughout the proposal area would change as a result of the widening of Henry Lawson Drive and the alteration of existing open space areas. There would be high visual impacts to views along Henry Lawson Drive south of Raleigh Reserve and near the Bullecourt Avenue and Pozieres Avenue intersections. This would be largely due to the increase in road width from 13 metres to around 30 metres and the removal of the existing mature street trees along Henry Lawson Drive, which form key components of views for motorists. High visual impacts would also occur near the Auld Avenue link road, where views would change from an undisturbed recreational area to a road corridor with vehicular traffic. Less severe impacts to views would occur near Henry Lawson Drive, Keys Parade and the Flower Power complex, and near the Henry Lawson Drive / Amiens Avenue intersection. This is due to these views already largely containing road infrastructure elements and other industrial or recreational elements which would not be impacted by the proposal.

A landscaping and replanting plan would be implemented at the conclusion of construction. While this would not completely align with the existing tree corridor and landscape characteristics, efforts would be made through this plan to minimise the operational landscape character and visual impacts of the proposal. Replanting of trees would occur within the Henry Lawson Drive corridor where possible. Further landscape character and visual impact mitigation measures are discussed in section 6.5.4.

Biodiversity

While the proposal has been designed to minimise the removal of native vegetation and threatened ecological communities (TECs) wherever practical, it would result in the removal of one hollow bearing tree and the removal of 5.68 hectares of threatened fauna habitat. This includes the removal of 2.98 hectares of vegetation which is classified as TECs under the *Biodiversity Conservation Act 2016*, 0.08 hectares of non-threatened native vegetation, and 2.62 hectares of planted native vegetation.

While the proposal area and its surrounds contain high potential for groundwater dependent ecosystems (GDEs), the risk of discharges of polluted water to groundwater from the proposal is deemed to be low. As such, the water table should not be affected by the proposal and the risk of changes to water availability to groundwater users and GDEs is also deemed to be low.

The construction of the new creek crossing along the Auld Avenue link road may also result in indirect impacts to key fish habitat from disturbance to sediments, which may affect water quality downstream. However, given the small width of the stream and the distance from the proposal to the Georges River (600 metres), the impact to water quality within key fish habitat is expected to be negligible.

Overall, despite vegetation clearance and potential impacts to aquatic ecosystems and GDEs, the proposal is unlikely to lead to a significant impact on threatened species, populations, ecological communities or their habitats.

To reduce the impacts as far as practical, vegetation removal and impacts to aquatic ecosystems and GDEs would continue to be minimised through detailed design. Other mitigation measures include carrying out pre-clearing surveys prior to construction, targeted surveys of threatened species which have been deemed likely to occur in the proposal area, including the Cumberland Plain Land Snail, and developing a plan to avoid accidentally impacting biodiversity within the proposal area. Biodiversity safeguards and management measures can be found in section 6.6.4.

Any residual impacts would be offset in line with Transport's Biodiversity Policy (Transport, 2022c), including consideration of no net loss to biodiversity and tree and hollow replacement. Preliminary ecosystem credit calculations have been carried out for impacts that trigger biodiversity offset thresholds, with the Cumberland Plain Land Snail and Southern Myotis requiring 18 and 32 species credits, respectively.

Socio-economic impacts

Construction of the proposal would result in disruptions to access and connectivity for residents, motorists, pedestrians, and cyclists due to temporary local road detours, driveway adjustments and construction of shared paths and footpaths. Construction work would be staged, and a Traffic Management Plan would be developed, to manage active and vehicular traffic near the proposal. There would also be impacts to the amenity of sensitive receivers in the form of noise, visual and air quality impacts, particularly when noise or vibration intensive equipment is used near receivers. Other socio-economic impacts would include land use changes, increased traffic delays throughout the construction phase, and potential sleep disturbance during night work. A Community Liaison Plan would be developed to help provide timely and accurate project information to the community during construction.

During operation, there would be benefits for active transport throughout the proposal area. The installation of new shared paths and footpaths and the connection of these with existing active transport infrastructure would improve connectivity for pedestrians and cyclists through the proposal area and would encourage greater use of active transport among local residents. Additionally, the proposal area would experience socio-economic benefits including improved safety for motorists largely through intersection improvements, and increased traffic efficiency considering future growth to Milperra and surrounding areas.

However, there would be moderate socio-economic impacts to access and connectivity for local motorists due to the creation of left-in left-out intersections at local road intersections with Henry Lawson Drive within the proposal area, which could increase the risk of residential isolation and increase travel times to social infrastructure near the proposal. There would also be moderate impacts to amenity and community values during operation as a result of increased traffic noise for properties on Henry Lawson Drive where the road corridor has shifted closer to property boundaries and reduced visual amenity due to the increased presence of road-related infrastructure. Property and land use would be impacted to a low-moderate extent during the proposal's operation due to changes in land use associated with the proposal, such as along the western side of Henry Lawson Drive, at the site of the new bioretention basin, the Raleigh Road extension and at the proposed new link road. Additionally, business and commercial values would be impacted to a low-moderate extent due to businesses on the northern side of the Bullecourt Avenue / Ashford Avenue intersection experiencing slight increases in noise levels. Transport would continue to consult key stakeholders including Council, developers, and emergency services to minimise impacts to the community. Socio-economic safeguards and management measures can be found in section 6.7.4.

Surface water

If not managed appropriately, key risks to surface water quality during construction could include increased sediment and the potential movement of contaminants. There is high potential to find acid sulphate soils in the northern area of the proposal area during construction, near the Milperra Drain and during earthworks. An acid sulphate soils management plan would be developed for the proposal which would manage the potential impacts of intercepting acid sulphate soils. In addition, construction water quality monitoring would be carried out upstream and downstream of the proposal to make sure that controls and site practices are effective at maintaining downstream water quality. Regular visual water quality checks would be carried out when working in or near waterways and further consideration of how to manage stockpiles, material laydown, chemical storage and accidental spills, including a site-specific emergency spill plan, with respect to floodwaters, would be carried out during detailed design.

During operation of the proposal, increases in impervious areas along the entire length of the proposal area could potentially lead to erosion of soils. During wet weather events, increased stormwater volume of a potentially degraded quality would drain to Milperra Drain and Georges River, including areas that are deemed key fish habitat (Georges River) and identified wetlands. To minimise impacts from polluted surface water, water quality treatments including the bioretention basin and drainage swales, would be implemented. Surface water safeguards and management measures can be found in section 6.8.4.

Non-Aboriginal heritage impacts

The former Milperra Soldier Settlement, which is a locally listed heritage item, is partially within the proposal area. The proposal would result in minor impacts to this item. While the proposal area would encroach into the heritage item and see a change to the intended scale of the former settlement, it would extend into areas that have been subject to more recent development and would have minimal impact on its heritage significance.

In addition, the Milperra Soldier Tree and commemorative plaque, planted by J. Morrison in 1917 is an unlisted potential heritage item within the proposal area. The current assessment shows that the tree would need to be removed due to direct impacts to its roots from the road widening works. The removal of this tree and changes to its immediate setting would result in irreversible impacts to the local significance of this tree. Efforts would be made during detailed design to minimise impacts of the proposal to allow retention of the tree.

There is a minor risk for archaeological items to be uncovered during ground excavations. This includes the potential items associated with former agricultural activities in the area, as well as land clearing and development associated with the former Milperra Soldier Settlement. However, there has been substantial ground and soil disturbance within the proposal area which means there is low potential for any archaeological remains. Additionally, items associated with the former uses of the area are unlikely to be intact.

During detail design, efforts would be made to minimise the impacts of the proposal to non-Aboriginal heritage items. Additionally, all heritage-related street signage would be retained or relocated if required, including the Milperra suburb road sign. Other safeguards for heritage items within the proposal area, including procedures for unexpected heritage finds during construction, are included in section 6.10.4.

Aboriginal cultural heritage impacts

A Cultural Heritage Assessment Report (CHAR) was carried out in September 2020 for the overall Henry Lawson Drive corridor upgrade between the Hume Highway and the M5 Motorway. The sections of the proposal area that were not captured in the CHAR were assessed in a separate Stage 1 Procedure for Aboriginal Cultural Heritage Consultation and Investigation assessment.

All sites identified as having potential for Aboriginal archaeological objects were deemed to be located outside of the proposal area. As a result, there would be no known impact to Aboriginal heritage items during the construction or operation of the proposal. However, if unknown or potential Aboriginal heritage items are uncovered, the *Standard Management Procedure – Unexpected Heritage Items* (Transport, 2022f) would be followed.

Justification and conclusion

Without the proposal, Henry Lawson Drive would remain in its current state, with increasing congestion at intersections and increasing travel times during peak periods. By providing additional capacity within the corridor and at intersections, the proposal would help alleviate this congestion and support traffic-generating development in the surrounding area, including the Bankstown Airport Redevelopment and the proposed Riverlands Development in Milperra.

The existing road environment also contributes to a high rate of casualty crashes. The increase in intersection capacity, the provision of appropriate shoulder widths, and an increased median width to separate opposing travel lanes, along with the smoother operation of the network, would help reduce traffic incidents.

The rezoning of the existing Western Sydney University site, to change its use to residential housing, would likely require improvements to the footpath and shared path network of the surrounding area. The proposal would provide benefits to active transport users in the Milperra area, with improved connectivity of shared paths and footpaths throughout the proposal area.

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 proposal objectives but would still result in some impacts to biodiversity, traffic, noise, flooding, landscape character and visual, and social/economic considerations. Safeguards and management measures as detailed in this REF would avoid or minimise these expected impacts. The proposal would also increase capacity to alleviate congestion and provide additional capacity to address future development and would improve the road environment to assist in the reduction of safety incidents.

Display of the REF

This REF is on display for comment between 26 June 2023 and 4 August 2023. You can access the documents in the following ways:

Internet

The REF documents are available as pdf files on the Transport project website at *nswroads.work/hld1b*.

Printed copies

The documents can be viewed at the following locations:

- Bankstown Library and Knowledge Centre, 80 Rickard Road, Bankstown, NSW, 2200
- Canterbury Bankstown Council, Upper Ground Floor, Bankstown Civic Tower, 66-72 Rickard Road, Bankstown, NSW, 2200.

Copies by request

Printed and electronic copies are available on request. Please note that there may be a charge for hard copies, CD or USB. To obtain a printed or electronic copy, please email *henrylawsondrive@transport.nsw.gov.au*.

Community information sessions

Both staffed and online information sessions will be held during the REF display period. The times and dates for these sessions will be advertised in collateral, social media and on the project website.

Staffed displays will be held in the local community:

Date	Time	Location
Thursday 29 June, 2023	**5:00pm – 8:00pm**	Milperra Public School, Pozieres Avenue, Milperra, NSW, 2214
Saturday 29 July, 2023	**11:00am – 2:00pm**	Milperra Public School, Pozieres Avenue, Milperra, NSW, 2214

How can I make a submission?

To make a submission about this proposal, please send your written comments to:

Email: *henrylawsondrive@transport.nsw.gov.au*

Phone: 1800 684 490

Henry Lawson Drive Upgrade – Stage 1B
Transport for NSW,
Level 8, 231 Elizabeth St
SYDNEY NSW 2000

Submissions must be received by 11:59pm 4 August 2023. Submissions will be managed in line with the *Transport for NSW Privacy Statement*. A copy can be made available upon request.

Please note that social media responses will not be considered as formal submissions about the proposal.

What happens next?

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

At the end of the REF display period, a submissions report which summarises feedback received and our responses will be published on the project website.

We will keep community members and other stakeholders informed of progress. You can access information on the project through the website, community newsletters, the project phone number, or email address.

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

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1 Introduction

This chapter introduces the proposal and provides context for the environmental assessment. The proposal, the objectives, project development history and the purpose of the report are detailed.

1.1 Proposal identification

Transport for NSW (Transport) proposes to upgrade a 1.8-kilometre section of Henry Lawson Drive between Auld Avenue, Milperra and the approach to the M5 Motorway (known as the Henry Lawson Drive Upgrade Stage 1B) (the proposal). This includes road widening to increase traffic capacity and improve travel time, as well as upgrades of key intersections to enhance capability and driver safety.

Key features of the proposal would include:

- widening Henry Lawson Drive from two to four lanes between Auld Avenue, Milperra and the M5 Motorway, Milperra with a raised central median
- upgrading the Henry Lawson Drive / Bullecourt Avenue signalised intersection, including:
  - an additional right-turn lane from Henry Lawson Drive (northbound) to Bullecourt Avenue (two right-turn lanes total)
  - an additional right-turn lane from Bullecourt Avenue to Henry Lawson Drive (northbound) (two right-turn lanes total)
  - converting the existing dedicated left-turn lane from Bullecourt Avenue to Henry Lawson Drive (southbound) into a dedicated left-turn slip lane
  - maintaining the dedicated left-turn lane from Henry Lawson Drive (southbound) to Bullecourt Avenue
- upgrading the Henry Lawson Drive / Pozieres Avenue signalised intersection, including:
  - a new dedicated right-turn lane from Henry Lawson Drive (southbound) to Pozieres Avenue
  - a new dedicated left-turn lane from Henry Lawson Drive (northbound) to Pozieres Avenue and relocation of the existing bus stop north of the intersection
- providing a new two-lane local link road between Auld Avenue and Keys Parade (about 160 metres), crossing over Milperra Drain, providing access to / from southbound lanes of Henry Lawson Drive and Auld Avenue, and removing up to eight parking spaces on Auld Avenue to accommodate the link road
- extending Raleigh Road about 120 metres to connect with Keys Parade at a roundabout, and removing the direct connection between Raleigh Road and Henry Lawson Drive
- converting the Henry Lawson Drive intersections to be left-in left-out only, at:
  - Ruthven Avenue
  - Whittle Avenue
  - Amiens Avenue
  - Ganmain Crescent
  - Fromelles Avenue
  - Hermies Avenue
- modifying the Bullecourt Avenue / Ashford Avenue intersection to better accommodate heavy vehicle movements
- constructing a three-metre-wide shared path:
  - on the western/southern side of Henry Lawson Drive between Pozieres Avenue and Keys Parade
  - along Keys Parade, the new Auld Avenue local link road and the extended section of Raleigh Road
- reconstruction of some existing shared paths within the proposal area

- constructing a new footpath within the proposal area:
  - on the eastern side of Henry Lawson Drive between the Flower Power and Ingram Avenue
  - along the northern side of Ingram Avenue
  - along the eastern side of Fromelles Avenue
- installing new drainage infrastructure and water quality controls within the proposal area, including:
  - an upgraded longitudinal and transverse drainage pits and pipes network along Henry Lawson Drive
  - a bioretention basin between Henry Lawson Drive, Bullecourt Avenue and Fleurbaix Avenue and maintenance access to this basin
  - swales along Henry Lawson Drive and Keys Parade and installation of Gross Pollutant Traps
  - relocation of an existing swale along the Auld Avenue link road
- construction activities and ancillary work, including:
  - relocation of utilities (including electrical, gas, water, and telecommunications)
  - civil earthworks, drainage work, water quality controls, and tie-in work to adjoining sections of Henry Lawson Drive and local roads
  - final roadworks including pavement, kerb and gutters, signs, road furniture, landscaping, lighting, and line marking
  - new traffic signals and intelligent transport systems including, but not limited to, closed-circuit television
  - establishment of temporary ancillary facilities to support construction, including compound sites, site offices, stockpile and laydown locations, temporary access tracks and water quality devices.

1.2 Proposal background

The proposal forms the second stage (Stage 1B) of the progressive upgrade to 8.5 kilometres of Henry Lawson Drive between the intersections of the Hume Highway, Villawood, and the M5 Motorway, Milperra. The Henry Lawson Drive Upgrade Program has been divided into four stages, with this proposal forming the second stage. A review of environmental factors (REF) and an environmental impact statement (EIS) was prepared and submitted for the first stage, Henry Lawson Drive Upgrade Stage 1A, in 2021. Stage 1B provides connection between Stage 1A and the M5 Motorway.

The strategic need for the proposal is to help ease existing traffic issues and increase traffic capacity at key intersections to help meet growing demand, with residential, commercial, and industrial development in the surrounding area, expected to increase in the coming years. Congestion is the most significant problem for the corridor, which causes frustrating and costly delays to all road users across spreading peaks. The strategic need for the proposal also relates to improving safety, as the current and future levels of congestion result in a high rate of vehicle crashes. Extensive rat running within surrounding residential areas has also created concern about the safety and health of the community.

The location of the proposal is shown in Figure 1-1 and an overview of the proposal is provided in Figure 1-2. Chapter 3 describes the proposal in more detail.

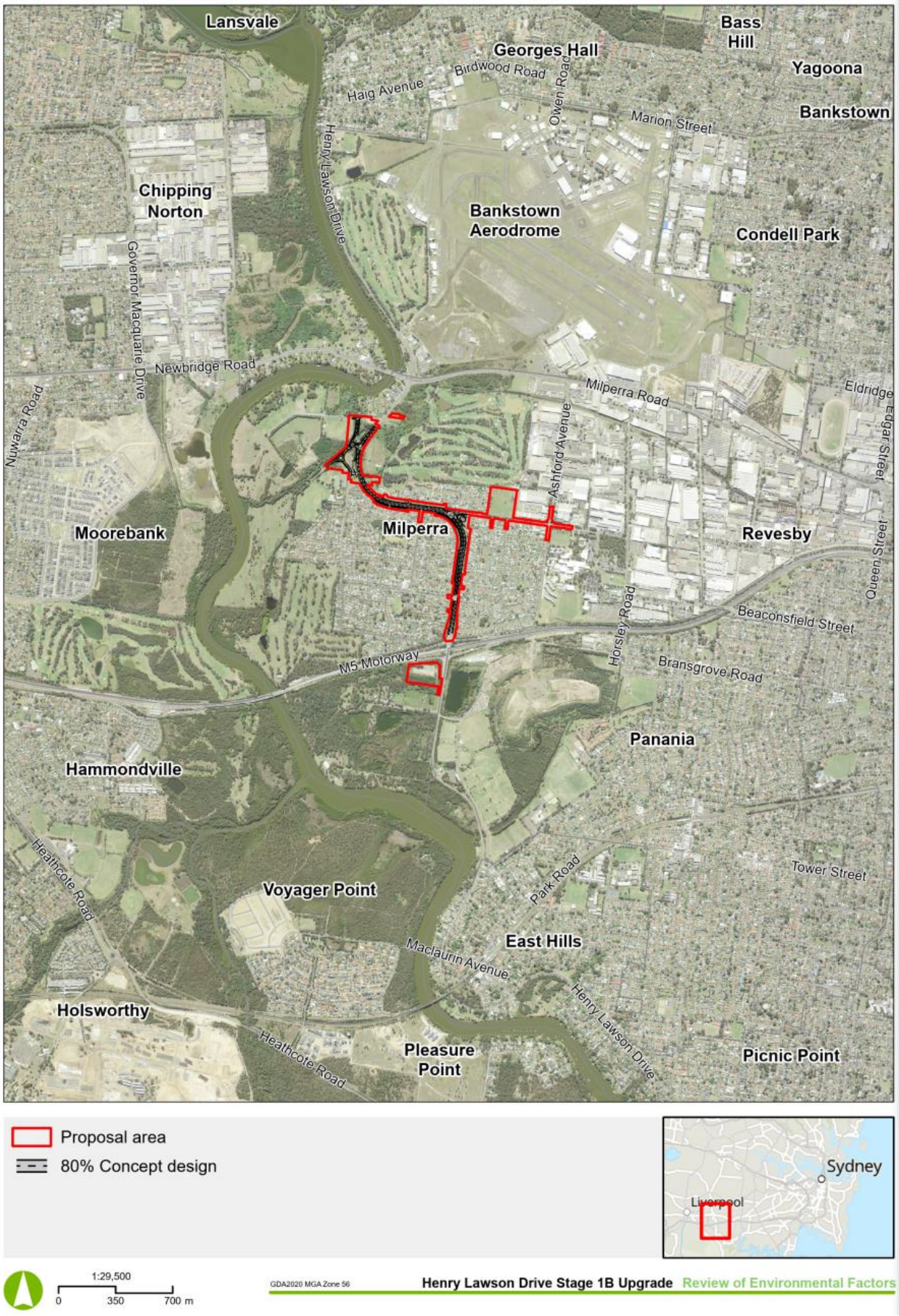


Figure 1-1 Location of the proposal

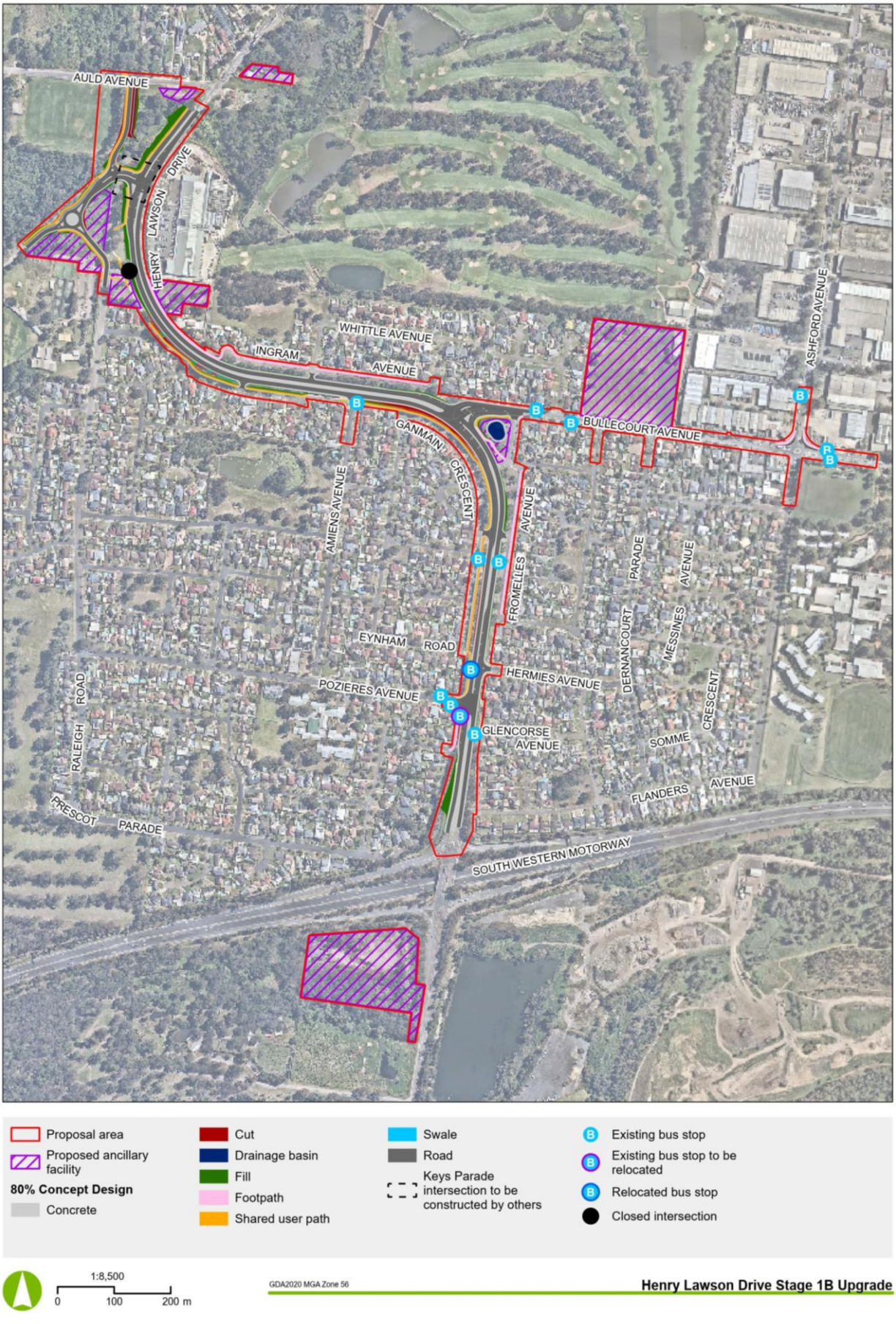


Figure 1-2 The proposal

A more detailed location description is provided in Chapter 3.

Subject to approval and funding, construction of the Stage 1B proposal may commence in 2026 and would take about two years to complete. Stage 1A was approved in July 2022 and construction commenced in early 2023 and will take about two years to complete. Other stages of upgrading Henry Lawson Drive would be developed and assessed separately in the future.

1.3 Purpose of the report

This REF has been prepared by Aurecon Australasia on behalf of Transport. For the purposes of these works, Transport is the proponent and determining authority under Division 5.1 of the *Environmental Planning and Assessment Act 1979 (NSW)* (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 carried out in the context of Section 171 of the Environmental Planning and Assessment Regulation 2021, the factors in *Guidelines for Division 5.1 assessments, (DPE 2022a)*, *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 (Commonwealth)* (EPBC Act).

In doing so, the REF helps to fulfil the requirements of:

- section 5.5 of the EP&A Act including that Transport 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 strategic assessment approval granted by the Federal Government under the EPBC Act in September 2015, with respect to the impacts of Transport's road activities on nationally-listed threatened species, ecological communities and migratory species.

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 sought from the Minister for Planning 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 if offsets are required and able to be secured.
- the potential for the proposal to impact any other matters of national environmental significance or Commonwealth land and the need, subject to the EPBC Act strategic assessment approval, to make a referral to the Australian Department of Climate Change, Energy, the Environment and Water for a decision by the Commonwealth Minister for the Environment on whether assessment and approval is required under the EPBC Act.

2 Need and options considered

This chapter describes the need for the proposal in terms of its strategic setting and operational need. It identifies the various options considered and the selection of the preferred option for the proposal.

2.1 Strategic need for the proposal

The proposal is needed to:

- alleviate congestion along the corridor that causes frustrating and costly delays for all road users across spreading peaks
- address a road environment contributing to a high rate of casualty crashes
- support growth in the area from large scale development in and around Milperra.

Without the development of the proposal, road and traffic conditions within the proposal area would continue into the future, including:

- worsening congestion along the corridor causing frustrating and costly delays for all road users across spreading peaks
- localised delays and safety concerns along Henry Lawson Drive at local road intersections
- poor driver behaviour in an unforgiving road environment contributing to a high rate of casualty crashes
- extensive rat running within surrounding residential areas creating concerns about the safety and health of the community.

How the proposal relates to strategic planning and policy documents is detailed in the following sections.

NSW Premier's Priorities

The Premier's Priorities (NSW Government, 2021) represent the NSW Government's commitment to making a difference in enhancing the quality of life of the people of NSW, with each priority set with an ambitious target. The key policy priorities for the NSW Government are:

- a strong economy
- highest quality education
- well-connected communities with quality local environments
- putting customers at the centre of everything we [the NSW Government] do
- breaking the cycle of disadvantage.

While the proposal is not specifically mentioned within the Premier's Priorities, the proposal supports the key policy priority of enhancing the people of NSW's quality of life through 'well connected communities with quality local environments'. The proposed widening of Henry Lawson Drive would help to ease congestion and improve travel times along the corridor, allowing road users to move more effectively along the section of road. The provision of the local link road between Auld Avenue and Keys Parade would improve connection to and from Henry Lawson Drive for users of recreational facilities on Auld Avenue. The proposal would also improve and enhance the safety of pedestrian and cyclist connections, through the provision of shared paths and footpaths, along the road corridor to connect with existing active transport and public transport facilities. The proposal would substantially contribute to better connecting the community and would enhance the local environment, in support of the Premier's Priorities.

Future Transport Strategy

The *Future Transport Strategy* (Transport, 2022a) is an update of the NSW Government's *Future Transport Strategy 2056* providing an integrated vision for NSW through a suite of strategies and plans for transport, developed alongside the State Infrastructure Strategy, Greater Sydney Region Plan and the Department of Planning and Environment's regional plans. The Future Transport Strategy sets the strategic directions for Transport to achieve world-leading mobility for customers, communities, businesses, and people. The refreshed strategy takes into account events such as the COVID-19 pandemic, droughts, bushfires and floods alongside population growth and global megatrends. It includes ground-breaking ideas to revitalise NSW's

six cities, connect regional communities, encourage thriving local neighbourhoods, and build on our economic success.

The Future Transport Strategy outlines outcomes and strategic directions that work towards its long-term vision for safe, healthy, sustainable, accessible, and integrated passenger and freight journeys in NSW. Part of these strategic directions is an aim to 'build well-designed transport infrastructure that makes places more liveable and successful', as well as aims to optimise existing transport infrastructure and make freight networks and supply chains more efficient and reliable. The proposal would help to alleviate congestion and improve travel times through improvements to existing infrastructure along Henry Lawson Drive and surrounding local roads. It would also improve freight networks and increase freight capacity, thereby aligning with the strategic objectives of the Future Transport Strategy.

In addition, the Future Transport Strategy also discusses Transport's 'Movement and Place' framework. The framework is defined in the strategy as a tool to manage the road network in a way that supports safe, efficient, and reliable journeys for people and freight whilst enhancing the liveability and amenity of places (Transport, 2018a). The proposal aligns with the framework through the objective to improve travel times and journey time reliability for all road users. The proposal would promote the Movement and Place framework through improved connectivity and safety for active transport users, by providing new and more integrated shared paths and footpaths to connect to existing recreational facilities and public transport. This would contribute to the liveability of the community and local/regional road users.

Greater Sydney Services and Infrastructure Plan

The *Greater Sydney Services and Infrastructure Plan* (Services and Infrastructure Plan) includes an overall transport vision for Greater Sydney and has been developed to support the Greater Sydney Commission's vision for Greater Sydney as a '30 minute city', a metropolis of three cities, where people have access to jobs and services within 30 minutes by public transport.

The Services and Infrastructure Plan builds on the state-wide transport outcomes identified in the Future Transport Strategy, establishing specific outcomes that Transport's customers can expect and identifying the policy, service, and infrastructure initiatives to achieve these (Transport, 2018b).

The Future Transport State-wide Outcomes and Greater Sydney Transport Customer Outcomes are as follows:

- customer focused – convenient and responsive to customer needs
- successful places – sustaining and enhancing the liveability of our places
- a strong economy – connecting people and places in the growing city
- safety and performance – safely, efficiently, and reliably moving people and goods
- accessible services – accessible for all customers
- sustainability – makes the best use of available resources and assets.

The proposal would contribute to achieving these customer outcomes through improving travel efficiency and reliability, managing congestion, and improving travel times along Henry Lawson Drive, particularly during peak periods. The safety and performance of the area would be improved through the widening of the road corridor and the upgrades to intersections along Henry Lawson Drive. It would enhance the accessibility of the area through new footpaths and shared paths. Sustainability outcomes would also be improved through the installation of new drainage infrastructure and water quality controls within the proposal area, particularly through the bioretention basin between Henry Lawson Drive, Bullecourt Avenue and Fleurbaix Avenue.

Freight and Ports Plan 2018 – 2023

In September 2018, Transport released the *Freight and Ports Plan 2018-2023* (FPP) as a supporting plan to the Future Transport Strategy 2056 (replaced by the Future Transport Strategy). The FPP was released to provide a guide for the freight industry over a five-year period to make the long-term investments required to benefit the industry as well as the State's future growth (Transport, 2018c).

The main aim of the FPP is for the industry and government to work together to achieve the following objectives:

- objective 1: economic growth
- objective 2: efficiency, connectivity, and access
- objective 3: capacity
- objective 4: safety
- objective 5: sustainability.

The proposal aligns closely with the objectives of the FPP through the upgrade of Henry Lawson Drive, which is an important freight connector between the Hume Highway, the M5 Motorway and industrial areas in Milperra and further afield. The proposal would increase road capacity, address existing congestion issues, and accommodate growth. In doing so, the proposal would improve efficiency and provide better connectivity and access for the community and all road users. The FPP discusses the contribution that congestion makes to the cost of moving freight, particularly around high-density urban areas (Transport, 2018c). The proposal would aim to improve freight efficiency and reduce vehicle operating costs on the road network through the upgrade of Henry Lawson Drive. In particular, intersection upgrades and widening aim to improve efficiency and safety along Henry Lawson Drive.

Road Safety Plan 2021

The *Road Safety Plan 2021* (Road Safety Plan) was established to guide the improvement of road safety in NSW. The plan is based on consultation with the NSW community to identify trends and key issues that can be responded to. The international 'Safe System Approach' is adopted in the plan to achieve the NSW target of 'zero fatalities and serious injuries on our roads by 2056' (Transport, 2018d). The steps to achieving a safer system that align closely with the proposal include creating safer urban places and communities and building a safe future. Developing 'liveable and safe urban communities' is a priority area highlighted in the Road Safety Plan. Actions that are discussed to achieve this include exploring options to accelerate safety upgrades at intersections. The proposal would upgrade Henry Lawson Drive and its related intersections to improve road safety outcomes for all road users (including motorists, pedestrians, and cyclists). The upgrade to the Pozieres Avenue intersection would improve safety outcomes through the provision of an additional right-turn lane, and the introduction of a left-turn slip lane. Other intersection upgrades to left-in, left-out elsewhere along Henry Lawson Drive would also contribute to the priorities of the Road Safety Plan through improved safety for drivers turning onto the street, reduced congestion at intersections and improved traffic flow. This would have benefits for current and future residents and road users travelling through the proposal area, contributing to the liveability of the community through the provision of safer infrastructure and connections.

State Infrastructure Strategy

The *State Infrastructure Strategy 2022-2042: Staying Ahead* (2022 SIS) outlines the NSW Government's 20-year strategic vision for infrastructure needs and priorities. The SIS identifies policies and strategies needed to meet the needs of the growing NSW population and economy.

The 2022 SIS recognises that NSW can best fund and implement a sizeable ongoing infrastructure program by selecting high-value programs that can be delivered in manageable stages. Infrastructure NSW recommends that the State's priorities over the next 20 years involve a different mix of projects than the past decade, as the focus on megaprojects should give way to a combination of smaller and medium-sized projects, in many cases delivered in stages, as multi-year programs. In this vein, the 2022 SIS calls for more attention to technology upgrades, augmentation and hardening of existing assets and networks and structured maintenance.

The 2022 SIS includes the following objectives:

- boost economy-wide productivity and competitiveness
- service growing communities
- embed reliability and resilience
- achieve an orderly and efficient transition to net zero
- enhance long-term water security
- protect our natural endowments

- harness the power of data and digital technology
- integrate infrastructure, land use and service planning
- design the investment program to endure.

The proposal would contribute to these objectives in the form of the economy-wide productivity and competitiveness of NSW, and service of the growing Milperra and wider Canterbury-Bankstown communities. Recommendations as part of these objectives include the funding and delivery of enabling infrastructure for growing communities and active transport infrastructure to support liveability. The increased capacity of Henry Lawson Drive, improved traffic flow and shared paths and footpaths that would be implemented by the proposal would contribute to these recommendations. Other recommendations include the increased efficiency of freight networks in Greater Sydney and corridor protection to enable efficient movement of freight. The proposal would increase freight capacity on Henry Lawson Drive and Bullecourt Avenue and improve freight access conditions to surrounding industrial areas, which would help to achieve the objectives and strategic directions of the 2022 SIS.

Greater Sydney Region Plan – A Metropolis of Three Cities

The *Greater Sydney Region Plan: A Metropolis of Three Cities* (GSRP) outlines the vision to transform Greater Sydney into a metropolis of three cities:

- the established Eastern Harbour City – building on its recognised economic strength and addressing liveability and sustainability
- the developing Central River City – investing in a wide variety of infrastructure and services and improving amenity
- the emerging Western Parkland City – establishing the framework for the development and success of an emerging new city.

The proposal is located within the developing Central River City. The GSRP highlights the importance of providing infrastructure to support cities, while also having the ability to adapt to meet the needs of future growth (Greater Sydney Commission, 2018a). The proposal would contribute to meeting these objectives through the upgrading of infrastructure on Henry Lawson Drive, Bullecourt Avenue, and other local roads as well as the provision of the new local link road, between Auld Avenue and Keys Parade. This would increase traffic efficiency for local road users and provide for future growth by allowing greater traffic capacity at key intersections.

One of the GSRP objectives also focuses on ensuring the freight and logistics network is competitive and efficient. It highlights the importance of locations surrounding key freight networks and ensuring they are not adversely impacted by traffic patterns and congestion. The upgrade of Henry Lawson Drive would contribute to achieving the GSRP objectives relating to freight and logistic networks through the provision of additional capacity along Henry Lawson Drive. This would also benefit the community through decreasing traffic congestion on local roads and improved access to residential areas.

South District Plan

The *South District Plan* provides a 20-year plan to manage growth, while enhancing Greater Sydney's liveability, productivity, and sustainability into the future. It is a guide for implementing the Greater Sydney Region Plan at a district level and is a bridge between regional and local planning. The South District Plan highlights supporting the growth of the Bankstown Airport-Milperra industrial area as a key method of implementing its vision (Greater Sydney Commission, 2018b).

The proposal supports the following planning priorities within the South District Plan:

- Planning Priority S1 Planning for a city supported by infrastructure
- Planning Priority S12 Delivering integrated land use and transport planning and a 30-minute city.

The proposal would contribute to these planning priorities through supporting proposed developments within the surrounding area, including the Riverlands Development which would be able to be accessed via Keys Parade. In addition, it would also support an increased capacity in the proposal area required for road users to efficiently access other parts of south-western Sydney through the widening of Henry Lawson Drive, and improved traffic flow at intersections.

Canterbury Bankstown Local Strategic Planning Statement 'Connective City 2036'

The *Canterbury Bankstown Local Strategic Planning Statement 'Connective City 2036'* (Strategic Planning Statement) was approved in December 2019 and provides an over-arching strategic plan to help guide growth in Canterbury Bankstown over the next 20 years. It identifies a suite of 20-year strategic initiatives that Council would need to start planning for now to ensure a successful and prosperous city over the medium to long term.

Connective City 2036 aims to integrate a variety of transport modes with different land uses so that more people can connect to more places within the City and beyond. It would help to improve the City's ecological and river systems and create quality places for healthy living and ecological integrity (Canterbury-Bankstown Council, 2019).

The proposal supports the following priorities relating to one of the 10 Evolutions - Movement for Commerce and Place:

- maintain and improve strategic road and rail transport corridors
- address blockages in the road network to improve traffic flow on Greater Sydney-serving roads
- protect Greater Sydney's regional freight corridors.

Henry Lawson Drive is identified in Connective City 2036 as one of the major roads reinforced as metropolitan transport and freight routes. The overall Henry Lawson Drive upgrade is highlighted as a project that would complement the work on the Bankstown City Centre. It is subsequently identified as a key action which would assist in the need to address blockages in the road network to improve traffic flow. The proposal would support Connective City 2036 through the widening and improved traffic flow of the Henry Lawson Drive corridor between Auld Avenue and the approach to the M5 Motorway, the improved freight capacity as a result of this road widening, and upgrades to the Bullecourt Avenue / Ashford Avenue intersection.

Bankstown CBD and Bankstown Airport Place Strategy

The *Bankstown CBD and Bankstown Airport Collaboration Area Place Strategy* provides a vision and shared objectives for the place and sets out priorities and actions to realise this vision. The vision is that by 2036, Bankstown CBD and Bankstown Airport Collaboration Area will be a green, healthy, and dynamic destination that capitalises on its diverse culture and its proximity to Salt Pan Creek and the Georges River. The Strategy was approved by the Greater Sydney Commission in December 2019.

It is acknowledged in the strategy document that the industrial and freight cluster is serviced by roads such as Henry Lawson Drive, Milperra Road and the M5 Motorway which are subject to major congestion, due mainly to the higher proportion of private vehicle use in and around the area (Greater Sydney Commission, 2019).

Two of the key actions of the strategy are:

- to develop a place-based integrated transport strategy that considers the health, academic, research and training precinct, growth at Bankstown CBD and connectivity to, from and within the Collaboration Area (Action 1)
- investigate and deliver improvements for pedestrian and cyclist connectivity and better at-grade pedestrian facilities across major road corridors and provide enhanced design, place, and safety outcomes at the interface of Bankstown CBD, key gateways, and destinations (Action 5).

The proposal would improve connectivity to Bankstown Airport and surrounding areas through increased capacity and traffic flow as a result of the widening of Henry Lawson Drive and the associated intersection upgrades. Additionally, improvements would be delivered for pedestrian and cyclist connectivity and safety through the provision of shared paths and footpaths.

Road Network Plan Summary Report: Henry Lawson Drive and Woodville Road

The Henry Lawson Drive and Woodville Road network plan (Transport, 2018e) provides a framework for the development and management of Henry Lawson Drive/Woodville Road, based on the network's strategic movement and place function and customer needs. The proposal relates to segment 6 in the identified road network, where the key land uses identified are low-density residential, public recreation and infrastructure.

The plan outlines the following objectives:

- a safe road system for every customer supporting the Towards Zero vision of zero fatalities and serious injuries on NSW roads by 2056
- improve travel time and reliability for key customer groups (freight and car users) along the corridor to support and enhance its function as a primary north-south link between the M5 Motorway and Parramatta
- support access to safe crossing opportunities of the corridor for active modes, for both commuting and recreational uses, linking local centres, and transport interchanges on parallel rail lines
- facilitate the efficient, safe, and reliable movement of goods along the corridor and beyond, supporting the growth of freight precincts such as Yennora, Villawood and Bankstown Airport, the metropolitan centre of Parramatta and strategic centres of Fairfield and Bankstown
- integrate current and future land use planning with road network development to ensure compatible and complementary uses and functions.

The proposal would help achieve the objectives of the road network plan through the increased capacity of the proposal, improving travel times and efficiency for motorists and freight operators, as well as improved connectivity and safety for active transport users. Road safety would be improved through the reduced congestion and improved traffic flow as a result of the widening of Henry Lawson Drive and the associated intersection upgrades. The new local link road between Auld Avenue and Keys Parade would also improve traffic flow, traffic safety and travel reliability.

Georges Riverkeeper Strategic Plan 2022-2026

This strategic plan sets out the direction that the Georges Riverkeeper will take over the four-year period 2022-2026. Georges Riverkeeper facilitates proactive waterway management that is adaptive and integrated across other areas of member councils, rather than being reactive and piecemeal (Georges Riverkeeper, 2022). There are five focus areas in the strategic plan which are:

- Catchment Actions Program
- River Health Monitoring Program
- Stormwater Program
- Research Program
- Education & Capability Building Program.

The strategic plan also notes that urbanisation in the Georges River Catchment has led to growing stormwater and liveability issues. The proposal would contribute to reducing stormwater issues through improved drainage infrastructure along the Henry Lawson Drive corridor. Liveability issues would also be addressed through improved traffic flow and capacity as a result of road widening and intersection upgrades, and improved pedestrian and cyclist accessibility through the provision of shared paths and footpaths in the proposal area.

2.2 Limitations of existing infrastructure

Henry Lawson Drive is currently a narrow two lane road through undulating topography. The road is a primary freight route and carries a substantial number of heavy vehicles for the north/south corridor linking the Hume Highway and the M5 Motorway. As mentioned in Section 2.1, Henry Lawson Drive is currently constrained by a range of factors. Primarily, Henry Lawson Drive experiences congestion due to the limited capacity at the intersections along its extent, with traffic flow stopping behind vehicles waiting to turn right into local streets. This has flow on impacts to safety and accessibility for the community and people travelling through the proposal area. The following section provides more detail on the limitations of existing infrastructure within the proposal area.

The proposal area currently provides limited dedicated pedestrian or cycling facilities, although pedestrian crossings are catered for at the signalised intersections. While the corridor does not play a major role in terms of public transport, there are two bus routes as well as school bus routes that are well patronised in the proposal area that travel along Henry Lawson Drive and Bullecourt Avenue. Buses are required to stop in the left hand northbound and southbound travel lanes on Henry Lawson Drive, which further contributes to traffic delays and congestion. Bus stops on Henry Lawson Drive at Pozieres Avenue and Ganmain Crescent are poorly serviced by footpaths.

2.2.1 Capacity and road safety on Henry Lawson Drive

There are up to about 2200 vehicles per hour during the AM peak, up to about 2300 vehicles per hour during the PM peak and up to about 2100 vehicles per hour during the weekend peak along Henry Lawson Drive. Additionally, Henry Lawson Drive is a key freight route in the Canterbury Bankstown LGA and within Greater Sydney. Of all vehicles using Henry Lawson Drive, between seven and 15 per cent are heavy vehicles during peak travel times.

Henry Lawson Drive currently has limited capacity, with most of its length between Auld Avenue and Pozieres Avenue being one lane in either direction. This locally changes at Bullecourt Avenue and Pozieres Avenue, where there are additional lanes to assist turning traffic. However, after these intersections, traffic needs to merge into one lane resulting in slower speeds when the road is busy. Travel times for the existing peak conditions on Henry Lawson Drive in both directions are outlined in Table 2-1.

Table 2-1 Existing peak travel times along Henry Lawson Drive

Direction	Weekdays			
	7:45AM-8:45AM	8:45AM-9:45AM	3:30PM-4:30PM	4:30PM-5:30PM
Northbound	04:03	05:38	03:55	03:54
Southbound	04:26	04:22	04:26	04:23

As growth and demand on the road network continues in south-western Sydney, the capacity of Henry Lawson Drive will need to increase to cater for the demand. In particular, surrounding development near the proposal area (such as the Riverlands Development) is expected to result in more vehicle movements on Henry Lawson Drive which is currently congested and has unreliable travel times.

Congestion and capacity constraints on the broader Henry Lawson Drive corridor has also resulted in road users 'rat running' within surrounding residential areas, creating community concerns about safety and health. In particular, Bullecourt Avenue and Ashford Avenue in Milperra are local streets that are subject to rat running by motorists attempting to avoid the Henry Lawson Drive/Milperra Road/Newbridge Road intersection. Traffic surveys carried out in 2018 indicated that a total of 26 heavy vehicles used Bullecourt Avenue and Ashford Avenue as rat run routes during the AM and PM peak periods, which is equivalent to around one heavy vehicle every 10 minutes. As demand on the road network increases, the use of the rat runs in local areas is also expected to increase.

2.2.2 Crash statistics, including available information on crash causes

As mentioned in Section 2.1, there is a high rate of crashes along Henry Lawson Drive between the Hume Highway and the M5 Motorway, which is a factor of congestion as well as the constrained road environment.

The proposal area had 194 crashes between January 2015 and May 2021 (Transport, 2021). 133 of those crashes were casualty crashes. The rate of fatality or serious injury (FSI) crashes was 22 per cent, which is lower than other sections of Henry Lawson Drive. Over 37 per cent of crashes in the proposal area (2015-2021) were rear end crashes, symptomatic of congestion and a one lane environment with local road intersections allowing right turn traffic movements.

The current and predicted levels of congestion on Henry Lawson Drive coupled with a constrained road environment (i.e., one way in each direction with limited median and road shoulders) has contributed to a high rate of vehicle crashes.

2.2.3 Further development and growth in the area

There are three developments recently established or proposed in the surrounding area that would interact with the proposal. Trips generated from these developments are expected to add to the existing congested conditions. The developments include:

Seniors housing development – project approved

27 Bullecourt Avenue, Milperra is currently a vacant piece of land that is being used by the Bankstown Golf Course. A seniors housing development on the site was approved in December 2020. The development comprises four buildings including a residential care facility, self-contained dwellings, community facilities, sealed road, car parking and associated earthworks under *State Environmental Planning Policy (Housing for*

Seniors or People with a Disability) 2004. This site is within the proposal area and has been identified as a potential ancillary facility.

Riverlands Development – planning phase

The Riverlands Development is a residential subdivision partly located within the proposal area on Keys Parade. It is expected to result in increased traffic along Henry Lawson Drive. The development would provide 500 dwellings in the first phase of development and another 500 dwellings in phase two (The Transport Planning Partnership Pty Ltd, 2020). The main access points to the development would be via Keys Parade, Raleigh Road, and Prescot Parade in Milperra (The Transport Planning Partnership, 2020). Based on the traffic and parking assessment (TTPA, 2019), the development is expected to result in an additional 48 movements in AM peak, and 48 movements in PM peak. These vehicles would access the development via Henry Lawson Drive and Bullecourt Avenue or Milperra Road and Ashford Avenue.

Bankstown Airport – under construction

Bankstown Airport is accessed from Tower Road, north of the proposal. The Bankstown Airport Master Plan 2019 was approved by the Federal Minister for Infrastructure, Transport, and Regional Development in November 2019. Bankstown Airport Limited is building a retail precinct and leisure centres, factory outlets and restaurants to maximise opportunities to increase economic activity and jobs growth within the Bankstown to Liverpool Enterprise corridor. As stated in the Bankstown Airport Masterplan 2019, the new non-aviation component of the development at the airport is expected to generate an additional 1,300 to 1,850 peak hour vehicle trips by 2024 (Bankstown Airport Limited, 2019). These vehicles would access the airport via Henry Lawson Drive or Newbridge Road and Milperra Road.

These traffic generating developments would result in increased demand on Henry Lawson Drive and could worsen existing congestion issues.

2.3 Proposal objectives and development criteria

2.3.1 Proposal objectives

The objectives of the proposal include:

- improve travel times, journey time reliability and road safety outcomes for all road users
- improve freight efficiency and reduce vehicle operating costs on the road network
- support new development in the precinct by improving traffic flow and connectivity to Bankstown Airport, Milperra Industrial Estate and proposed residential development in the area and the surrounding road network
- improve connectivity and safety for pedestrians and cyclists.

2.3.2 Urban design objectives

Urban design objectives for the proposal include:

- **sense of place**: contributing to urban structure, urban quality, and the economy
- **natural environment**: fitting with the landform
- **connectivity and wayfinding**: connecting modes and communities and promoting active transport
- **environmental sustainability**: contributing to green infrastructure and responding to natural systems
- **integration**: fitting with the built fabric
- **connecting to Country and incorporating heritage and cultural contexts.**

2.4 Alternatives and options considered

2.4.1 Strategic options

A range of strategic options were developed in response to the existing challenges on Henry Lawson Drive between Hume Highway and the M5 Motorway. In 2018, non-infrastructure and infrastructure solutions were identified and assessed through a series of Investment Logic Mapping (ILM) workshops conducted in November 2018 (GTA Consultants, 2019).

The challenges identified in the ILM workshop were congestion, lack of future capacity, road closures due to flooding and other events, rat running in surrounding residential areas and crash history along Henry Lawson Drive.

Four strategic response options were considered:

- do-minimum – maintenance of Henry Lawson Drive only
- increase capacity – duplication of Henry Lawson Drive
- travel demand management – implementation of contra-flow arrangements on Henry Lawson Drive
- increase productivity – upgrade Henry Lawson Drive to a bus rapid transit or light rail corridor.

Of these strategic options, the 'increase capacity' option was selected as it is expected to address the identified challenges associated with Henry Lawson Drive. It was also acknowledged that the strategic options of 'travel demand management' and 'increase productivity' would be considered at a later stage (GTA Consultants, 2019).

Strategic alternatives

Following the selection of the 'increase supply' strategic option, a range of strategic alternatives were investigated. Three different strategic alternatives were considered. These included:

- alternative 1 – widening of Henry Lawson Drive to four lanes (two lanes in each direction)
- alternative 2 – widening of Henry Lawson Drive to four lanes (two lanes in each direction) with a widened median to allow for six lanes into the future
- alternative 3 – widening of Henry Lawson Drive to six lanes (three lanes in each direction).

A Value Management (VM) Workshop was held in December 2018 to evaluate the three alternatives. The three alternatives were compared against the 'do minimum' strategic response (without upgrade, ongoing maintenance, and optimising intersection operations such as signalling optimisations or minor intersection reconfiguration only). The participants of the VM Workshop included the Transport project team, key Transport stakeholders and external subject matter experts.

A traffic benefit and economic analysis was also used to help identify the most optimal solution. Traffic modelling used in the analysis included a range of factors such as vehicle-kilometre-travelled (VKT), vehicle-hour travelled (VHT), number of vehicle stops, average speed and traffic volume (Transport, 2019a). These were assessed for the three alternatives and the do minimum alternatives for the existing case (2018) and the future cases (2026 and 2036). Following the comparison of traffic modelling results, the three alternatives and do minimum alternative were assessed against three benefits, which were:

- savings in travel time
- vehicle operating costs
- crash costs.

The VM workshop concluded that the four lane widening (Alternative 1) was the preferred option, as it had the highest benefits. Primarily, traffic modelling showed that Alternative 1 would sufficiently address the congestion problem within the foreseeable future. Alternative 2 and 3 were discounted as they only provided marginal benefits over Option 1. Both alternatives (2 and 3) to upgrade Henry Lawson Drive to six lanes were predicted to also result in increased costs and impacts to the community as a result of property acquisition. Overall, Option 1 offers the best value-for-money solution supported by the highest benefits to savings in travel time among the alternatives assessed.

2.4.2 Proposal options

Option assessments were carried out for various features of the proposal. This section details the options assessment carried out for the proposal alignment and alternative access for Auld Avenue.

The methodology, identified options, assessment, and preferred option for each of these features are detailed in the following sections.

Proposal alignment

The Henry Lawson Drive Stage 1A review of environmental factors (REF) considered a number of options to set the alignment for that stage of the upgrade program. The options that were considered included widening to the west or the east. For the Stage 1A project, the option that would widen to the east of Henry Lawson Drive was selected. At the southern extent of Stage 1A, the alignment switched to duplicate to the western side of Henry Lawson Drive, including the placement of the new Milperra Drain Bridge to the west of the existing road corridor.

At the northern extent of the proposal, to tie-in with the Stage 1A design and due to the recently completed Flower Power on the eastern side of Henry Lawson Drive, the alignment for the proposal needed to be upgraded to the west of the existing road pavement.

In addition, from Flower Power to the M5 Motorway, the existing road reserve alignment and open space on the western side of the existing road, and the proximity of private property on the eastern side, also resulted in an alignment to the west being favoured to minimise property impacts.

Alternative access for Auld Avenue

The Henry Lawson Drive Stage 1A REF identified a change to the Henry Lawson Drive / Auld Avenue intersection to a left-in left-out traffic movement. In response to the feedback received during the preparation and public display of the Henry Lawson Drive Stage 1A REF from the community and Canterbury – Bankstown Council, Transport re-evaluated the solution for the Auld Avenue intersection.

Transport carried out further traffic counts at Auld Avenue, including weekend counts, to gain a better understanding of traffic demand at the intersection. Transport then assessed the feasibility of a range of options to improve the proposed traffic movement at the intersection in consultation with Canterbury-Bankstown Council.

The identified options that were considered to maintain the current level of access to Auld Avenue are as follows:

- left in / left out at Henry Lawson Drive / Auld Avenue (as described in the Henry Lawson Drive Stage 1A REF)
- left in / left out / right in at Henry Lawson Drive / Auld Avenue
- signalised intersection at Henry Lawson Drive / Auld Avenue
- roundabout at Henry Lawson Drive / Auld Avenue
- seagull traffic arrangement at Henry Lawson Drive / Auld Avenue
- Auld Avenue / Keys Parade connection and implementation of left in / left out at Henry Lawson Drive / Auld Avenue.

A description of each of the options are detailed in Table 2-2.

Table 2-2 Auld Avenue intersection access options

Option	Description
Left in / left out	The intersection of Auld Avenue and Henry Lawson Drive would change to a left-in/left-out arrangement. A raised concrete median would separate the northbound and southbound lanes at this location. This is the option described in the Henry Lawson Drive Stage 1A REF.
Left in / left out / right in	The intersection of Auld Avenue and Henry Lawson Drive would remain an unsignalised intersection, however right turn movements from Auld Avenue would be restricted. Right turn into Auld Avenue would remain, with a 60 m storage lane on Henry Lawson Drive.
Signalised intersection at Henry Lawson Drive / Auld Avenue	The intersection of Auld Avenue and Henry Lawson Drive would be converted to a signalised intersection. Henry Lawson Drive would be widened to two lanes in either direction with a left slip lane (northbound) and right turn lane (southbound). Auld Avenue would be widened to include a left turn and a right turn lane onto Henry Lawson Drive.
Roundabout at Henry Lawson Drive / Auld Avenue	The intersection of Auld Avenue and Henry Lawson Drive would be converted to a two lane roundabout.
Seagull intersection	The intersection of Auld Avenue and Henry Lawson Drive would be widened to include a seagull arrangement that would allow for all traffic movements, similar to the current situation.
Auld Avenue / Keys Parade connection	This would see the construction of a new road between Auld Avenue and Keys Parade intersection. This would allow access to and from Auld Avenue and the southbound lanes of Henry Lawson Drive, utilising the signalised intersection at Keys Parade and Henry Lawson Drive. The intersection at Auld Avenue would also be upgraded as per the Henry Lawson Drive Stage 1A REF (i.e., would become a left in / left out arrangement) upon completion of the connection.

The options were assessed against the key drivers of safety, operation, traffic performance, practicality, program, and cost.

The analysis identified that the preferred solution was a new connection between Auld Avenue and Keys Parade. While having some negative impacts, including increased environmental and social impacts to areas closer to areas on Auld Avenue, particularly additional vegetation clearing, the Auld Avenue / Keys Parade connection was ranked the highest in terms of traffic performance, operations, and practicality.

The other options were discounted due to:

- left in / left out at Henry Lawson Drive / Auld Avenue intersection:
  - limits access into Auld Avenue
  - opposed to by the community (both local and those that use the sporting fields) and Canterbury – Bankstown Council
- left in / left out /right in at Henry Lawson Drive / Auld Avenue intersection:
  - limits access out of Auld Avenue that would result in increased travel times
  - would result in traffic delays on Henry Lawson Drive due to queuing back of turning vehicles
- signalised intersection at Henry Lawson Drive / Auld Avenue intersection:
  - traffic signals at the intersection are not warranted due to the small number of turning movements into Auld Avenue
  - this would introduce a third set of traffic lights in close proximity on Henry Lawson Drive (Milperra Road, Auld Avenue, Keys Parade) that could result in driver annoyance
- roundabout at Henry Lawson Drive / Auld Avenue intersection:

  - falls outside the proposal boundary and would result in additional private/ residential land acquisition
  - need to include a new service road for property access
  - increased vegetation clearing
  - worst construction impacts to surrounding sensitive receivers
  - poorest value for money, with the highest cost
- seagull arrangement at Henry Lawson Drive / Auld Avenue intersection:
  - concerns about road safety with vehicles needing to cross a widened Henry Lawson Drive
  - would result in traffic delays on Henry Lawson Drive due to queuing back of turning vehicles
  - performed poorly against safety, operations, traffic performance.
  - poorest value for money, with the highest cost but no appreciable difference on traffic performance for Henry Lawson Drive.

2.5 Design refinements

The concept design proposed in this REF was developed based on Strategic Option 1 (refer to Section 2.4.1). The concept design was developed to provide further design and constructability information to obtain planning approval.

The design refinements during development of the concept design are outlined in the following sections.

2.5.1 Raleigh Road

Raleigh Road was originally proposed to be a left-in, left-out intersection at Henry Lawson Drive. With the development of Keys Parade for the Riverland Development, there was an opportunity to connect Raleigh Road to Keys Parade providing access for people in Milperra to Auld Avenue and associated recreational facilities, which was not accessible from the local road network. In addition, it provides access to and from the western side of Milperra and the southbound lanes of Henry Lawson drive utilising the Keys Parade / Henry Lawson Drive signalised intersection.

The extension provided the opportunity to close the Raleigh Road connection to Henry Lawson Drive to provide additional recreational land for the community adjacent to Raleigh Reserve and remove the road crossing for shared path users.

2.5.2 Amiens Avenue intersection

The Amiens Avenue intersection with Henry Lawson Drive was originally designed as a signalised intersection. However, due to the proximity to the signalised Keys Parade and Bullecourt Avenue intersections, this could result in congestion as traffic queues back from the sets of lights and would not achieve the proposal objective of improving travel time and journey time reliability. With the inclusion of the Raleigh Road connection, which would allow Amiens Avenue traffic access to the Keys Parade intersection, the Amiens Avenue intersection was changed to a left-in, left-out intersection.

2.5.3 Bullecourt Avenue intersection

The Bullecourt Avenue intersection was originally designed to maintain the existing turning lanes, being:

- one northbound right turn lane and one southbound lane from Henry Lawson Drive onto Bullecourt Avenue
- one right turn and one left turn lane from Bullecourt Avenue onto Henry Lawson Drive.

During development of the concept design, the intersection design was modified with:

- An additional right turn lane for vehicles turning from Henry Lawson Drive onto Bullecourt Avenue has been added (providing two right turn lanes total) to provide additional turning capacity and improve access to the eastern side of Milperra through two right turn lanes. The length of turning lanes were also increased to make use of the available space in the median.

- An additional right turn lane for vehicles turning from Bullecourt Avenue onto Henry Lawson Drive (providing two right turn lanes). This provides additional turning capacity for northbound vehicles at the intersection, allowing them to queue in two dedicated lanes.
- Converting the left turn lane from Bullecourt Avenue onto Henry Lawson Drive to a left turn slip lane to improve the flow of vehicles from Bullecourt Avenue to Henry Lawson Drive.

These improvements were made to accommodate the increased number of vehicles using this intersection due to the local road intersection changes to be left-in left-out only.

2.5.4 Pozieres Avenue intersection

The Pozieres Avenue intersection with Henry Lawson Drive was originally designed to maintain the existing scenario, being:

- two northbound and two southbound through lanes on Henry Lawson Drive
- two eastbound lanes and one westbound lane on Pozieres Avenue at its intersection with Henry Lawson Drive.

During development of the concept design, the intersection design was modified with:

- a dedicated left turn lane for northbound vehicles from Henry Lawson Drive to Pozieres Avenue
- a dedicated right turn lane for southbound vehicles from Henry Lawson Drive to Pozieres Avenue.

These lanes have been provided to allow motorists to pull into and decelerate in a dedicated lane to reduce the risk of rear end accidents at this intersection. It would also improve traffic performance on Henry Lawson Drive by reducing queuing in the:

- kerbside northbound through lane for motorists wishing to turn left at this intersection
- outside southbound through lane for motorists wishing to turn right at this intersection.

2.5.5 Footpath on the eastern side of Henry Lawson Drive

As part of Transport's Movement and Place Policy, Transport has provided pedestrian access along the eastern side of Henry Lawson Drive. The footpath was placed on the local road network (Ingram Avenue and Fromelles Avenue) to provide a direct connection to residences, greater separation between path users and vehicles on Henry Lawson Drive and maintain its connection to the existing discrete sections of footpath along the corridor.

2.5.6 Shared path on the western/southern side of Henry Lawson Drive

As part of Transport's Movement and Place Policy, Transport implemented a shared path along the western/southern side of Henry Lawson Drive to maintain connections to the existing shared path network. This has been placed between Henry Lawson Drive and parallel local roads to provide a continuous path of travel without crossing property driveways.

In consultation with Canterbury-Bankstown Council, the shared path design has been refined to minimise impacts to street trees along Henry Lawson Drive. The shared path alignment along Henry Lawson Drive has been adjusted where possible, including north of Ganmain Crescent, to retain as many street trees as possible. During detailed design, opportunities to further reduce the number of trees impacted by the proposal would be investigated (in accordance with Safeguard A1).

In addition to alignment adjustments, alternative shared path types (on-ground and above ground) have been considered to minimise impacts on tree roots. Above ground path types with minimal excavation were not an acceptable design option due to the need to provide handrails which would restrict intermittent access to and egress from the paths for residents accessing local streets and due to maintenance requirements.

Alternatives to providing a shared path included maintaining the existing arrangement with on road cycling facilities, dedicated cycling lanes, separated bicycle lane and a footpath. These alternatives were considered but were not progressed as they would not align with safety and urban design requirements. As such, the proposal has progressed with a shared path utilising on-ground path types only.

During detailed design, further consideration would be given to the construction strategies and techniques for on-ground path types.

3 Description of the proposal

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

Transport proposes to upgrade Henry Lawson Drive along a 1.8-kilometre section between Keys Parade and the M5 Motorway. The proposal includes road widening to increase traffic capacity and improve travel time, as well as upgrades of key intersections to enhance capability and driver safety.

Key features of the proposal would include:

- widening Henry Lawson Drive from two to four lanes between Auld Avenue, Milperra and the M5 Motorway, Milperra with a raised central median
- upgrading the Henry Lawson Drive / Bullecourt Avenue signalised intersection, including:
  - an additional right-turn lane from Henry Lawson Drive (northbound) to Bullecourt Avenue (two right-turn lanes total)
  - an additional right-turn lane from Bullecourt Avenue to Henry Lawson Drive (northbound) (two right-turn lanes total)
  - converting the existing dedicated left-turn lane from Bullecourt Avenue to Henry Lawson Drive (southbound) into a dedicated left-turn slip lane
  - maintaining the dedicated left-turn lane from Henry Lawson Drive (southbound) to Bullecourt Avenue
- upgrading the Henry Lawson Drive / Pozieres Avenue signalised intersection, including:
  - a new dedicated right-turn lane from Henry Lawson Drive (southbound) to Pozieres Avenue
  - a new dedicated left-turn lane from Henry Lawson Drive (northbound) to Pozieres Avenue and relocation of the existing bus stop north of the intersection
- providing a new two-lane local link road between Auld Avenue and Keys Parade (about 160 metres), crossing over Milperra Drain, providing access to / from southbound lanes of Henry Lawson Drive and Auld Avenue, and removing up to eight parking spaces on Auld Avenue to accommodate the link road
- extending Raleigh Road about 120 metres to connect with Keys Parade at a roundabout, and removing the direct connection between Raleigh Road and Henry Lawson Drive
- converting the Henry Lawson Drive intersections to be left-in left-out only, at:
  - Ruthven Avenue
  - Whittle Avenue
  - Amiens Avenue
  - Ganmain Crescent
  - Fromelles Avenue
  - Hermies Avenue
- modifying the Bullecourt Avenue / Ashford Avenue intersection to better accommodate heavy vehicle movements
- constructing a three-metre-wide shared path:
  - on the western/southern side of Henry Lawson Drive between Pozieres Avenue and Keys Parade
  - along Keys Parade, the new Auld Avenue local link road and the extended section of Raleigh Road
- reconstruction of some existing shared paths within the proposal area
- constructing a new footpath within the proposal area:
  - on the eastern side of Henry Lawson Drive between the Flower Power and Ingram Avenue

  - along the northern side of Ingram Avenue
  - along the eastern side of Fromelles Avenue
- installing new drainage infrastructure and water quality controls within the proposal area, including:
  - an upgraded longitudinal and transverse drainage pits and pipes network along Henry Lawson Drive
  - a bioretention basin between Henry Lawson Drive, Bullecourt Avenue and Fleurbaix Avenue and maintenance access to this basin
  - swales along Henry Lawson Drive and Keys Parade and installation of Gross Pollutant Traps
  - relocation of an existing swale along the Auld Avenue link road
- construction activities and ancillary work, including:
  - relocation of utilities (including electrical, gas, water, and telecommunications)
  - civil earthworks, drainage work, water quality controls, and tie-in work to adjoining sections of Henry Lawson Drive and local roads
  - final roadworks including pavement, kerb and gutters, signs, road furniture, landscaping, lighting, and line marking
  - new traffic signals and intelligent transport systems including, but not limited to, closed-circuit television
  - establishment of temporary ancillary facilities to support construction, including compound sites, site offices, stockpile and laydown locations, temporary access tracks and water quality devices.

The key features of the proposal are shown in Figure 3-1a-e. These are described in greater detail in the remainder of the chapter.

The concept design would be further refined during detailed design to minimise environmental and social impacts and to consider community feedback to the exhibition of the REF.

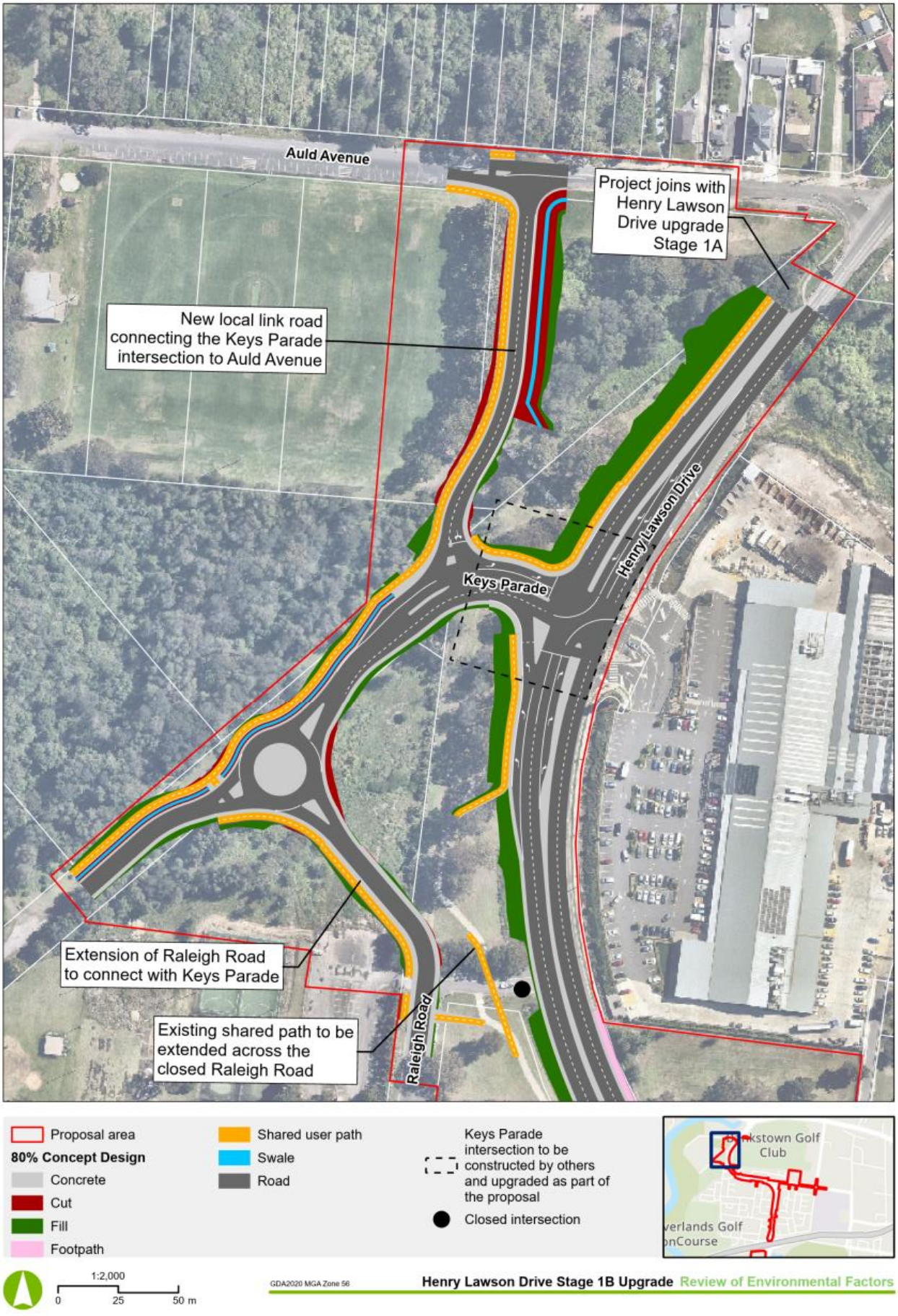


Figure 3-1a Key features of the proposal

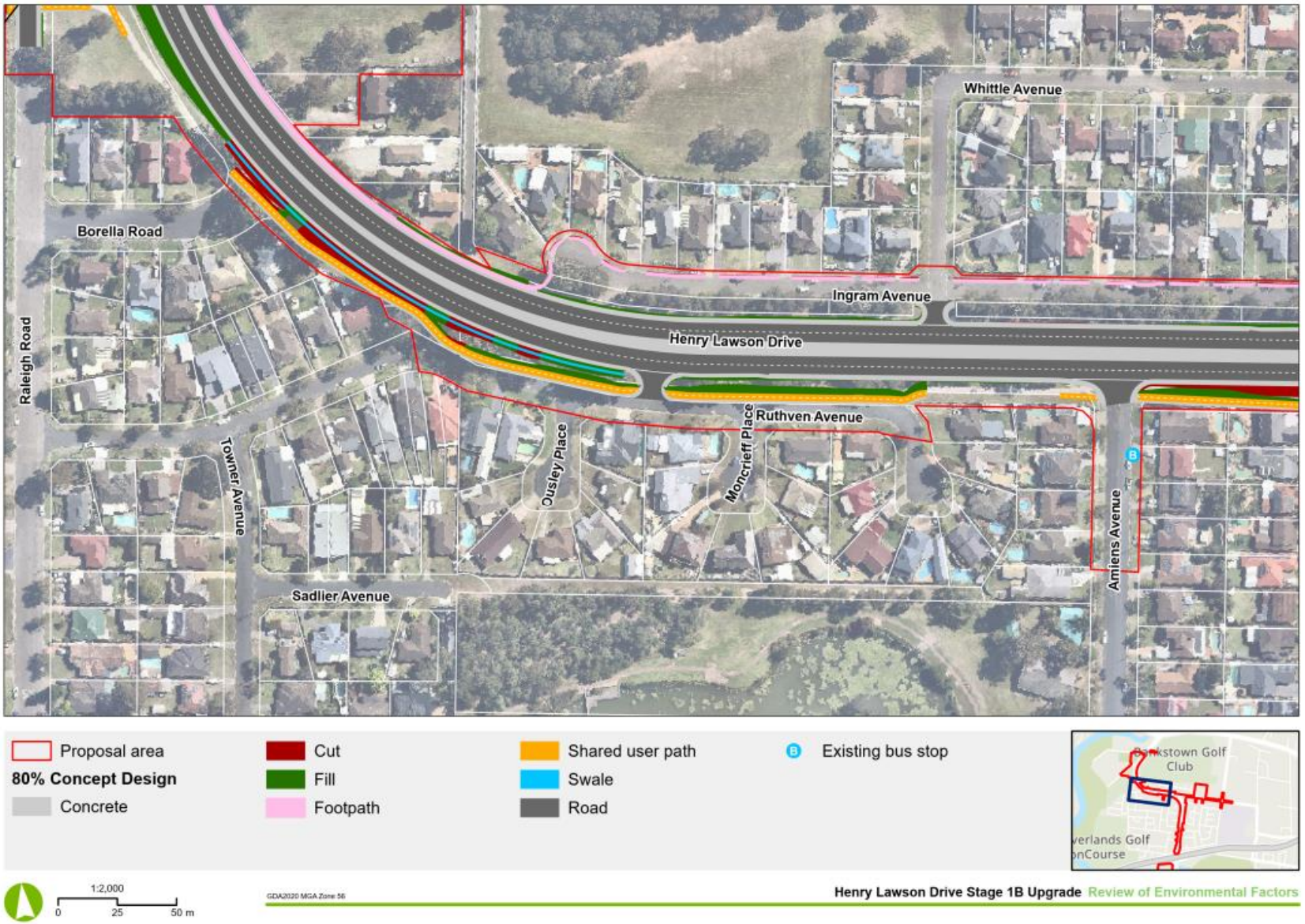


Figure 3-1b Key features of the proposal

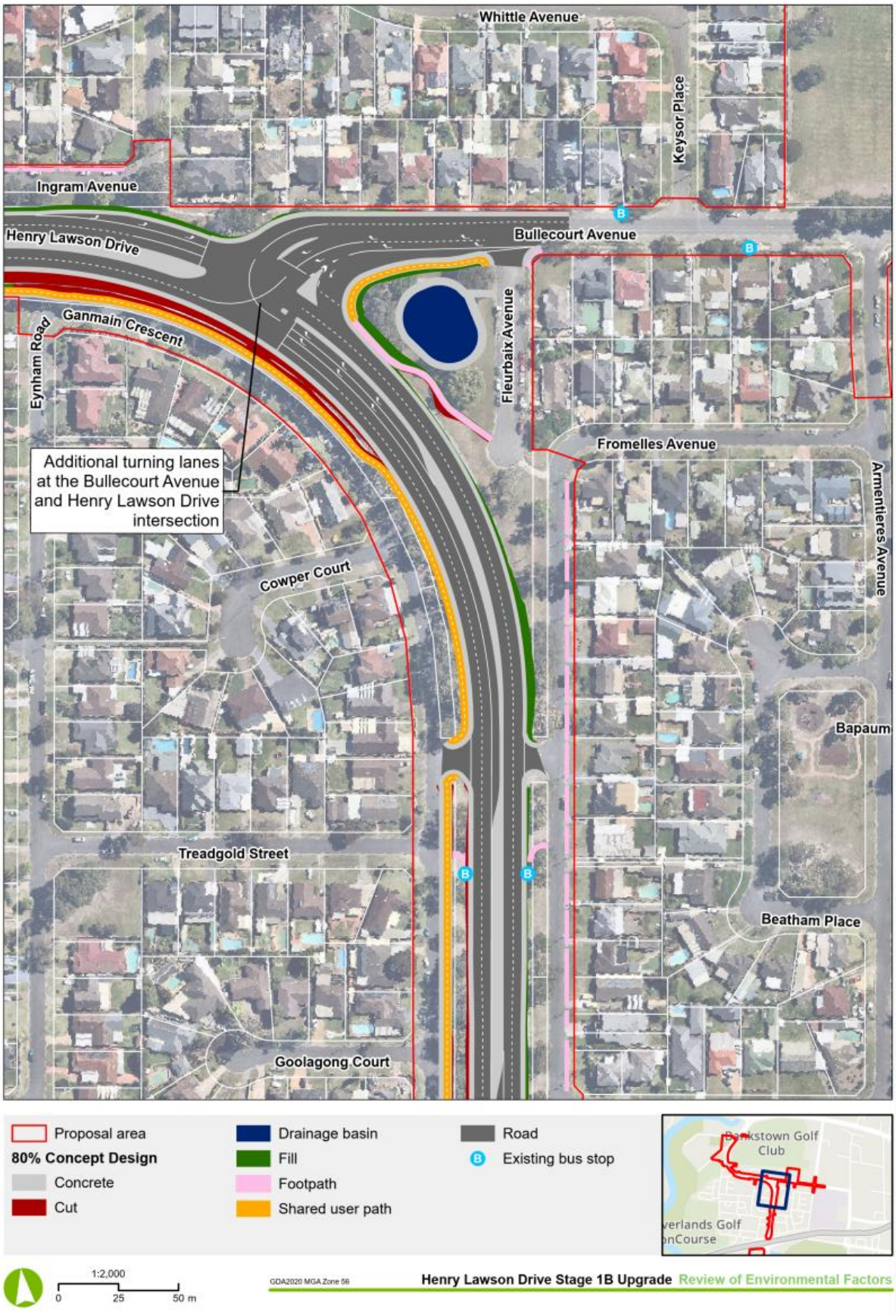


Figure 3-1c Key features of the proposal

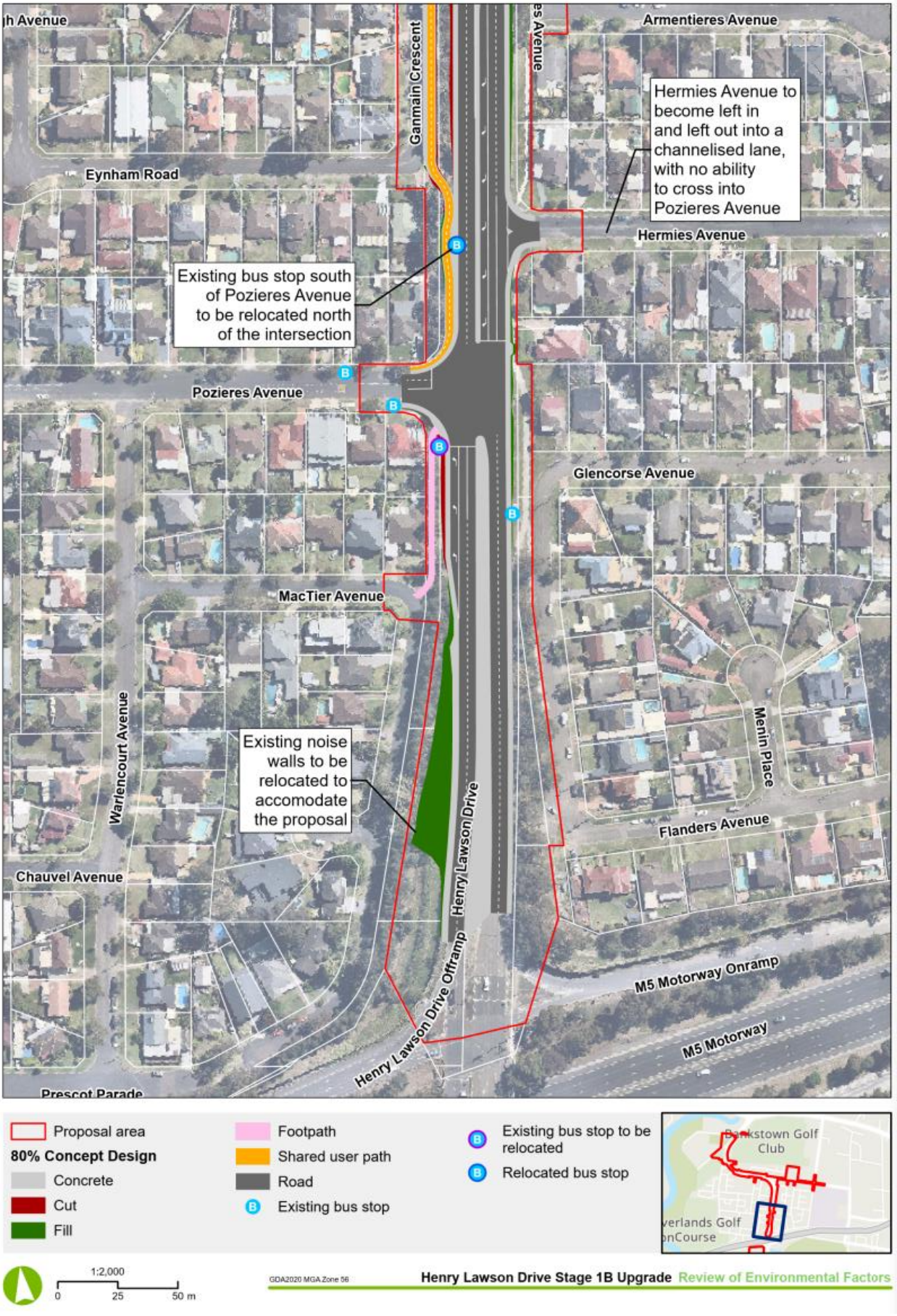


Figure 3-1d Key features of the proposal

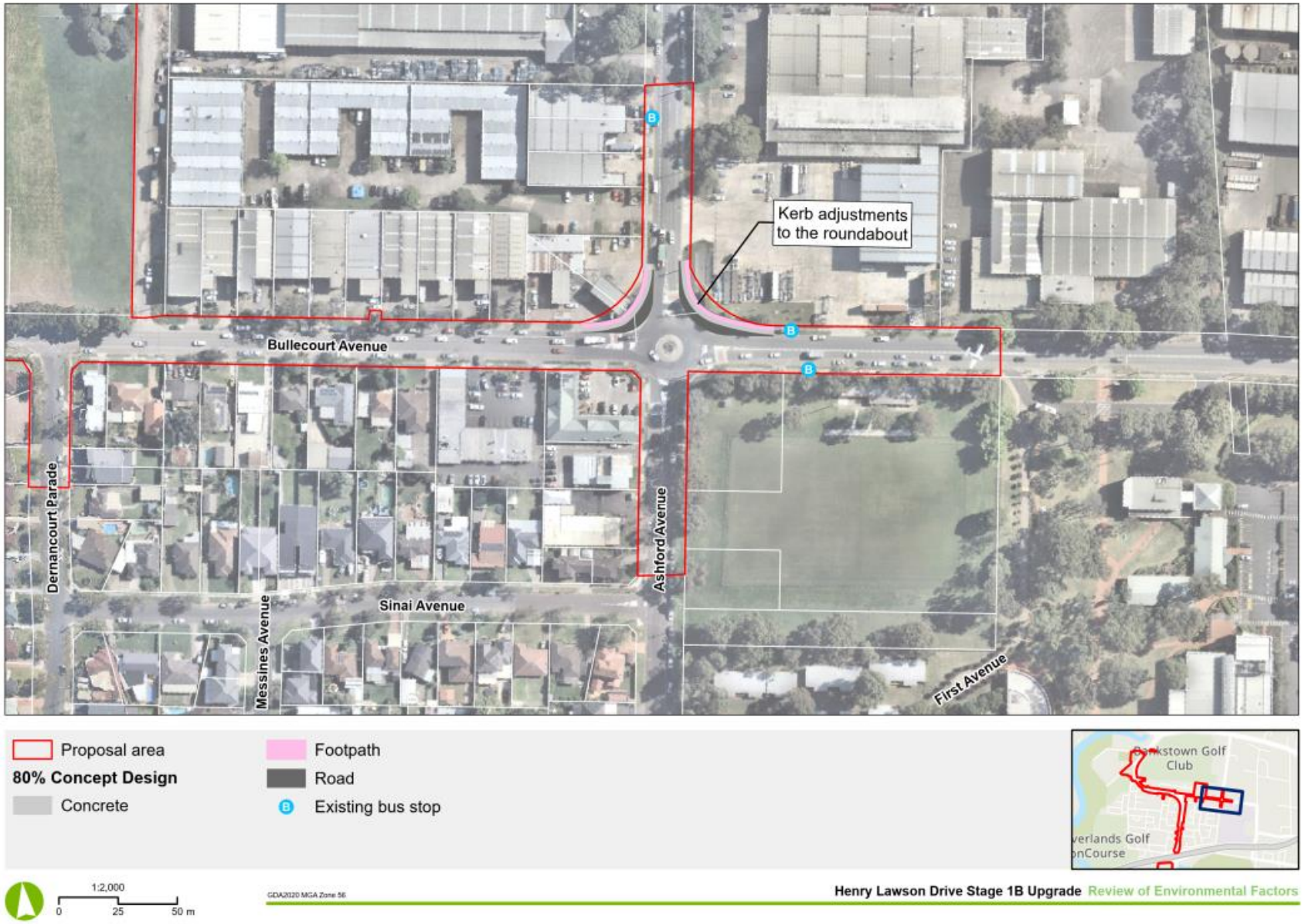


Figure 3-1e Key features of the proposal

3.2 Design

3.2.1 Design criteria

The proposal has been designed to satisfy relevant standards and applications, including:

- published Transport supplements to Austroads Guides
- Austroads Road Design Guides
- Australian Standards.

Specific design criteria for the elements of the proposal are presented in Table 3-1.

Table 3-1 Design criteria

Design element	Henry Lawson Drive	Keys Parade	Local roads
Carriageway	Dual carriageway (two lanes in each direction)	Two lanes in each direction near Henry Lawson Drive, tapering back to one lane in each direction	One lane in each direction
Design speed (km/h)	70	70	60
Posted speed (km/h)	60	60	50
Design vehicle (Check vehicle)	26 metre B-Double (36.5 metre A-Double)	12.5 metre rigid truck **Dual right turn movements:** 12.5 metre rigid truck and a passenger car simultaneously (19 metre Semi-Trailer)	**Bullecourt Ave:** 26 metre B-Double Dual Right turn movements: 26 metre B-Double and a passenger car simultaneously (36.5 metre A-Double) **Other local roads:** 12.5 metre rigid truck (19 metre Semi-Trailer)
Lane width (m)	**Kerbside:** 4 **Offside:** 3.5 minimum **Horizontal curves:** 4	3.5	**Local link road between Auld Avenue and Keys Parade:** 3.3 **Raleigh Road:** 3.5 **Pozieres Avenue:** 3 **Bullecourt Avenue:** 3.3 **Ashford Avenue:** As per existing
Left turn lane width (m)	4	-	4 (including kerb channel)
Right turn lane width (m)	3.3	-	3.3
Minimum median width (m)	1.5	-	-
Minimum verge width (m)	1.5 0.5 near shared paths	-	-
Crossfall (per cent)	3	3	3

Design element	Henry Lawson Drive	Keys Parade	Local roads
Maximum superelevation (per cent)	4	-	-
Maximum vertical grade (per cent)	2.9	-	-
Footpath width (m)	Varies	-	Varies
Shared path width (m)	3	3	3
Batter	4H:1V	4H:1V	4H:1V
Safety barriers	W-Beam steel safety barrier	-	-
Pavement	Full depth asphalt	Full depth asphalt	Full depth asphalt

Any other accesses not identified in this table have been designed for a passenger car, with a 12.5 metre single unit truck as the check vehicle.

3.2.2 Engineering constraints

A number of engineering constraints have been considered in the development of the design. The major constraints considered are described in Table 3-2.

Table 3-2 Engineering and development constraints of the proposal

Constraint	Description
Construction and traffic staging	Construction of the proposal would occur on heavily trafficked roads, including Henry Lawson Drive and Bullecourt Avenue, which are important thoroughfares as well as key access routes for Milperra residents. Effective traffic control and construction staging would be required to minimise impacts to local traffic.
State Environmental Planning Policy (Resilience and Hazards) 2021 coastal wetlands area	The proposal has been designed to avoid impacts to coastal wetlands. While the proposal area does not impact on the wetlands, it passes through the coastal wetlands proximity buffer and over waterways that drain into coastal wetlands.
Property impacts	The road alignment of Henry Lawson Drive and Bullecourt Avenue has been designed to avoid full property acquisition of residential properties next to the proposal. The widening along Henry Lawson Drive would occur within a historical road reservation (local heritage).
Flower Power Garden Centre	The proposal has been designed to avoid direct impacts to the property boundary of the Flower Power Garden Centre opposite Keys Parade and to tie-in to the existing access to Flower Power at the Henry Lawson Drive / Keys Parade intersection. The Flower Power emergency access to Henry Lawson Drive (Lot 1 DP563421) needs to be maintained at all times.
Keys Parade intersection	The Keys Parade intersection into the Riverland Development is anticipated to be constructed in early 2023 by the developer for the subdivision. The proposal would need to be designed to acknowledge that the intersection would be upgraded prior to works for the proposal.
Sydney Water sewage pumping facility	Keys Parade has been designed to avoid the need for relocation of the Sydney Water sewage pumping facility (Lot 1 DP596508).
Utilities and facilities	There are a range of facilities and utilities that need to be retained by the proposal. This includes the recently installed red light speed camera at Pozieres Avenue, the VMS near Amiens Avenue and bus stop shelters.

3.2.3 Major design features

Widening of Henry Lawson Drive

The proposal would involve the widening of Henry Lawson Drive from two lanes to four lanes (two lanes in each direction) between Keys Parade and the M5 Motorway over a distance of about 1.8 kilometres.

The northern limit of the proposal on Henry Lawson Drive is about 200 metres north of its intersection with Keys Parade. The southern limit of the proposal on Henry Lawson Drive is about 100 metres north of its intersection with the M5 Motorway and would tie into existing sections of dual carriageway.

There would be four travel lanes along Henry Lawson Drive, with each carriageway being about 7.5 to eight metres wide, with increased widening at intersections to account for turning lanes (with widths of up to 14.6 metres for each carriageway), as discussed in the following sections. The verge and median areas would vary in width and include a concrete median.

Indicative cross sections are shown in Figure 3-2 and Figure 3-3.

Figure 3-2 Typical cross section – Henry Lawson Drive south of Raleigh Road (near Ruthven Avenue)

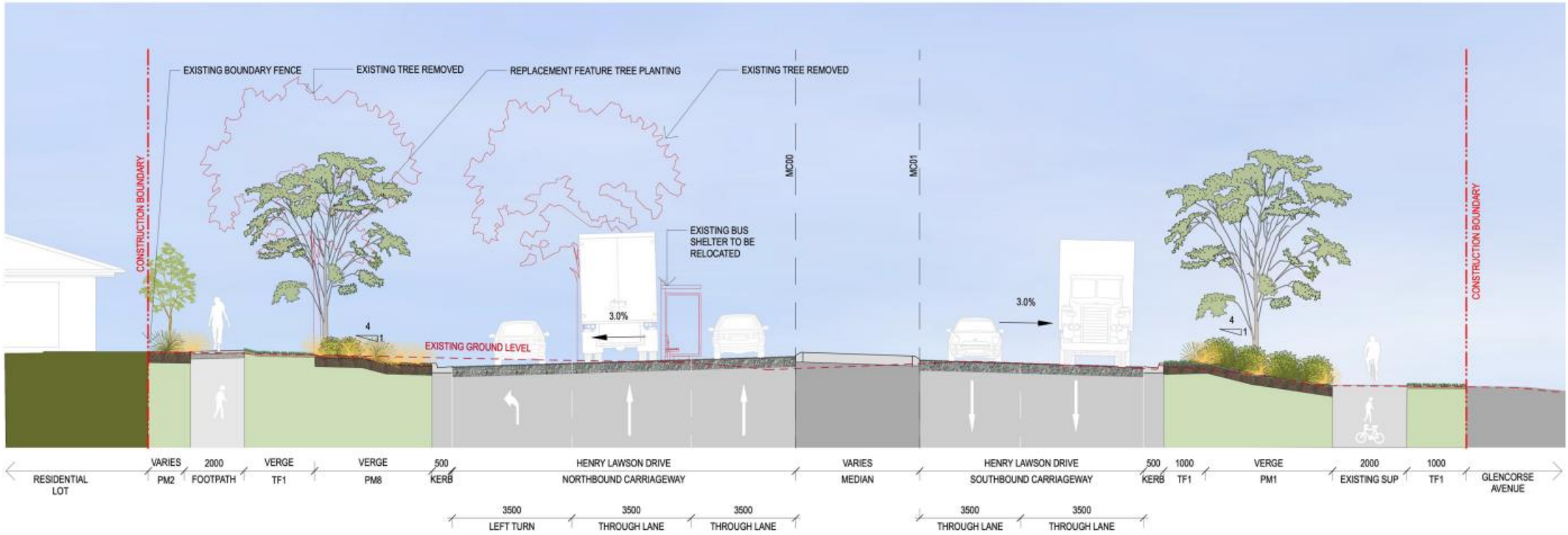


Figure 3-3 Typical cross section – Henry Lawson Drive south of Pozieres Avenue

Intersection upgrades

Henry Lawson Drive / Keys Parade intersection

The proposal would tie-in with the intersection upgrades to the Henry Lawson Drive / Keys Parade intersection proposed to be constructed as part of the 'Riverlands by Mirvac' development. This is subject to a separate planning approval and would provide access to Keys Parade from Henry Lawson Drive.

The proposal would widen the new intersection to tie into the Henry Lawson Drive duplication. The intersection would include:

- two right turn southbound lanes from Henry Lawson Drive into Keys Parade
- a dedicated northbound slip lane from Henry Lawson Drive into Keys Parade
- a dedicated northbound right turn lane from Henry Lawson Drive into Flower Power
- two lanes from Keys Parade onto Henry Lawson Drive.

To access Auld Avenue, vehicles travelling south on Henry Lawson Drive would need to turn right onto Keys Parade, turn around at the roundabout and turn left onto the local link road. Further detail is discussed in the following sections.

The proposed configuration of the Henry Lawson Drive and Keys Parade intersection is shown in Figure 3-4.

Figure 3-4 Henry Lawson Drive / Keys Parade Intersection

Henry Lawson Drive / Bullecourt Avenue intersection

The proposal would upgrade the existing signalised Henry Lawson Drive / Bullecourt Avenue intersection. This would include:

- an additional right-turn lane on Henry Lawson Drive, providing two dedicated right-turn lanes for vehicles travelling northbound on Henry Lawson Drive wishing to turn right into Bullecourt Avenue
- shifting to the east the existing dedicated southbound left-turn lane on Henry Lawson Drive for vehicles wishing to turn left into Bullecourt Avenue east to accommodate two through lanes on Henry Lawson Drive
- an unsignalised left-turn slip lane from Bullecourt Avenue onto the southbound carriageway of Henry Lawson Drive with a signalised pedestrian crossing connection to the shared path on the southern side of Bullecourt Avenue.

The existing signalised pedestrian crossings across Bullecourt Avenue and across Henry Lawson Drive on the southern side of this intersection would be maintained and adjusted to accommodate the proposed road widening.

The proposed configuration of the Henry Lawson Drive and Bullecourt Avenue intersection is shown in Figure 3-5.

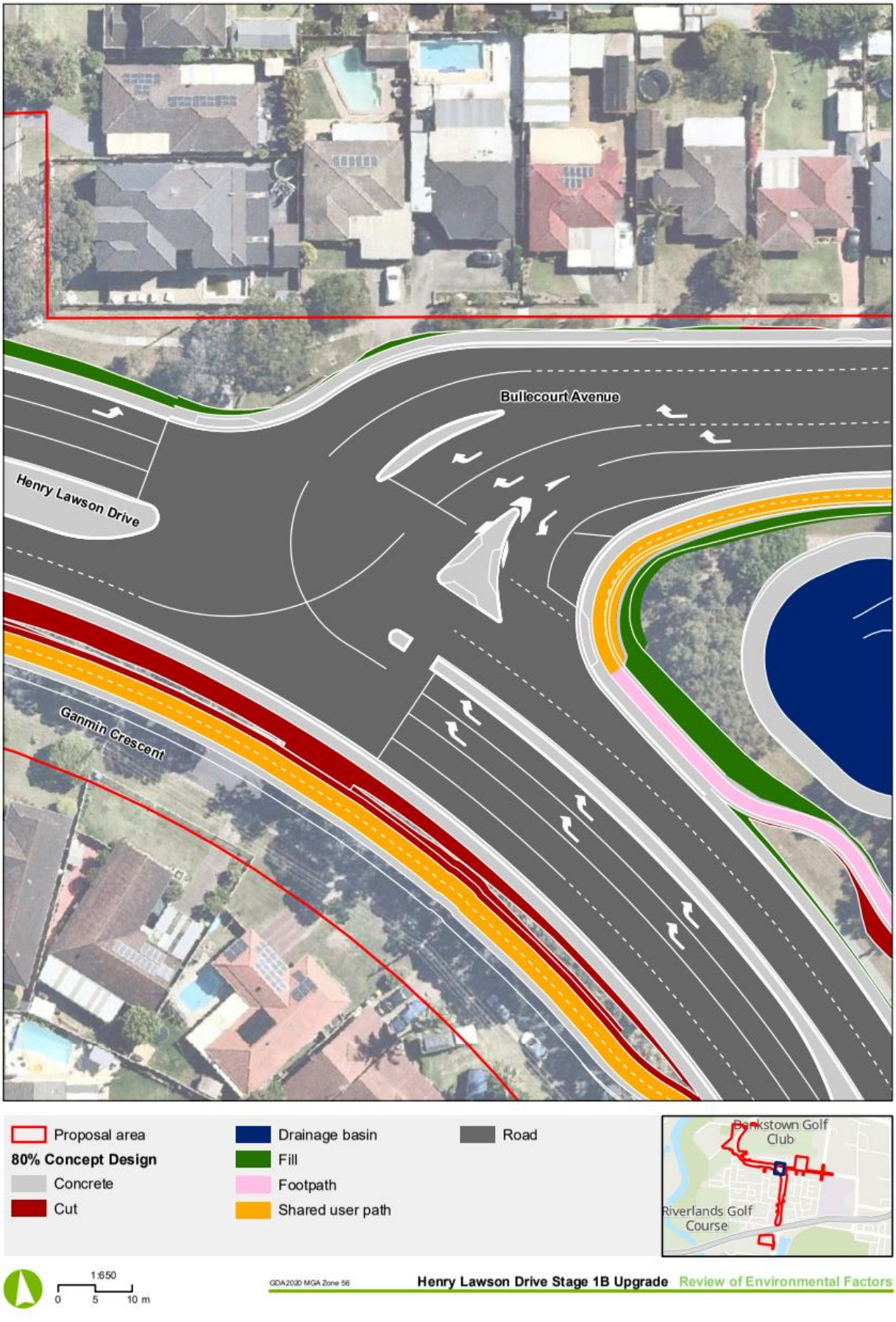


Figure 3-5 Henry Lawson Drive / Bullecourt Avenue intersection

Henry Lawson Drive / Pozieres Avenue intersection

The proposal would upgrade the existing signalised Henry Lawson Drive / Pozieres Avenue intersection. This would include:

- a dedicated left-turn lane on Henry Lawson Drive for northbound traffic
- a dedicated right-turn lane on Henry Lawson Drive for southbound traffic, providing vehicle storage to minimise impacts to the two southbound through lanes
- shifting the northbound through lanes west to allow the carriageways to be divided.

The two existing signalised pedestrian crossings would be maintained and adjusted to accommodate the proposed road widening for pedestrians wishing to cross either Pozieres Avenue or Henry Lawson Drive (on the northern side of this intersection). The crossing on the northern side of Henry Lawson Drive would become a shared path crossing with bicycle lanterns. A new pedestrian crossing would also be provided on the southern side of this intersection.

The bus stop located to the south of the Pozieres Avenue intersection would be relocated north of the intersection to improve traffic flow and avoid conflicts with stopping buses and vehicles in the slip lane turning left into Pozieres Avenue. The existing bus shelter would be relocated to this location.

The proposed configuration of the Henry Lawson Drive / Pozieres Avenue intersection is shown in Figure 3-6.

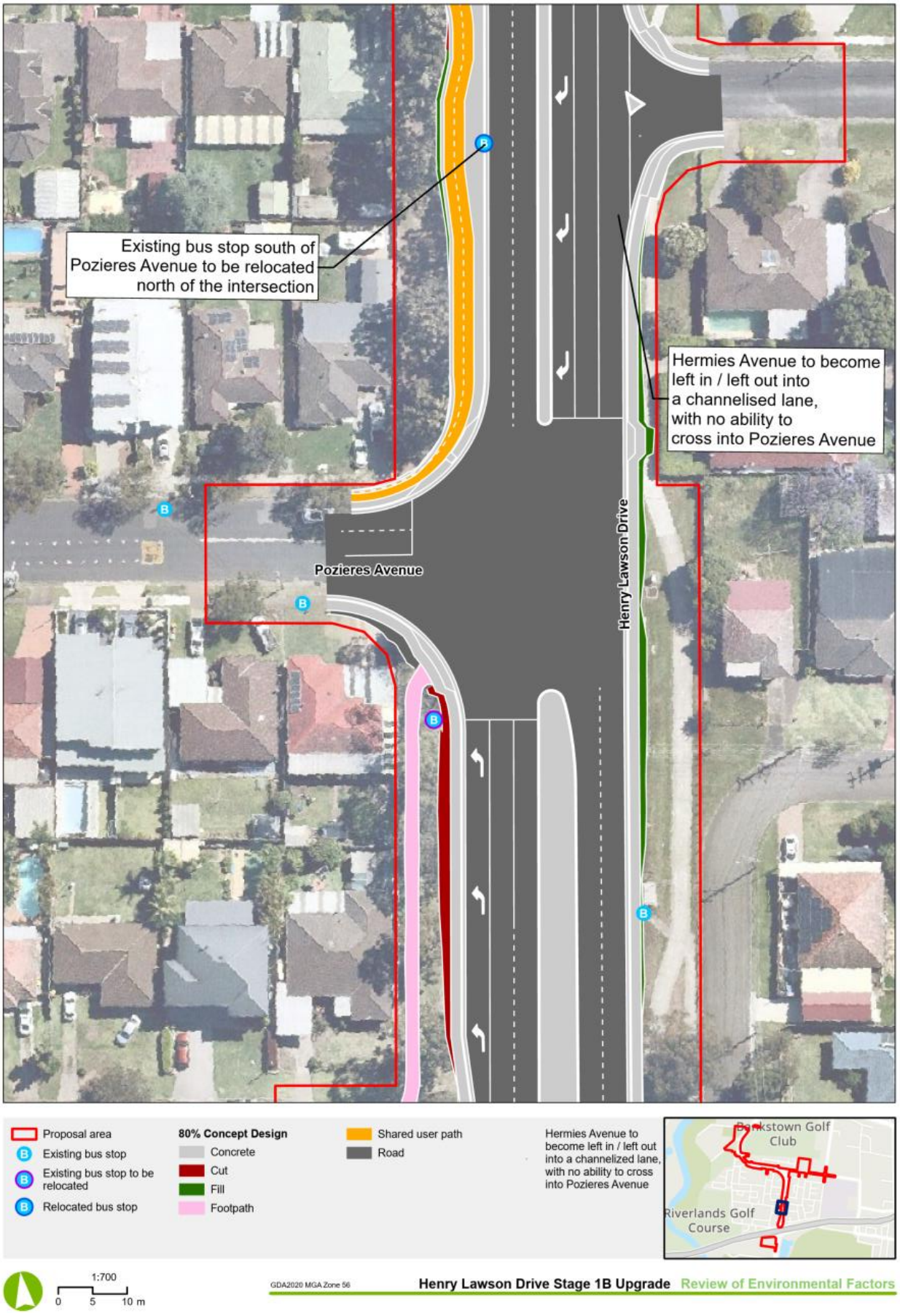


Figure 3-6 Henry Lawson Drive / Pozieres Avenue intersection

Bullecourt Avenue / Ashford Avenue intersection

The proposal would upgrade the existing Bullecourt Avenue / Ashford Avenue intersection to improve heavy vehicle turning movements between the northern side of Ashford Avenue and Bullecourt Avenue. On the two northern sides of the intersection, the road pavement would be widened with adjustments to existing kerbs. These works would minorly encroach into properties around the roundabout and would require partial property acquisition of three lots. Further details on property acquisition are provided in Section 3.6. Work would be limited to avoid impacts to the petrol station infrastructure. No adjustments would be made to the roundabout position or the southern side of the intersection.

The proposed configuration of the Bullecourt Avenue / Ashford Avenue intersection is shown in Figure 3-7.

Figure 3-7 Bullecourt Avenue / Ashford Avenue intersection

Henry Lawson Drive and other local roads

The proposal would convert existing non-signalised intersections along Henry Lawson Drive to be left-in left-out only. Access routes to and from Henry Lawson Drive for local roads which would be converted into left-in left-out only as part of the proposal are outlined in Table 3-3. The shortest access routes from Henry Lawson Drive to the local road network are shown in Figure 3-8a-b and Henry Lawson Drive access routes from the local road network are shown in Figure 3-9a-b.

Where the proposal would interrupt access to properties, all properties would be provided with restored or new permanent access arrangements. This would be confirmed during detailed design.

Table 3-3 Local road access to and from Henry Lawson Drive for roads converted to left-in left-out access only

Local road	Access to and from Henry Lawson Drive
Ruthven Avenue	• Access to and from Ruthven Avenue and the southbound lanes of Henry Lawson Drive would be via the Henry Lawson Drive / Keys Parade intersection and the extension of Raleigh Road.
Whittle Avenue	• Access to and from Whittle Avenue and the northbound lanes of Henry Lawson Drive would be via the Henry Lawson Drive / Bullecourt Avenue intersection and Keysor Place.
Amiens Avenue	• Access to and from Amiens Avenue and the southbound lanes of Henry Lawson Drive would be via the Henry Lawson Drive / Keys Parade intersection or via the Henry Lawson Drive / Pozieres Avenue intersection and the local road network.
Ganmain Crescent	• Access to and from Ganmain Crescent Avenue and the southbound lanes of Henry Lawson Drive would be via the Henry Lawson Drive / Keys Parade intersection or via the Henry Lawson Drive / Pozieres Avenue intersection and the local road network.
Fromelles Avenue	• Access to and from Fromelles Avenue and the northbound lanes of Henry Lawson Drive would be via the Henry Lawson Drive / Bullecourt Avenue intersection and Armentieres Avenue.
Hermies Avenue	• Access to and from Hermies Avenue and the northbound lanes of Henry Lawson Drive would be via the Henry Lawson Drive / Bullecourt Avenue intersection and Dernancourt Parade. • Motorists wishing to access Pozieres Avenue from Hermies Avenue would also need to use Dernancourt Parade and Bullecourt Avenue to access the southbound carriageway of Henry Lawson Drive. The Henry Lawson Drive / Hermies Avenue intersection would only permit left turning vehicles into the kerbside lane to travel south through the Pozieres Avenue intersection. Vehicles would not be permitted to cross traffic to turn right into Pozieres Avenue (refer to Figure 3-6).

In addition, the Raleigh Road intersection with Henry Lawson Drive would be closed, with Raleigh Road extended to join Keys Parade to the northwest of Raleigh Road, near the Milperra Sports Centre. Motorists on Raleigh Road would access Henry Lawson Drive from the signalised Keys Parade intersection allowing access to both the northbound and southbound lanes.

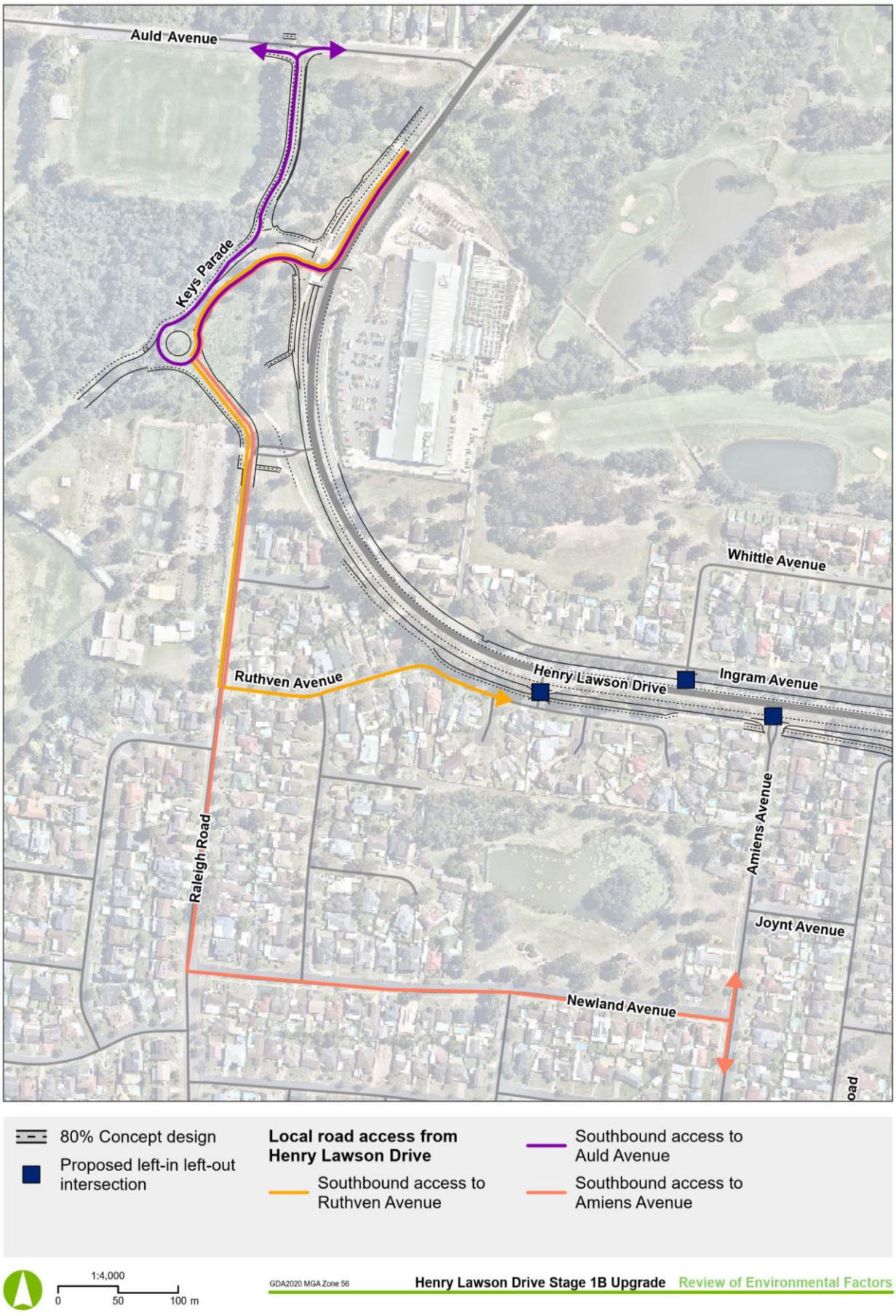


Figure 3-8a Local road access from Henry Lawson Drive

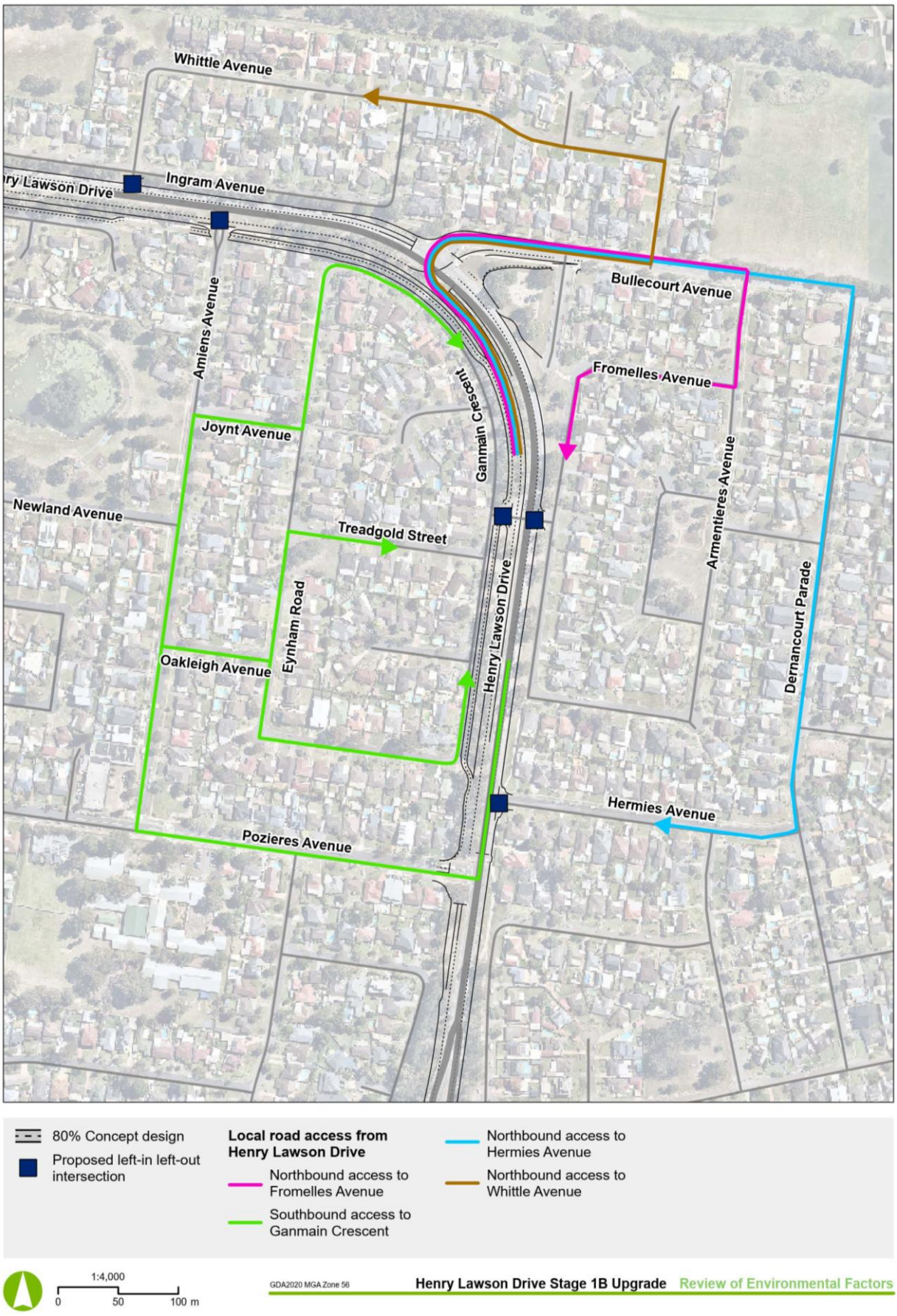


Figure 3-8b Local road access from Henry Lawson Drive

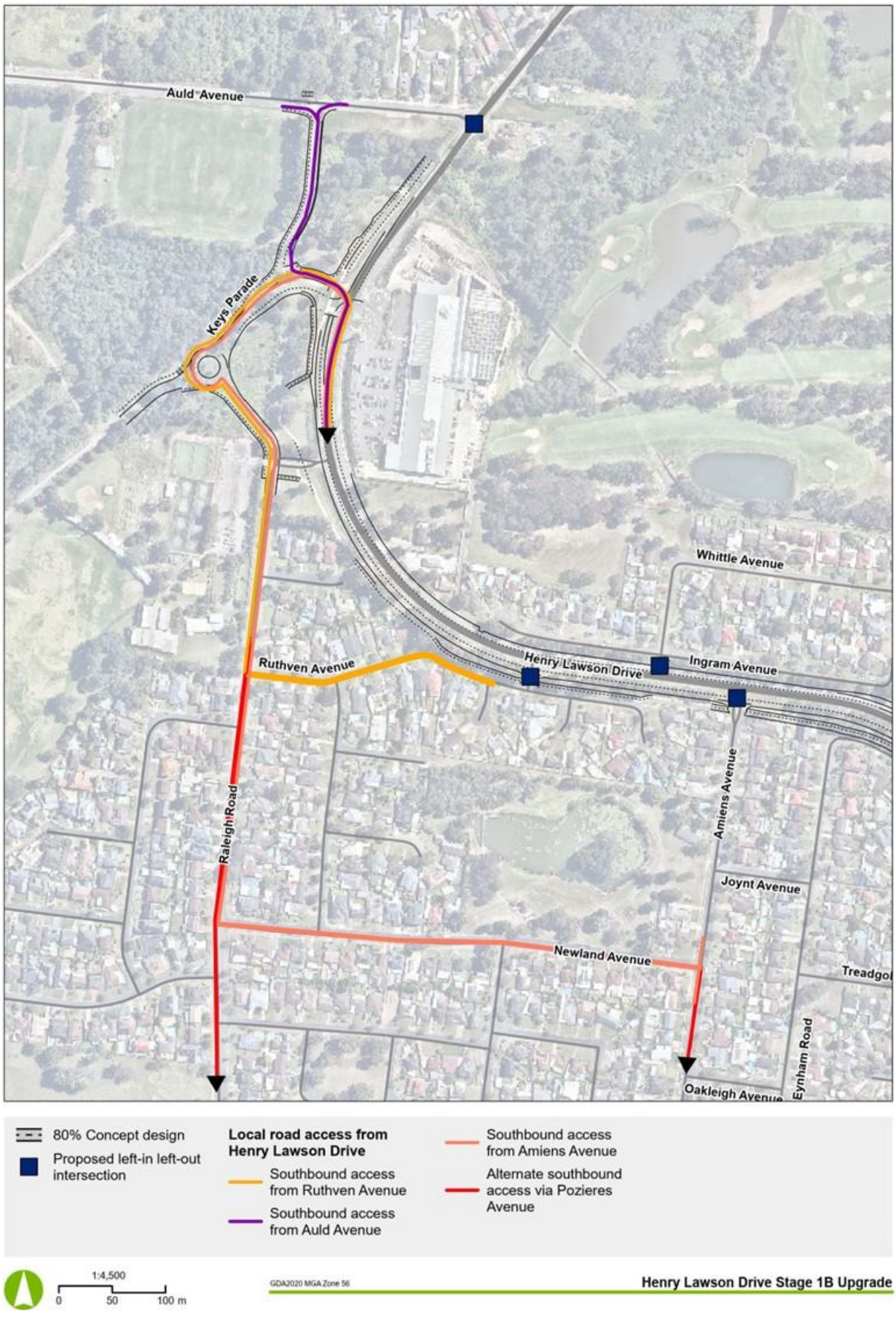


Figure 3-9a Henry Lawson Drive access from local roads

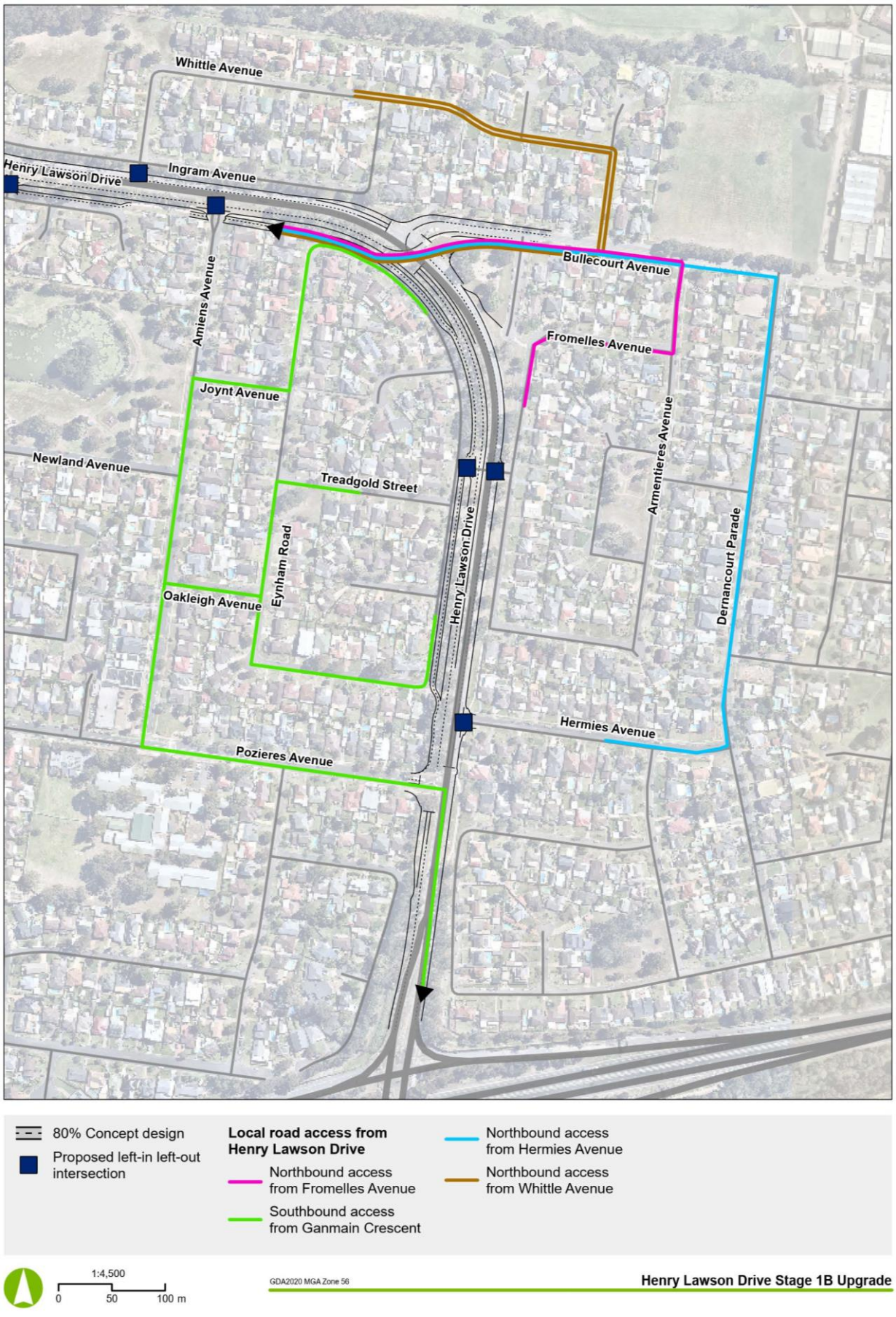


Figure 3-9b Henry Lawson Drive access from local roads

Local link road between Auld Avenue and Keys Parade

A new two-lane local link road with a shared path would be provided between Auld Avenue and Keys Parade, to the west of Henry Lawson Drive and immediately to the east of the Gordon Parker Reserve playing fields. It would provide northbound and southbound local access between the two roads. To safely connect with Auld Avenue, up to eight parking spaces on Auld Avenue next to the Gordon Parker Reserve would be removed. There would also be adjustments to the existing pedestrian refuge on Auld Avenue to tie-in with the shared path along the local link road.

Under the Henry Lawson Drive Upgrade Stage 1A project (subject to a separate planning approval), Auld Avenue would be converted to left-in left-out only. However, as discussed in the Henry Lawson Drive Upgrade Stage 1A Submissions Report (Transport, 2021), this would only occur once an alternative access (via link road) is constructed.

The local link road would allow motorists on Auld Avenue to efficiently access the southbound carriageway of Henry Lawson Drive via the signalised Henry Lawson Drive / Keys Parade intersection. It would remove the need for a detour via the northbound carriageway of Henry Lawson Drive to travel south along the road corridor.

As part of the local link road, Keys Parade would be extended to the southwest to a roundabout. At the link road / Keys Parade intersection, vehicles on Keys Parade would not be able to turn right to access Auld Avenue. To access Auld Avenue, vehicles travelling south on Henry Lawson Drive would need to enter Keys Parade, perform a U-turn at the roundabout and turn left into the link road.

The local link road would include a box culvert road bridge across Milperra Drain with two road lanes and a shared path to the north of Keys Parade. This would replace the existing shared path bridge (which would be removed due to the proposal). A new shared path would be constructed alongside Keys Parade and the link road to maintain active transport connectivity.

The link road and extension to Raleigh Road is shown in Figure 3-1a. Access to Auld Avenue for motorists travelling south on Henry Lawson Drive is shown in Figure 3-8a.

Property access adjustments

The five residential properties within the proposal area with direct access to Henry Lawson Drive would have their driveway access converted to left-in left-out only due to the installation of a central raised median. This would affect 497, 499, 503, 553 and 553A Henry Lawson Drive, Milperra.

Access arrangements between these properties and the northbound carriageway are outlined in Table 3-4 and shown in Figure 3-10.

Table 3-4 Property access for residential properties with direct access to Henry Lawson Drive

Properties	Access to northbound carriageway from properties	Access to properties from northbound carriageway
497, 499 and 503 Henry Lawson Drive, Milperra	• Access would be via the Henry Lawson Drive / Bullecourt Avenue intersection	• Access would be via the Henry Lawson Drive / Keys Parade intersection to use the roundabout at Raleigh Road
553 and 553A Henry Lawson Drive, Milperra	• Access would be via Henry Lawson Drive south of the M5 Motorway	• Access would be via the Henry Lawson Drive / Bullecourt Avenue intersection

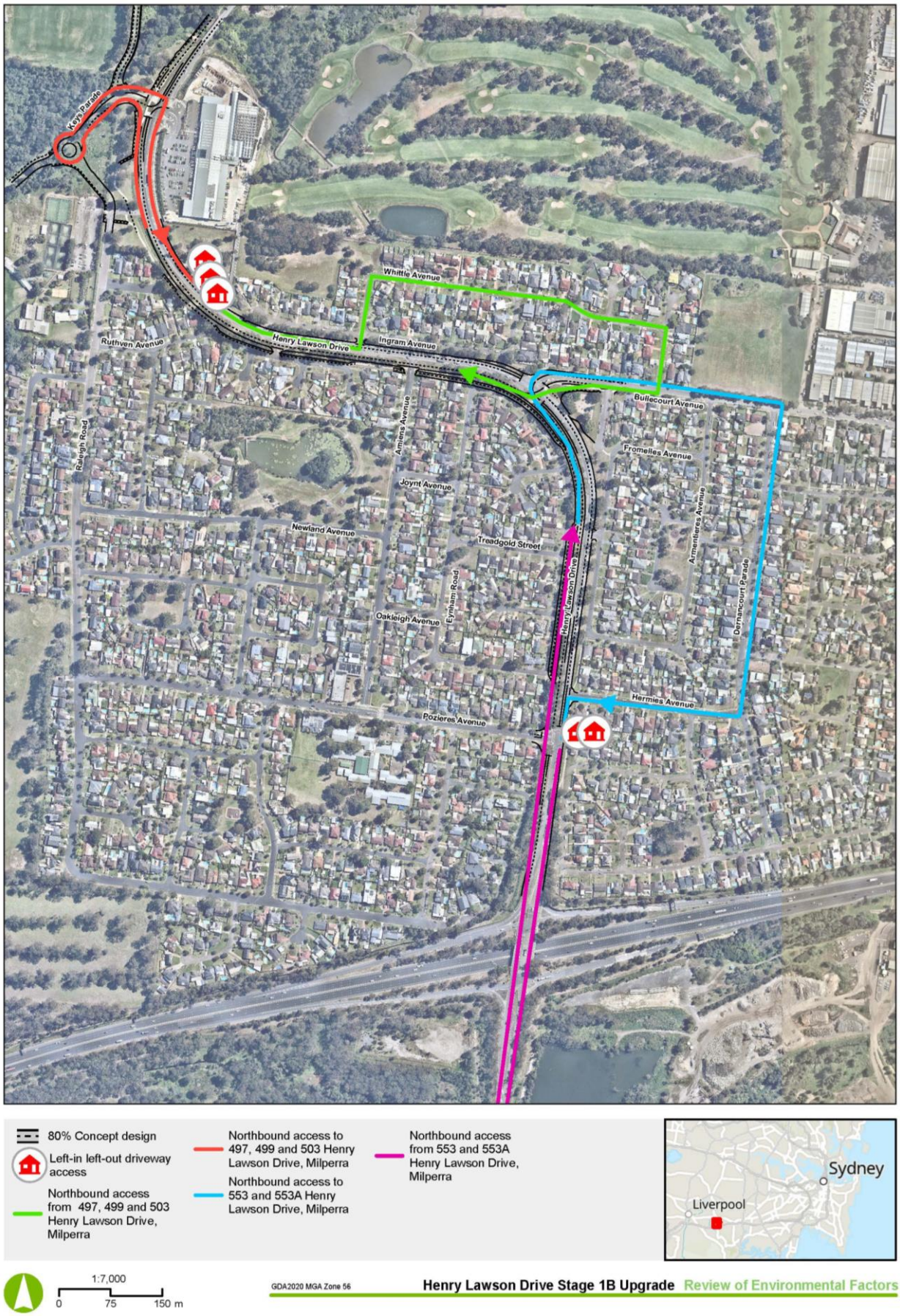


Figure 3-10 Possible left-in left-out driveway access routes

Shared paths and footpaths

Proposed shared paths and footpaths are shown in Figure 3-1a-e.

Shared paths

Currently there are a number of short links of shared paths along the western side of Henry Lawson Drive that connect the playing fields along Auld Avenue to local roads including Raleigh Road, Borella Road, Ruthven Avenue, Amiens Avenue and Ganmain Crescent. A small stretch connects Ganmain Crescent to the intersection at Pozieres Avenue after which the shared path continues south on the eastern side of Henry Lawson Drive.

The proposal would install a three-metre-wide shared path along the western/southern side of Henry Lawson Drive between Pozieres Avenue and Borella Road and north of Keys Parade. Due to the closure of the Henry Lawson Drive / Raleigh Road intersection, the existing shared path would also be re-aligned through Raleigh Reserve to connect areas of parkland. This would require existing pavement to be removed and landscaped, which would extend Raleigh Reserve to connect with other open space areas to create a continuous grassed area. The sections of new path would tie-in to retained sections of existing Council shared path along Henry Lawson Drive. This would connect to a new section of shared path north of Keys Parade which would connect with the new Milperra Drain Bridge approved as part of the 1A project.

A new shared path would also be constructed along the Raleigh Road extension to the roundabout with Keys Parade then along Keys Parade and the link road to Auld Avenue.

The existing section of shared path between Henry Lawson Drive and Fleurbaix Avenue on the southern side of Bullecourt Avenue would be reinstated. These paths would be concrete.

This would provide continuous consistent active transport paths from Pozieres Avenue to the playing fields in Auld Avenue and connecting to existing paths along the Georges River.

Footpaths

The proposal would provide a new concrete footpath in the following sections:

- on the eastern side of Henry Lawson Drive between the existing footpath outside Flower Power and Ingram Avenue
- on the eastern side of Fromelles Avenue and Ingram Avenue connecting into existing Council paths.

These footpaths would tie-in with existing sections of path along Henry Lawson Drive to provide improved pedestrian connectivity along the eastern side of Henry Lawson Drive.

Drainage and water quality

The proposal would include the following road drainage infrastructure:

- Longitudinal drains, which would run along length of the roads and are designed to remove water from the road surface as quickly as possible. This would include a system of pits and pipes within the median and kerb on Henry Lawson Drive and Keys Parade, as well as across the Bullecourt Avenue / Ashford Avenue intersection. This network would connect with water quality management measures and allow natural stormwater runoff.
- A drainage swale:
  - On the western side of Henry Lawson Drive between Borella Road and Ruthven Avenue. This would connect with existing swales to the north of Borella Road to move stormwater away from the road corridor.
  - On the eastern side of the new link road between Auld Avenue and Keys Parade.
  - On the western side of Keys Parade.
- A box culvert bridge across Milperra Drain as part of the Auld Avenue to Keys Parade local link road, which would allow water to pass through Milperra Drain and support vehicles, pedestrians and cyclists travelling along the local link road.
- Water quality management and stormwater treatment measures, including:
  - a bioretention basin between Henry Lawson Drive, Bullecourt Avenue and Fleurbaix Avenue and maintenance access to this basin
  - two Gross Pollutant Traps (near Ingram Avenue and north of Keys Parade)

- relocation of a 90-metre vegetated treatment swale on the eastern side of the local link road between Auld Avenue and Keys Parade
- a 200-metre vegetated treatment swale on the western side of Henry Lawson Drive between Borella Road and Ruthven Avenue
- scour protection at longitudinal pipes, drainage outlets and swales to prevent erosion and scour from the flow of water.

Along Bullecourt Avenue, other than localised changes to the kerb at the roundabout, the existing kerb and drainage system would be maintained.

The pavement drainage pit and pipe network would be designed to achieve flood immunity for a 10 per cent annual exceedance probability (AEP) flood event, with additional capacity in major storm events. The swales would be designed to provide protection against a 20 per cent AEP flood event.

Pavements

The proposal would use the existing pavements as much as possible to avoid the need for extensive new pavement layers along Henry Lawson Drive and Bullecourt Avenue. A variable asphalt overlay would be used to rehabilitate the existing pavement in areas where the proposal is on top of the existing alignment.

In sections where widening of the road is required, a full depth asphalt pavement would be constructed to match the same road level as the rehabilitated pavement. The pavement on Keys Parade and the local link road between Auld Avenue and Keys Parade would also be full depth asphalt pavement, with an asphalt overlay to tie in with existing road levels.

Bus stops

The existing bus stop on Henry Lawson Drive (northbound) to the south of Pozieres Avenue would be relocated due to the widened road corridor and dedicated left turn lane into Pozieres Avenue. The bus stop would be relocated north of the intersection. All other existing bus stops within the proposal area and the bus stop on Pozieres Avenue (eastbound) near Henry Lawson Drive would be retained. These bus stops are shown in Figure 3-1b-e.

Each relocated or retained bus stop would be a like-for-like replacement of the existing bus stop, including bus shelters, bus stop signage and timetables (where relevant). The project would provide connections between the bus stops and the footpath/shared path network.

Driveway adjustments

The proposal may require driveway adjustments for some properties to tie into updated footpath and kerb levels. This would include properties on:

- Henry Lawson Drive south of the Flower Power Garden Centre
- Ingram Avenue and Fromelles Avenue
- Henry Lawson Drive opposite Pozieres Avenue
- Bullecourt Avenue near its intersections with Henry Lawson Drive and Ashford Avenue

Some property acquisition would be required as part of the proposal, as outlined in Section 3.6.

Supporting infrastructure

The proposal would include supporting infrastructure, which would be confirmed during detailed design and likely include provision of:

- landscaping in the road verges and medians in line with the urban and landscape strategy
- traffic control signals at signalised intersections
- a relocated red light speed camera at Pozieres Avenue
- intelligent transport system infrastructure, including:
  - closed-circuit television cameras and associated utilities
  - a variable-message sign near the Henry Lawson Drive and Amiens Avenue intersection
- guide, regulatory and warning signs for road users

- line marking along the road corridor, including retroreflective raised pavement markers on all lane, edge and barrier lines
- roadside furniture to support public and active transport
- LED street lighting along the road corridor.

3.3 Construction activities

3.3.1 Work methodology

Construction activities would be carried out in line with a construction environmental management plan (CEMP) to ensure work complies with Transport's commitments and legislative requirements. Detailed work methodologies would be identified by the construction contractor.

A construction footprint (vegetation clearance boundary) has been developed for the proposal to cover all work and construction activities. In general, the construction footprint has assumed a five metre buffer from the edge of design. The footprint also takes into account ancillary facilities and work areas for equipment and machinery. Where possible, the footprint has been developed to minimise environmental impacts. The construction footprint has been assumed to be the proposal area, with the exception of a portion of vegetation to the south of the ancillary facility to the south of the M5 Motorway. The vegetation clearance boundary is shown in Figure 3-11 (refer to Section 3.4).

Construction staging of the proposal would be determined by the construction contractor. However, it is anticipated that work for the proposal would be carried out across two stages, with preliminary work (refer to Table 3-6) occurring when the construction contractor first establishes the site.

During construction, work would need to be staged to minimise disruptions to traffic and maintain traffic flow (where possible). Indicative construction staging is outlined in Table 3-5.

Table 3-5 Indicative construction staging

Stage	Description
Stage 1	• Offline construction of future northbound lanes on the western side of the existing Henry Lawson Drive • Offline construction of local link road between Auld Avenue and Keys Parade • Offline construction of the Raleigh Road extension to Keys Parade • Construction of widened left-turn slip lane at the Henry Lawson Drive and Bullecourt Avenue intersection • Maintain two-way traffic flow on the existing Henry Lawson Drive at a reduced speed limit • Detours to Ruthven Avenue, Amiens Avenue, Ganmain Close and Pozieres Avenue due to closure of local road accesses • Out of hours work may be required at major intersections
Stage 2	• Construction work on existing Henry Lawson Drive to correct road levels, install drainage and rehabilitate existing pavement to become future southbound lanes • Two-way traffic flow would be maintained on the newly built future northbound carriageway (constructed during Stage 1) at a reduced speed limit • Detours to Ingram Avenue, Whittle Avenue, Bullecourt Avenue, Fromelles Avenue and Hermies Avenue due to closure of local road accesses • Out of hours work may be required at major intersections

Detailed activities involving the construction staging and work sequencing would be further developed in detailed design and confirmed once construction contractors have been engaged.

The proposal is expected to involve the following activities:

- preliminary work
- utility adjustment work
- earthworks
- widening and pavement work
- drainage work
- footpath, intersection crossing, and shared path work
- intersection configuration and traffic signals
- landscaping and finishing work
- removal of ancillary facilities and site rehabilitation

These construction activities are described in further detail in Table 3-6.

Table 3-6 Proposed methodology for each construction activity

Activity	Proposed methodology
Preliminary work	• installation of construction boundary hoarding/fencing • installation of erosion and sedimentation controls • vegetation removal and grubbing work • establishment of ancillary facilities, designated laydown areas and services required for these facilities (e.g., communication, water, electrical and security) • adjustment of existing fencing structures • installation of temporary traffic and pedestrian controls • location and pot holing of existing utilities and drainage structures • geotechnical investigations, if required
Utility work	• pre-construction utility location identification • relocation of existing drainage, to facilitate earthworks • protection of services, where required • adjustment, relocation, and installation of services • testing and commissioning of services • reinstatement of surfaces, including backfill and compaction
Earthworks	• site inspection and survey • removal of topsoil, stockpiling and/or disposal if weed affected • cut/fill works to subgrade • preparation for new pavement areas • foundation treatments, where required • grading and compaction of materials to required levels • installation and maintenance of temporary drainage • construction of open swales next to Keys Parade, the local link road between Auld Avenue and Keys Parade and on the western side of Henry Lawson Drive Ruthven Avenue and Borella Road
Widening and pavement work	• construction of new kerbs and gutters (including new driveway access) as required • placement of pavements granular, concrete and/or asphalt for permanent works

Activity	Proposed methodology
	• placement of temporary pavements to facilitate traffic switches • traffic switches as required during construction, with traffic flow to be maintained while widening and pavement works are being carried out
Drainage work	• installation of new stormwater drainage and install environmental controls as required • excavation of trenches and pits for drainage, preparation of bedding material, delivery of and placement of precast pipe and pits, backfilling of trenches and compaction • construction of new box culvert bridge across Milperra Drain near Keys Parade • grout filling and/or removal of redundant stormwater drainage • lining of swale drains, as required • installation of maintenance access to bioretention basin
Footpath, intersection crossings and shared path work	• survey and set-out of formwork • cut to level and compact • pour concrete and finish • backfill footpath and finish with landscaping • pedestrian switch from temporary footpath to permanent works
Intersection configuration and traffic signals	• traffic switches as required • redirection of pedestrians and cyclists to temporary paths • survey and set-out of intersection layout • removal/relocation of concrete medians and islands as required • temporary pavement constructed where required. • removal/relocation of traffic control signal poles as required under the construction staging plan • cutting in of loops at traffic signals • construction of permanent pavement and line marking • reinstatement of pavement, footpaths and signal functionality
Landscaping and finishing work	• Progressive landscaping would be carried out throughout the construction. This would include: – spreading of topsoil and mulch – planting • Finishing work would include: – installation of intelligent transport systems, new street lighting, road furniture and signage – line marking – removal of all traffic management devices and environmental controls.
Removal of ancillary facilities and site rehabilitation	• relocation/decommissioning of temporary utilities and services • decommission and removal of site offices, equipment and materials at completion • rehabilitation of ground surface

3.3.2 Construction workforce

The number and types of workers would vary throughout the different stages of construction but would include workers such as:

- plant and machinery operators
- traffic controllers
- labourers
- utilities servicers
- project and site managers

An average of about 45 construction workforce staff are estimated to work on the proposal per day, with about 80 staff during peak construction periods. Final details of the workforce would be identified at a later stage by the construction contractor.

3.3.3 Construction hours and duration

Construction is expected to commence in 2026 subject to funding and would take about 24 months to complete.

Construction work would be carried out in both standard hours and out-of-hours works (OOHW). Standard construction hours as defined in the Interim Construction Noise Guideline (DECC 2009) (ICNG) are:

- Monday to Friday: 7am – 6pm
- Saturday: 8am – 1pm
- Sunday and Public Holidays: No work

OOHW would be required to minimise disruptions to the road network. The main work that would be required to occur out of hours would be at major intersections, including at the intersections of:

- Henry Lawson Drive and Keys Parade
- Henry Lawson Drive and Bullecourt Avenue
- Henry Lawson Drive and Pozieres Avenue
- Bullecourt Avenue and Ashford Avenue.

Any OOHW would be carried out in line with the Construction Noise and Vibration Guidelines (Roads and Maritime 2016).

3.3.4 Plant and equipment

The plant and equipment which would be used during construction of the proposal is outlined in Table 3-7.

Table 3-7 Proposal plant and equipment

Activity	Plant
Preliminary work	• generator, water truck, miscellaneous hand tools • flatbed truck, vacuum truck, tipper truck (including rigid truck and truck and trailer) • tracked excavators (between five and 30 tonnes), skid steer loader, backhoe • tree mulcher and stump grinder • vacuum truck, tipper truck, concrete agitator truck • cranes, including Hiab crane trucks, mobile cranes (up to about 300 tonnes) • elevated work platform, scissor lift
Utility work	• generator, air compressor, water pump, water truck, miscellaneous hand tools • flatbed truck, vacuum truck, tipper truck (including rigid truck)

Activity	Plant
	• tracked excavators (between five and 30 tonnes), backhoe • compaction equipment (including tamper rammer and plate compactor) • concrete agitator truck, concrete line pump • cranes, including Hiab crane trucks, manitou and mobile cranes (up to about 20 tonnes) • elevated work platform, scissor lift. • jackhammer
Earthworks	• generator, water pump, water truck, miscellaneous hand tools • flatbed truck, tipper truck (including rigid truck and truck and trailer) • tracked excavators (between five and 30 tonnes), skid steer loader, backhoe • compaction equipment (including padfoot roller, smooth drum roller, tamper rammer and plate compactor), grader • profiler
Widening and pavement work	• generator, air compressor, water pump, water truck, miscellaneous hand tools • jackhammer • flatbed truck, vacuum truck, tipper truck (including rigid truck and truck and trailer) • tracked excavators (between five and 30 tonnes), skid steer loader, backhoe • compaction equipment (including padfoot roller, smooth drum roller, multi tyre roller, tamper rammer and plate compactor), grader • kerb laying machine, concrete agitator truck, concrete boom pump, concrete line pump • profiler, asphalt paver, bitumen spray truck, line marking machine • cranes, including Hiab crane trucks, manitou
Drainage work	• generator, air compressor, water pump, water truck, miscellaneous hand tools • flatbed truck, vacuum truck, tipper truck (including rigid truck and truck and trailer) • tracked excavators (between five and 30 tonnes), skid steer loader, backhoe • compaction equipment (including tamper rammer and plate compactor) • concrete agitator truck, concrete line pump • cranes, including Hiab crane trucks, manitou and mobile cranes (up to about 300 tonnes)
Footpath, intersection crossing and shared path work	• generator, air compressor, water truck, miscellaneous hand tools • tipper truck (including rigid truck and truck and trailer) • tracked excavators (between five and 30 tonnes), skid steer loader, backhoe • compaction equipment (including tamper rammer and plate compactor) • concrete agitator truck, concrete boom pump, concrete line pump • jack hammer
Intersection configuration and traffic signals	• generator, air compressor, water truck, miscellaneous hand tools • flatbed truck, tipper truck (including rigid truck and truck and trailer) • tracked excavators (between five and 30 tonnes), skid steer loader, backhoe

Activity	Plant
	• compaction equipment (including padfoot roller, smooth drum roller, multi tyre roller, tamper rammer and plate compactor) • kerb laying machine, concrete agitator truck • profiler, asphalt paver, bitumen spray truck, line marking machine • cranes, including Hiab crane trucks, manitou and mobile cranes (up to about 300 tonnes) • elevated work platform, scissor lift
Landscaping and finishing work	• generator, air compressor, water truck, miscellaneous hand tools • flatbed truck, tipper truck (including rigid truck and truck and trailer) • tracked excavators (between five and 30 tonnes), skid steer loader, backhoe • concrete agitator truck • line marking machine • cranes, including Hiab crane trucks, manitou and mobile cranes (up to about 300 tonnes) • elevated work platform, scissor lift
Removal of ancillary facilities and site rehabilitation	• generator, miscellaneous hand tools • flatbed truck, tipper truck (including rigid truck and truck and trailer) • tracked excavators (between five and 30 tonnes), skid steer loader, backhoe • grader • jackhammer • cranes, including Hiab crane trucks, manitou and mobile cranes (up to about 300 tonnes) • elevated work platform, scissor lift

3.3.5 Earthworks

While the proposal would retain the existing road pavement and level where possible, earthworks would be required along the length. Earthworks required would include the stripping of topsoil, material from excavations (cut) and material required for the new road alignment (fill).

The areas of largest earthworks would be along the western side of the existing Henry Lawson Drive road corridor, Keys Parade, the local link road between Auld Avenue and Keys Parade and near the Bullecourt Avenue and Ashford Avenue intersection. Earthworks would be also carried out for utility work.

Table 3-8 provides the estimated quantities of materials associated with earthworks as calculated during the concept design stage.

Where possible, cut material would be reused on site. As there would be a surplus of about 3639 cubic metres of excavated material to required fill material, any suitable excess excavated material would be exported to other Transport projects where possible. However, if material is not suitable, it would be classified in line with the NSW Environment Protection Authority (EPA) Waste Classification Guidelines (EPA 2014) and disposed of at an approved materials recycling or waste disposal facility.

The final earthwork requirements would be confirmed during detail design.

Table 3-8 Estimated earthworks quantities

Activity	Volume (cubic metres)
Topsoil strip volume (to a depth of 150 millimetres)	8029
Material from excavations (cut)	19,680
Material required for road alignment (fill)	16,041
Total surplus of cut to fill	3639

3.3.6 Source and quantity of materials

About 5800 cubic metres of concrete and 9800 cubic metres of asphalt would be required. The proposal would also require other materials including concrete for the culvert bridge and concrete pits. These would be transported to the site and stored temporarily at ancillary facilities during construction. Other typical materials that would be used for construction include:

- earthwork materials, such as topsoil, general fill and select fill
- aggregates for drainage, producing concrete and asphalt and spray seals
- sand for drainage and producing concrete and asphalt
- cement for producing concrete
- concrete for drainage, culvert bridge and miscellaneous work such as barrier kerbs, kerbs and gutters, paving and signpost footings
- road base for constructing flexible road surfaces
- precast concrete elements for culvert bridge and miscellaneous work
- steel for barrier railings and concrete reinforcement

Materials would be sourced from appropriately licensed commercial suppliers in nearby areas to minimise haulage routes, where possible. None of the materials proposed to be used are considered to be in short supply.

While water demand for the proposal is only indicative at this stage, the proposal is not expected to be water intensive given the nature and scale of the proposal. Water use during construction would be minor and largely used for dust suppression and for the construction of the widened carriageway (e.g., compaction). The water requirement would vary, dependent on material sources and methodologies applied by the construction contractor and weather conditions. Sufficient potable water would be supplied for about an average of 45 construction staff per day, or about 80 staff during peak construction periods. This is expected to be about 270 kilolitres per annum. The proposed ancillary facility at 439 Henry Lawson Drive or the ancillary facility on Bullecourt Avenue would be used as a site office. The existing building at 439 Henry Lawson Drive would be demolished as part of the Henry Lawson Drive Stage 1A upgrade and demountable buildings would be brought to the site for use as office and amenity space. For other ancillary facilities, potable water would be obtained from sources such as portable office water dispensers.

All non-potable water would be sourced from construction sediment sumps, a standpipe (if one is located nearby), local sub-contractor watercarts or an alternative nearby source. Water would be sourced responsibly and in line with any water restrictions at the time of construction, or relevant exemptions would be sought. The proposal would not extract water or require a licence to extract water for construction needs or for domestic purposes. Water requirements and water supply options would be further investigated during detailed design.

Source and quantity of road furniture, steel, aggregates and other materials would be confirmed during the detailed design phase.

3.3.7 Traffic management and access

The proposal is expected to generate light and heavy vehicle traffic movements during construction. Vehicle movements would mainly be associated with:

- delivery of construction materials including concrete and precast structural elements
- spoil removal
- importation of fill material for earthworks
- delivery and removal of construction equipment and machinery
- workers travelling to, from and within the construction site

Construction haulage routes

Several haulage route options would be available during construction and would enable access to the ancillary facilities and work areas from the north (Hume Highway via Henry Lawson Drive, Milperra Road or Newbridge Road), south (M5 Motorway) and east (Bullecourt Avenue). Haulage within the locality of the proposal area may take several routes including:

- Henry Lawson Drive
- Bullecourt Avenue
- Ashford Avenue
- Pozieres Avenue
- Raleigh Road
- Auld Avenue
- Milperra Road
- Webster Steet, or Bransgrove Road and existing oval area (pending consultation with Council)
- Newbridge Road.

Construction traffic numbers

Indicative construction traffic numbers for the proposal are provided in Table 3-9.

Table 3-9 Estimated construction traffic

Vehicle type	Total vehicle movements per day	Vehicle movements per day at peak construction period	AM peak movements	PM peak movements
Construction personnel (cars and private vehicles)	100	160	96	64
Light construction vehicles and utes	40	90	54	36
Heavy vehicles and trucks	50	72	43	29

Construction access management

Access along Henry Lawson Drive would be maintained during construction, however, reduced speed limits may be implemented. Traffic switches and lane closures may be required during each stage of construction. Where possible, these lane closures would be timed during low traffic periods (such as at night or outside peak periods). Motorists would be informed of changed traffic conditions prior to the changes coming into effect. Access for emergency vehicles would be maintained, as well as emergency access from the Flower Power.

Road closures would be required as part of construction staging (refer to Section 3.3.1) at the following intersections:

- Henry Lawson Drive / Ruthven Avenue
- Henry Lawson Drive / Whittle Avenue
- Henry Lawson Drive / Amiens Avenue

- Henry Lawson Drive / Bullecourt Avenue
- Henry Lawson Drive / Fromelles Avenue
- Henry Lawson Drive / Ganmain Close
- Henry Lawson Drive / Hermies Avenue
- Henry Lawson Drive / Pozieres Avenue.

Detours would be provided for motorists wishing to access these roads (refer to Table 3-10).

A Road Occupancy Licence (ROL) would be obtained and consultation with the community carried out prior to road or lane closures occurring.

Construction staging has been designed to minimise impacts to local roads (refer to Section 3.3.1). When local road access is disrupted, residents and businesses would need to use the detours outlined in Table 3-10.

Table 3-10 Local road detours

Access to/from	Access to Henry Lawson Drive (north of the proposal area)	Access to Henry Lawson Drive (south of the proposal area) and M5 Motorway
Residences on the eastern side of Henry Lawson Drive	Detour to Bullecourt Avenue. Alternatively, detour to Milperra Road via Ashford Avenue. Use Milperra Road westbound to access Henry Lawson Drive.	Detour to the nearest open local road onto Henry Lawson Drive.
Residences on the western side of Henry Lawson Drive	Detour to the nearest open local road onto Henry Lawson Drive. Once the Raleigh Road extension to Keys Parade is operational, motorists would be able to access Henry Lawson Drive using these roads.	Detour to Henry Lawson Drive (southbound) via Pozieres Avenue. Once the Raleigh Road extension to Keys Parade is operational, motorists would be able to access Henry Lawson Drive using these roads.

Oversize overmass vehicles would not be able to travel along Henry Lawson Drive during construction. Vehicles wanting to travel northbound on Henry Lawson Drive would be required to either:

- Travel east along the M5 Motorway from Henry Lawson Drive until The River Road. Then, travel north on The River Road and along Milperra Road westbound until Henry Lawson Drive.
- Travel west along the M5 Motorway from Henry Lawson Drive until Heathcote Road. Then, travel north on Heathcote Road and finally east on Newbridge Road until Henry Lawson Drive.

Vehicles wanting to travel southbound would need to follow these routes in reverse. Use of oversize or overmass vehicles would be with relevant authority approvals.

Access to all properties would be maintained. However, some properties may experience short-term disruption during construction. The construction contractor would consult with individual property owners and businesses to minimise impacts.

Access for pedestrians, cyclists and to public transport would be maintained throughout the proposal area during construction. Pedestrian and cyclist access along the existing shared path along the western/southern side of Henry Lawson Drive and other existing footpaths in the proposal area may be disrupted during construction. Alternative arrangements and detours would be managed through signage and wayfinding. Bus stops on Henry Lawson Drive, Amiens Avenue, Bullecourt Avenue, and Pozieres Avenue within the proposal area would be temporarily relocated to allow for safe access when construction is occurring nearby. Detours for pedestrian and cyclist access to the relocated bus stops would be provided.

3.4 Ancillary facilities

To support construction, a range of ancillary facilities would be required. The facilities would include:

- site compounds for site offices, car parking, sheds, workshops and storage
- areas for material delivery and storage
- areas for capturing and treating water from construction areas
- stockpile locations for materials spoil and mulch

The layout and potential uses for each ancillary facility would be determined to minimise environmental impacts and finalised during detailed design.

Ancillary facilities would be temporary and developed for the sole purpose of the construction of the proposal. They would be returned to pre-existing conditions or rehabilitated upon completion of construction, in agreement with the landowner.

Eight potential ancillary facilities have been identified within the proposal area. These sites were identified in areas that maximised the use of existing infrastructure, buildings or vacant land and were readily accessible from other parts of the proposal area. These facilities are located at:

- 439 Henry Lawson Drive, Milperra
- Auld Avenue, Milperra
- Milperra Sports Centre, Milperra
- Raleigh Reserve, Milperra
- 491 and 495 Henry Lawson Drive, Milperra
- 'Bullecourt Triangle' (between Bullecourt Avenue, Fleurbaix Avenue and Henry Lawson Drive), Milperra
- Bullecourt Avenue, Milperra
- 448 and 450 Henry Lawson Drive, Milperra

The ancillary facilities are shown in Figure 3-11 and are described in the following sections.

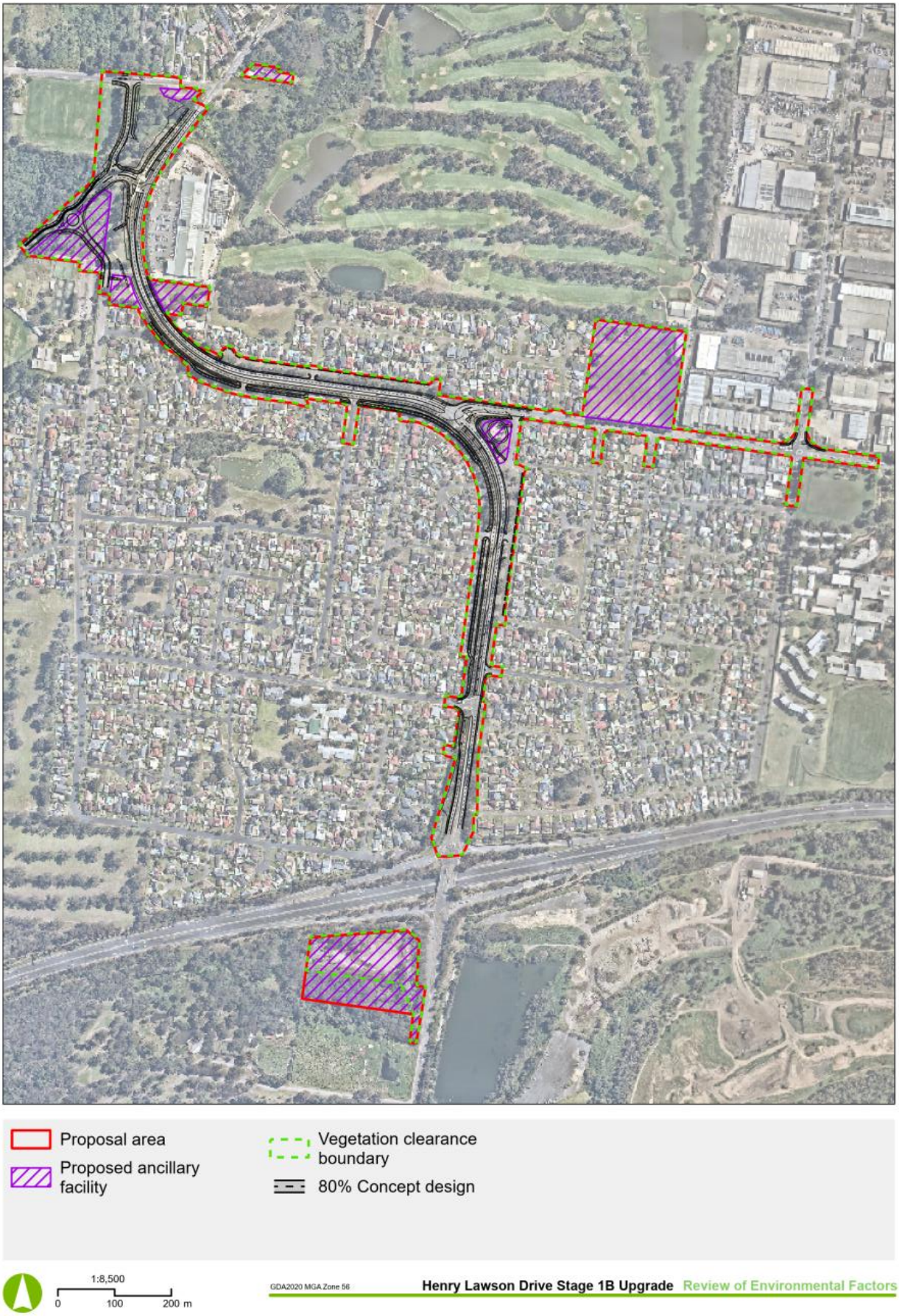


Figure 3-11 Ancillary facilities

Due to the constrained nature of the proposal area, and nearby presence of the Georges River and Milperra Catchment, some of the identified ancillary facilities are within the 10 per cent AEP floodplain for these catchments. As such, a Flood Management Plan would be developed to minimise environmental impacts associated with flooding of the ancillary facilities.

Where practical, temporary buildings and structures would be used to provide a noise barrier between ancillary facilities and nearby sensitive receivers. Their placement would also minimise shadowing impacts and the potential for receivers to be overlooked. Lighting would be designed to minimise light spill onto adjoining properties. Spoil stockpiles would be located away from potential flood areas and sensitive receivers, where possible.

Additional information on the environmental impacts of the ancillary sites, including noise impacts to sensitive receivers, are detailed in Chapter 6.

439 Henry Lawson Drive, Milperra

The 439 Henry Lawson Drive ancillary facility is a residential property located on Lots 15 and 16 DP18399. This property would be acquired as part of Henry Lawson Drive Upgrade Stage 1A and established for use as an ancillary facility as part of that upgrade. This proposal would reuse the parts of the ancillary facility which are located outside land defined as coastal wetlands under the Hazards and Resilience SEPP. The total area proposed to be used during construction of this proposal is 0.17 hectares.

The eastern border of the ancillary facility contains grassed areas and a vegetated creek line (Milperra Drain). There are several residential properties close to the ancillary facility including one property to the south on the eastern side of Henry Lawson Drive and properties on the western side of Henry Lawson Drive, including those along Auld Avenue. Impacts to the residents from construction, including the use of ancillary facilities, are considered in Chapter 6.

While facilities and materials located within the ancillary facility have the potential to displace floodwater from both the Georges River and Milperra Drain, impacts on flood behaviour for events up to the one per cent AEP are expected to be minor. A Flood Management Plan would be developed to manage potential risks of interactions with site materials and flood waters. This would include provision for only materials which can be easily relocated (e.g., plant) to be stored at this ancillary facility due to the potential for flooding. At this facility, materials would also be stored towards the front of the property as far away from the Milperra Drain as is practical.

Access to the ancillary facility would be off Henry Lawson Drive via a left-in, left-out arrangement. Larger trucks and deliveries would require traffic controls to access the site.

Potential uses for this ancillary facility would be consistent with Henry Lawson Drive Upgrade Stage 1A and include:

- site staff parking
- main site offices within the existing building
- materials storage
- storage of topsoil, imported material and green waste.

The building at this facility would be demolished as part of Henry Lawson Drive Upgrade Stage 1A and demountable buildings would be brought to the site for use as office and amenity space. Site restoration requirements for this ancillary facility following the completion of construction would be consistent with those agreed upon as part of Henry Lawson Drive Upgrade Stage 1A.

Auld Avenue, Milperra

The Auld Avenue ancillary facility is located on the south-western corner of Auld Avenue and Henry Lawson Drive. The ancillary facility has an area of about 0.1 hectares and is located partially on Lot 44 DP7304 and partially within the Auld Avenue corridor. The site is currently used as an informal parking area and for carrying out U-turns on Auld Avenue. This ancillary facility would be established and used as part of Henry Lawson Drive Upgrade Stage 1A and would contain a water quality basin and then be reused as an ancillary facility during construction of this proposal.

There is dense vegetation adjoining Milperra Drain on the southern side of the ancillary facility. To the north, there are residential properties on Auld Avenue and Henry Lawson Drive. Gordon Parker Reserve and a

shared path are located to the west of the ancillary facility, with vehicles accessing the reserve via Auld Avenue.

While facilities and materials located within the ancillary facility have the potential to displace floodwater from both the Georges River and Milperra Drain, impacts on flood behaviour for events up to the one per cent AEP are expected to be minor. A Flood Management Plan would be developed to manage potential risks of interactions with site materials and flood waters. This would include provision for only materials which can be easily relocated to be stored at the facility.

Access to the ancillary facility would be left-in, right-out via Auld Avenue.

Potential uses for this ancillary facility would be consistent with Henry Lawson Drive Upgrade Stage 1A and include:

- hardstand and laydown area
- plant and equipment storage.

Site restoration requirements for this ancillary facility following the completion of construction would be consistent with those agreed upon as part of Henry Lawson Drive Upgrade Stage 1A.

Milperra Sports Centre, Milperra

The Milperra Sports Centre ancillary facility is located on the northern end of Lot 101 DP603087, accessible off Raleigh Road, with a total area of about 1.02 hectares. The site is currently part of the Milperra Sports Centre property, however is unused, mostly vacant land.

There is non-native vegetation on the western and north-western side of the ancillary facility. It is located at least 100 metres away from residential dwellings and other sensitive receivers and is an area with low heritage conservation significance.

Potential uses for this ancillary facility would include:

- hardstand and laydown area
- plant and equipment storage.

While the ancillary facility is within the 10 per cent AEP for the Milperra Catchment, impacts on flood behaviour and potential for materials within the site to be displaced and transported along Milperra Drain are minor. A Flood Management Plan would be developed to manage these potential risks. This would include provision for only materials which can be easily relocated to be stored at this facility. The ancillary facility is outside the 10 per cent AEP for the Georges River catchment.

Access to the ancillary facility would be right-in, left-out via Raleigh Road.

Raleigh Reserve, Milperra

The Raleigh Reserve ancillary facility is located within the existing Raleigh Reserve on Lot 52 DP237901, with a total area of about 0.23 hectares. It is located between Henry Lawson Drive and Raleigh Road and is currently a park used for recreation.

Potential uses for this ancillary facility would include:

- hardstand and laydown area
- plant and equipment storage.

There are residential receivers located immediately to the south of the proposed ancillary facility on Borella Road and on the eastern side of Henry Lawson Drive. It is in an area of low heritage conservation significance and is mostly cleared land with pockets of non-native vegetation. The ancillary facility is located outside the 10 per cent AEP.

Access to the ancillary facility would be via Raleigh Road. There would also be direct access to the construction areas along the western side of Henry Lawson Drive from this ancillary facility. Larger trucks and deliveries may require traffic controls to access the site.

491 and 495 Henry Lawson Drive, Milperra

The 491 and 495 Henry Lawson Drive ancillary facility is located immediately south of Flower Power on the eastern side of Henry Lawson Drive. The ancillary facility has an area of about 0.41 hectares and is located on Lot 1 DP572468 and Lot 5 DP583916. It is currently council-owned vacant land.

This ancillary facility is immediately to the north of residential receivers. While it has low ecological and heritage significance, there is an informal memorial for a road fatality located on the Henry Lawson Drive road frontage.

Potential uses for this ancillary facility would include:

- hardstand and laydown area
- plant and equipment storage.

While the ancillary facility is within the 10 per cent AEP for the Milperra Catchment, impacts on flood behaviour and potential for materials within the site to be displaced and transported along Milperra Drain are minor. Any materials stockpiled on the site would be bunded and secured to minimise impacts to Milperra Drain. The ancillary facility is outside the 10 per cent AEP for the Georges River catchment.

Access to the ancillary facility would be via Henry Lawson Drive with a left-in, left-out only arrangement. Larger trucks and deliveries would require traffic controls to access the site.

'Bullecourt Triangle', Milperra

The 'Bullecourt Triangle' ancillary facility is located between Bullecourt Avenue, Fleurbaix Avenue and Henry Lawson Drive. It has an area of about 0.26 hectares, is located within the Henry Lawson Drive road reserve on the eastern side of the road and is currently vacant land.

Potential uses for this ancillary facility would be consistent with Henry Lawson Drive Upgrade Stage 1A and include:

- plant and equipment storage
- use of the area as a construction sedimentation basin.

This ancillary facility is surrounded by residential receivers in all directions, on Bullecourt Avenue, Fleurbaix Avenue, Henry Lawson Drive and Fromelles Avenue. It is also located within the Milperra Soldier Settlement (former) locally listed heritage item. Impacts to this heritage item during construction of the proposal have been assessed in Section 6.10. The ancillary facility is also in an area of low ecological significance and is located outside the 10 per cent AEP Georges River and Milperra Catchment floodplains.

Access to the ancillary facility would be via Fleurbaix Avenue. Larger trucks and deliveries may require traffic controls to access the site.

Bullecourt Avenue, Milperra

The Bullecourt Avenue ancillary facility is located on the northern side of Bullecourt Avenue between Keysor Place and Bullecourt Lane and has an area of about 2.78 hectares. The ancillary facility is currently vacant land and is leased by Bankstown Golf Club.

Potential uses for this ancillary facility would include:

- site staff parking
- main site offices within the existing building
- materials storage
- storage of topsoil, imported material and green waste.

There are residential receivers to the south and west and commercial receivers to the east of the ancillary facility. While it is in an area of low ecological and heritage significance, the Milperra Soldier Settlement (former) locally listed heritage item is immediately to the south of the ancillary facility along Bullecourt Avenue.

While the ancillary facility is within the 10 per cent AEP for the Milperra Catchment, impacts on flood behaviour and potential for materials within the site to be displaced and transported along Milperra Drain are

minor. Any materials stockpiled on the site would be bunded and secured to minimise impacts to Milperra Drain. The ancillary facility is outside the 10 per cent AEP for the Georges River catchment.

Access to the ancillary facility would be via Bullecourt Avenue. Larger trucks and deliveries may require traffic controls to access the site.

448 and 450 Henry Lawson Drive, Milperra

The 448 and 450 Henry Lawson Drive ancillary facility is located on the western side of Henry Lawson Drive to the south of the M5 Motorway on Lot 2 DP604178, Lot 11 DP731859, Lot 12 DP731859, Lot 24 DP731859 and Lot 25 DP731859. It has a total area of about 2.64 hectares. The ancillary facility is currently vacant and contains an existing hardstand area of about one hectare.

Potential uses for this ancillary facility would include:

- materials storage
- storage of topsoil, imported material and green waste
- hardstand and laydown area
- plant and equipment storage.

As shown in Figure 3-11, the vegetation clearance boundary does not encompass the entirety of this ancillary facility. The vegetation clearance boundary has been defined so that access to the site can still occur, however the intent is for work to only occur on the existing hardstand area. As such, direct impacts to biodiversity relate to the area within the vegetation clearance boundary, rather than the entire proposal area (refer to Section 3.4).

This ancillary facility is located away from residential receivers, in an area of low ecological and heritage significance and outside the 10 per cent AEP floodplain.

Access to the ancillary facility would be via the Henry Lawson Drive northbound carriageway, with a left-in, left-out only arrangement. Larger trucks and deliveries may require traffic controls to access the site.

Additional ancillary facilities

If any additional ancillary facilities are required, further consultation would be carried out to identify the suitability of ancillary facility locations and whether any additional environmental controls or assessments are necessary. The criteria used for assessment of additional ancillary facilities would include consideration of whether the ancillary facility is:

- at least 40 metres away from the nearest waterway
- of low ecological and heritage conservation significance
- at least 100 metres away from residential dwellings and other land uses that may be sensitive to noise
- of relatively level ground
- outside the 10 per cent AEP floodplain
- in plain view of the public (to deter theft and illegal dumping)
- outside the drip line of trees
- in previously disturbed areas that do not require the clearing of native vegetation
- located adjacent to the proposal
- in an area with access to existing roads.

3.5 Public utility adjustment

Public utility adjustments and relocations would be required for the proposal (refer to Table 3-11). This would include:

- electricity supply and street lighting
- gas
- mains water
- telecommunications.

Generally, utility relocations and adjustments along Henry Lawson Drive would largely occur on the western side of the existing road corridor. There would also be relocations required for some utilities which cross the existing road corridor, including near the existing signalised intersections. Most telecommunications and mains water utilities would be retained, with more extensive relocations required for electricity supply and street lighting.

As noted in Table 3-11, relocation of a Jemena DN150 high pressure pipe near the Bullecourt Avenue / Ashford Avenue intersection would be required. This would include open trenching across Ashford Avenue and purging the section of redundant main prior to removal. Transport has commenced discussions with Jemena about the purging and relocation of this asset.

Proposed adjustments would be finalised in consultation with utility providers during detailed design. Potential impacts to utilities are discussed further in Chapter 6 of this report.

Table 3-11 Proposed utility adjustments

Utility type	Utility description	Location	Requirement
Telecommunications	Telstra and Optus (combined) P100 conduits	Multiple locations, including: • near the Henry Lawson Drive / Bullecourt Avenue intersection (between Ch 726 and Ch 816) • near the Henry Lawson Drive / Amiens Avenue intersection (Ch 960)	Relocation required
	Telstra and Optus (combined) overhead wires	Multiple locations, including: • near the Henry Lawson Drive / Bullecourt Avenue intersection (between Ch 778 and Ch 843) • near the Henry Lawson Drive / Ruthven Avenue intersection (between Ch 1178 and Ch 1182) • near the existing Henry Lawson Drive / Raleigh Road intersection (between Ch 1316 and Ch 1410) • near the Henry Lawson Drive / Fleurbaix Avenue intersection (between Ch 728 and Ch 778) • near the Henry Lawson Drive / Pozieres Avenue intersection (Ch 251) • near the Bullecourt Avenue / Ashford Avenue intersection (crossing Ashford Avenue and crossing Bullecourt Avenue) • on Auld Avenue (between Ch1732 and Ch 1755) • near the Henry Lawson Drive / Amiens Avenue intersection (between Ch 975 and Ch 977)	Relocation required

Utility type	Utility description	Location	Requirement
	Telstra P35 conduit	Near The Henry Lawson Drive / Auld Avenue intersection (Ch 1832)	Relocation required
	Telstra, Optus, NBN, AARNET and TPG (combined) optic fibres	Multiple locations, including: • near the Bullecourt Avenue / Ashford Avenue intersection (crossing Bullecourt Avenue, on both sides of Ashford Avenue and between Ch 632 and Ch 644) • near the Henry Lawson Drive / Ruthven Avenue intersection (between Ch 958 and Ch 1260) • near the Henry Lawson Drive / Pozieres Avenue intersection (between Ch 171 and Ch 251)	Relocation required
	Telstra conduit	Near the Bullecourt Avenue / Ashford Avenue intersection (on the east side of Ashford Avenue)	Relocation required
Mains water	Sydney Water DN450 pipe	On the eastern side of Henry Lawson Drive between Raleigh Road (Ch 1436) and Flower Power emergency access (between Ch 1252 and Ch 1359)	Relocation required
	Sydney Water DN200 pipe	Multiple locations, including: • across Henry Lawson Drive near the Flower Power emergency access (between Ch 1238 and 12646) • near the Bullecourt Avenue / Ashford Avenue intersection	Relocation required
	Sydney Water DN250 pipe	Multiple locations, including: • near the Henry Lawson Drive / Amiens Avenue intersection (Ch 975) • near the Henry Lawson Drive / Hermies Avenue intersection (between Ch 316 and Ch 347) • near the Bullecourt Avenue / Ashford Avenue intersection	Relocation required
	Sydney Water DN100 pipe	Near the Henry Lawson Drive / Hermies Avenue intersection (Ch 344)	Relocation required
	Sydney Water DN150 pipes	Multiple locations, including: • near the Henry Lawson Drive / Pozieres Avenue intersection (between Ch 265 and Ch 266) • near the Henry Lawson Drive / Hermies Avenue intersection (Ch 317) • near the Bullecourt Avenue / Ashford Avenue intersection	Relocation required
Gas	Jemena DN150 high pressure pipe	Near the Bullecourt Avenue / Ashford Avenue intersection	Relocation required (including purging)

Utility type	Utility description	Location	Requirement
Electricity supply and street lighting	Ausgrid LV overhead wires	Multiple locations, including: • near the Henry Lawson Drive / Bullecourt Avenue intersection (between Ch 728 and Ch 895) • near the Henry Lawson Drive / Pozieres Avenue intersection (between Ch 251 and Ch 264) • on Henry Lawson Drive near the proposed bioretention basin (between Ch 668 and Ch 673) • near the Henry Lawson Drive / Ganmain Crescent intersection (between Ch 545 and Ch 779) • near the Henry Lawson Drive / Whittle Avenue intersection (between Ch 989 and Ch 1074) • near the Henry Lawson Drive / Ruthven Avenue intersection (between Ch 1044 and Ch 1260) • near the Henry Lawson Drive / Keys Parade intersection (between Ch 1461 and Ch 1674) • near the Henry Lawson Drive / Auld Avenue intersection (between Ch 1706 and Ch 1718) • near the existing Henry Lawson Drive / Raleigh Road intersection (between Ch 1325 and Ch 1436) • near the Henry Lawson Drive / Amiens Avenue intersection (between Ch 834 and Ch 1062) • near the Henry Lawson Drive / Hermies Avenue intersection (between Ch 328 and Ch 340)	Relocation required
	Ausgrid 11kV overhead transmission lines	Multiple locations, including: • on Henry Lawson Drive between its intersection with Amiens Avenue and Ruthven Avenue (between Ch 1017 and Ch 1182) • Henry Lawson Drive and Pozieres Avenue intersection (Ch 251).	Relocation required
	Ausgrid lighting poles and transmission lines	Multiple locations, including: • across Henry Lawson Drive north of its intersection with Keys Parade (Ch 1649 and Ch 1677) • across Henry Lawson Drive north of the Flower Power emergency access (Ch 1288 - Ch 1317 and Ch 1325) • across and on the western side of Henry Lawson Drive at its intersection with Amiens Avenue (Ch 896) • near the Henry Lawson Drive and Bullecourt Avenue intersection (Ch 670, Ch 763, Ch 778, Ch 779 and Ch 810)	Relocation required

Utility type	Utility description	Location	Requirement
		• near the Henry Lawson Drive and Whittle Avenue intersection (Ch 1062)	
	Ausgrid substation	South of the Henry Lawson Drive / Ganmain Crescent intersection (Ch 486)	Relocation required
	Ausgrid bare cables, P150 cables, P125 cables, AC140 and P50 cables	Multiple locations, including: • south of the Henry Lawson Drive / Ganmain Crescent intersection (bare cables, P150 and P50) (between Ch 485 and Ch 515) • near the Bullecourt Avenue / Ashford Avenue intersection (P125, AC140 and bare cables) • near the existing Henry Lawson Drive / Raleigh Road intersection (P150 and P50) (between Ch 1429 and Ch 1440)	Relocation required
	Ausgrid underground conduits	Multiple locations, including: • Near the Bullecourt Avenue / Ashford Avenue intersection • north of the Henry Lawson Drive / M5 Motorway intersection (between Ch21 and Ch 204) • near the Henry Lawson Drive / Ganmain Crescent intersection (between Ch 480 and Ch 485)	Relocation required

3.6 Property acquisition

The proposal would require partial property acquisition of four lots. No full acquisition would be required. Temporary lease arrangements would be required throughout the proposal area for other land required for construction of the proposal.

The property acquisition process would be carried out in line with the *Land Acquisition Policy and the Land Acquisition (Just Terms Compensation) Act 1991* and *Land Acquisition Reform 2016*. During detailed design, the extent of property acquisition would be refined and consultation with relevant property owners would occur to develop property adjustment plans.

There may also be driveway adjustments on land owned by Canterbury Bankstown Council for some properties on Henry Lawson Drive southbound between Raleigh Road and Ingram Avenue, opposite the Henry Lawson Drive and Pozieres Avenue intersection and on Bullecourt Avenue near its intersection with Henry Lawson Drive. This land would be leased during construction.

Proposed property acquisition is presented in Table 3-12 and Figure 3-12.

Table 3-12 Proposed property acquisition

Lot and DP	Total area (square metres)	Acquisition / lease area (square metres)	Acquisition or lease	Current owner	Land use zone (LEP)[1]
Lot 12 DP24770	841	78	Partial acquisition	Private	IN2
Lot 11 DP24770	890	72	Partial acquisition	Private	IN2
Lot 43 DP7304	11153	1621	Partial acquisition	Council	RU4

Lot and DP	Total area (square metres)	Acquisition / lease area (square metres)	Acquisition or lease	Current owner	Land use zone (LEP)[1]
Lot 44 DP7304	9868	9859	Partial acquisition	Council	RE1
Lot 1 DP596508	118	118	To be leased for construction	Public authority	RU4
Lot 101 DP603087	79153	10315	Partial acquisition	Private	RU4
SP89012	17760	245	Partial acquisition	Private	IN1
Lot 203 DP850124	297	297	Full acquisition	Council	RE1
Lot 31 DP243969	416	416	Full acquisition	Council	RE1
Lot 30 DP243969	1082	1069	Partial acquisition	Council	RE1
Lot 111 DP261551	216	185	Partial acquisition	Council	R2
Lot 48 DP248606	590	565	Partial acquisition	Council	RE1
Lot 32 DP599369	1095	1095	Full acquisition	Council	RE1
Lot 31 DP599369	14	14	Full acquisition	NSW Government	RE1
Lot 43 DP262669	388	388	Full acquisition	Council	R2
Lot 10 DP255067	249	249	Full acquisition	Council	R2
Lot 202 DP850124	394	394	Full acquisition	Council	SP2
Lot 15 DP715029	1359	1331	Partial acquisition	Council	R2
Lot 32 DP239714	807	516	Partial acquisition	Council	RE1
Lot 161 DP752013	26616	26566	To be leased for construction	Private	R2
Lot 183 DP240118	216	216	To be leased for construction	Council	RE1
Lot 182 DP240118	734	734	To be leased for construction	Council	RE1
Lot 43 DP239166	578	578	To be leased for construction	Council	RE1
Lot 272 DP752013	1012	1012	To be leased for construction	Private	R2
Lot 1 DP572468	3427	3399	To be leased for construction	Council	RE1
Lot 5 DP583916	788	787	To be leased for construction	Council	RE1

Lot and DP	Total area (square metres)	Acquisition / lease area (square metres)	Acquisition or lease	Current owner	Land use zone (LEP)[1]
Lot 45 DP7304	5260	5230	To be leased for construction	Council	RE1
Lot 111 DP241675	906	899	To be leased for construction	Council	RE1
Lot 52 DP237901	2280	2279	To be leased for construction	Council	RE1
Lot 54 DP237901	187	187	To be leased for construction	Council	RE1
Lot 12 DP731859	9922	9922	To be leased for construction	Council	RE1
Lot 11 DP731859	9800	9800	To be leased for construction	Council	RE1
Lot 2 DP604178	5311	5311	To be leased for construction	Council	RE1
Lot 164 DP231963	893	876	To be leased for construction	Council	RE1
Lot 1 DP238384	203	199	To be leased for construction	Council	RE1
Lot 198 DP236031	616	613	To be leased for construction	Council	RE1
Lot 58 DP236028	495	495	To be leased for construction	Council	RE1
Lot 57 DP236028	732	732	To be leased for construction	Council	RE1
Lot 147 DP230022	338	330	To be leased for construction	Council	RE1

1 - IN2 – Light industrial, RU4 – Primary Production Small Lots, RE1 – Public Recreation, IN1 – General Industrial, R2 – Low Density Residential, SP2 – Road Infrastructure Facility.

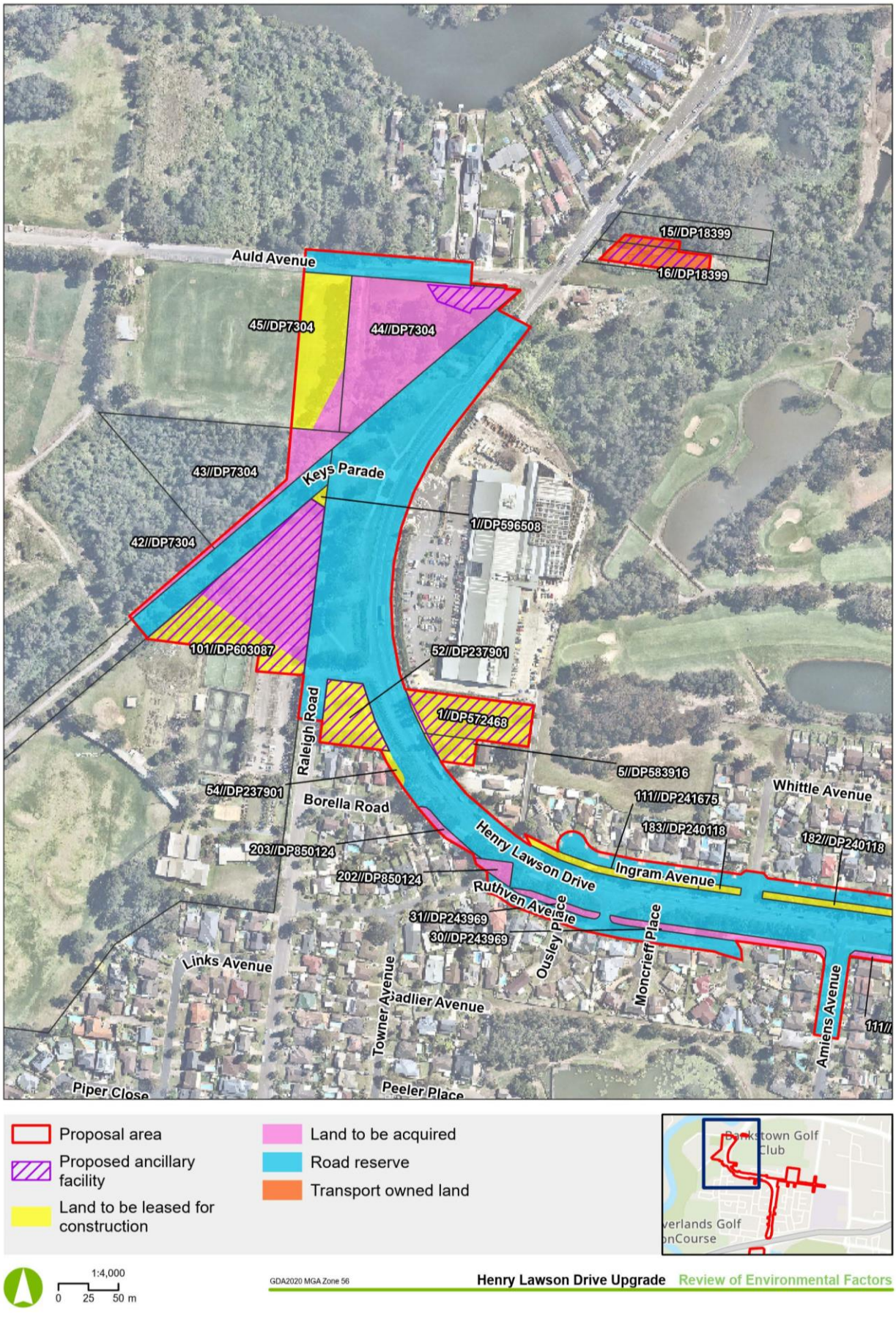


Figure 3-12a Proposed property acquisition

Figure 3-12b Proposed property acquisition

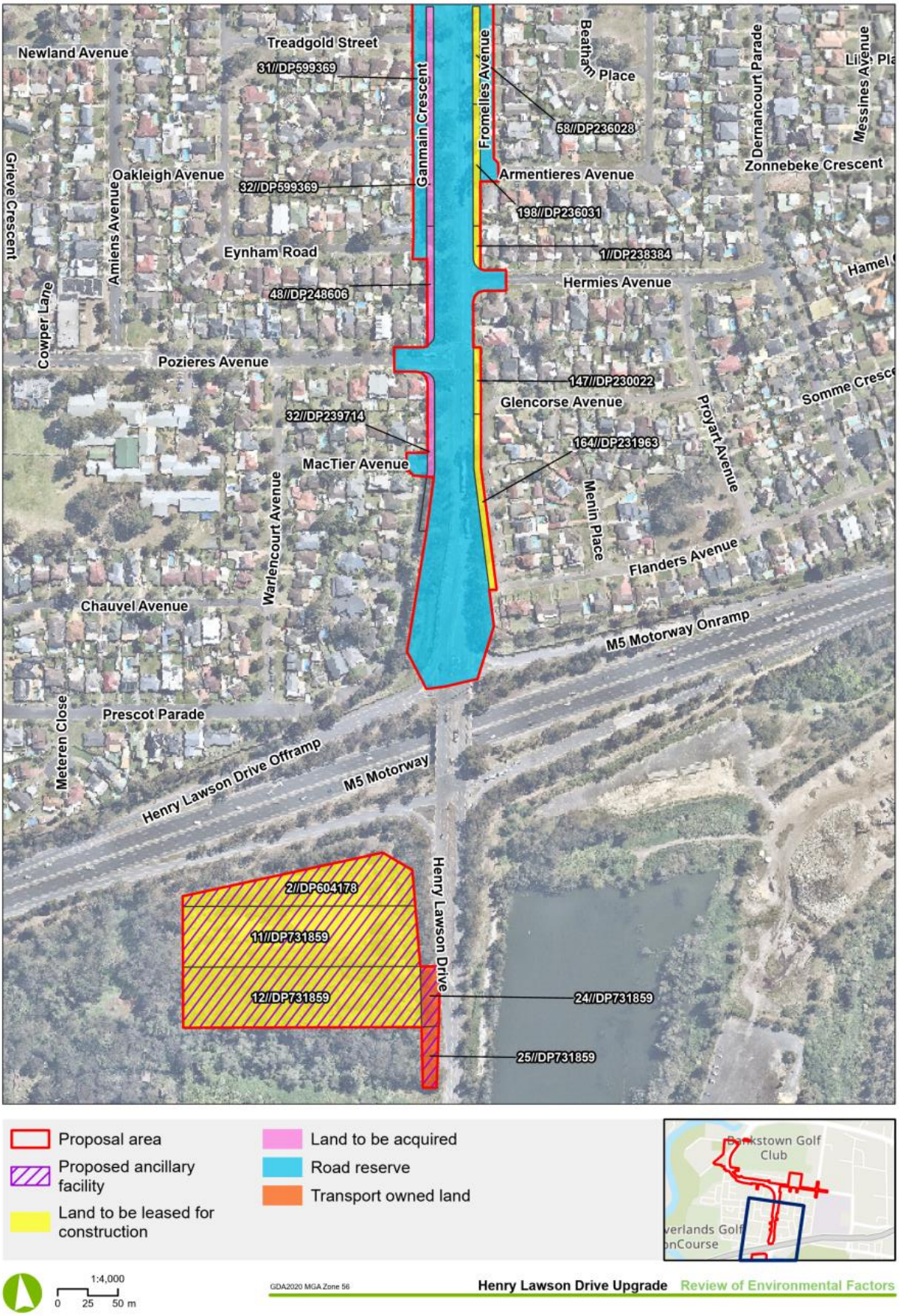


Figure 3-12c Proposed property acquisition

4 Statutory and planning framework

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 (Transport and Infrastructure) 2021

State Environmental Planning Policy (Transport and Infrastructure) 2021 (SEPP (Transport and Infrastructure)) aims to facilitate the effective delivery of infrastructure across the State.

Section 2.109 of SEPP (Transport and Infrastructure) 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 a road and road infrastructure facilities and is to be carried out by Transport or on behalf of Transport, it can be assessed under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (NSW). 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 (Resilience and Hazards) 2021
- State Environmental Planning Policy (Planning Systems) 2021
- State Environmental Planning Policy (Precincts – Central River City) 2021
- State Environmental Planning Policy (Precincts – Eastern Harbour City) 2021
- State Environmental Planning Policy (Precincts – Regional) 2021
- State Environmental Planning Policy (Precincts – Western Parkland City) 2021

Section 2.10 to 2.15 of SEPP (Transport and Infrastructure) 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 SEPP (Transport and Infrastructure) (where applicable), is discussed in chapter 5 of this REF.

State Environmental Planning Policy (Resilience and Hazards) 2021

Coastal management

Chapter 2 of the State Environmental Planning Policy (Resilience and Hazards) 2021 (Resilience and Hazards SEPP) aims to promote an integrated and co-ordinated approach to land use planning in the coastal zone in a manner consistent with the objectives of the *Coastal Management Act 2016* (Coastal Management Act). The coastal zone is defined in the Coastal Management Act as being the area of land comprised of one or more of four coastal management areas:

- coastal wetlands and littoral rainforests area
- coastal vulnerability area
- coastal environment area
- coastal use area

This proposal is not on any land identified as coastal wetlands, littoral rainforests, coastal environment or coastal use areas. However, is located within the 'proximity area for coastal wetlands' mapped under the Resilience and Hazards SEPP. Section 2.8 of the Resilience and Hazards SEPP states that development consent must not be granted to development on land wholly or partly identified as "proximity area for coastal wetlands" unless the consent authority is satisfied that the proposed development would not impact on the biophysical, hydrological or ecological integrity of the adjacent coastal wetland or the quantity and quality of surface and ground water flows to the adjacent coastal wetland.

While this REF is being assessed under Division 5.1 of the EP&A Act and development consent is not required, as due diligence, Chapter 6 of the REF assesses these potential impacts from the proposal and management measures identified in Chapter 7 to further minimise potential impacts. This REF has identified that these impacts would not be significant.

Remediation of land

Chapter 4 of the Resilience and Hazards SEPP aims to promote the remediation of contaminated land for the purpose of reducing the risk of harm to human health or any other aspect of the environment –

- by specifying when consent is required, and when it is not required, for a remediation work, and
- by specifying certain considerations that are relevant in rezoning land and in determining development applications in general and development applications for consent to carry out a remediation work in particular, and
- by requiring that a remediation work meet certain standards and notification requirements

A preliminary site investigation (PSI) has been carried out for the proposal and is summarised in Section 6.12. The investigation detected contamination and potential contaminated areas within and near the proposal area. It was determined that there is risk associated with encountering hazardous ground gas (HGG) and contaminants of potential concern (COPCs) in soil and groundwater during future construction and through offsite movement. While there is also a high probability of encountering acid sulphate soils between two and four metres below ground within the northern section of the proposal area, construction work is unlikely to disturb soil at this depth. As a result of these findings, recommendations were made for further investigation. A Detailed Site Investigation (DSI) would be carried out.

State Environmental Planning Policy (Biodiversity and Conservation) 2021

Chapter 11 of the State Environmental Planning Policy (Biodiversity and Conservation) 2021 (Biodiversity and Conservation SEPP) applies to land within the Georges River Catchment. It aims to maintain and improve water quality and river flows of the Georges River to ensure that development avoids and/or minimises impacts to the catchment. Other objectives include the need to protect and enhance the environmental quality of the catchment, manage the use of resources in the catchment and deliver the principles of ecologically sustainable development (ESD) within the catchment.

Section 11.5(b) of the Biodiversity and Conservation SEPP states that the planning principles identified in Sections 11.6 and 11.7 apply when a public authority proposes to carry out development or an activity which does not require development consent, but which has the potential to adversely affect the water quality, river flows, flood regime or ecosystems within the catchment.

The proposal is consistent with the objectives and planning principles of Chapter 11 of the Biodiversity and Conservation SEPP. The proposal considers potential impacts to water quality, river flows, flooding and ecosystems within the catchment, including erosion and sedimentation and potential water quality impacts during construction (refer Chapter 6). While the proposal is not within the Sydney Drinking Water Catchment and so does not require a Neutral or Beneficial Effect (NorBE) assessment, the proposed water quality treatment as part of the drainage design has achieved the stringent NorBE criteria (refer to Appendix J). Mitigation measures to avoid and reduce the potential impacts on the Georges River are included in Section 7.2.

4.1.2 Local Environmental Plans

Bankstown Local Environmental Plan 2015

The proposal is located within the Canterbury Bankstown local government area (LGA). The City of Canterbury Bankstown was formed in May 2016, replacing the former Bankstown City and Canterbury City Councils. The amalgamation process did not consolidate the LEPs of the local councils, and as a result, the Bankstown Local Environmental Plan 2015 (Bankstown LEP) and Canterbury Local Environmental Plan 2012 (Canterbury LEP) remain in force.

As the proposal is located within the former Bankstown City Council LGA, the Bankstown LEP applies. The proposal would pass through the following land in the Bankstown LEP:

- IN1 General Industrial
- IN2 Light Industrial
- R2 Low Density Residential

- RE1 Public Recreation
- RE2 Private Recreation
- RU4 Primary Production Small Lots
- SP2 Infrastructure.

Table 4-1 outlines the land use zones and consistency of the proposal against the objectives of each zone. illustrates the land use zones under the Bankstown LEP within the proposal area.

Table 4-1 Consistency of the proposal with LEP zones

Zone	Objective of zone	Consistency of proposal with objectives
IN1 General Industrial	• to provide a wide range of industrial and warehouse land uses • to encourage employment opportunities • to minimise any adverse effect of industry on other land uses • to support and protect industrial land for industrial uses	The proposal is marginally within this land use zone near the Bullecourt Avenue / Ashford Avenue intersection. The proposal through the upgrade of the Bullecourt Avenue / Ashford Avenue intersection and upgrade to Henry Lawson Drive is consistent with these objectives as it would improve access to industrial development to support growth of industrial businesses within this zone.
IN2 Light Industrial	• to provide a wide range of light industrial, warehouse and related land uses • to encourage employment opportunities and to support the viability of centres • to minimise any adverse effect of industry on other land uses • to enable other land uses that provide facilities or services to meet the day to day needs of workers in the area • to support and protect industrial land for industrial uses	The proposal is marginally within this land use zone near the Bullecourt Avenue / Ashford Avenue intersection. The proposal through the upgrade of the Bullecourt Avenue / Ashford Avenue intersection and upgrade to Henry Lawson Drive is consistent with these objectives as it would improve access to industrial development to support growth of industrial businesses within this zone.
R2 Low Density Residential	• to provide for the housing needs of the community within a low-density residential environment • to enable other land uses that provide facilities or services to meet the day to day needs of residents • to allow for certain non-residential development that is compatible with residential uses and does not adversely affect the living environment or amenity of the area • to allow for the development of low-density housing that has regard to local amenity • to require landscape as a key characteristic in the low-density residential environment	The proposal is within this land use zone along Bullecourt Avenue as well as sections of existing local roads within the proposal area. The proposal is consistent with these objectives as it would improve road and active transport infrastructure, safety, amenity and liveability along Henry Lawson Drive and the local road network. It would allow residents to access services and facilities more efficiently in surrounding suburbs. The proposal would not involve acquisition of any residential dwellings.

Zone	Objective of zone	Consistency of proposal with objectives
RE1 Public Recreation	• to enable land to be used for public open space or recreational purposes • to provide a range of recreational settings and activities and compatible land uses • to protect and enhance the natural environment for recreational purposes	The proposal is within this land use zone near the Auld Avenue / Keys Parade link road , near Raleigh Road and in sections of road verge along Henry Lawson Drive. The proposal once constructed would improve recreational settings through improvements to active transport linkages from Milperra to the playing fields on Auld Avenue (including shared paths and footpaths). The proposal has been designed to minimise impacts on the natural environment and scenic resources.
RE2 Private Recreation	• to enable land to be used for private open space or recreational purposes • to provide a range of recreational settings and activities and compatible land uses • to protect and enhance the natural environment for recreational purposes	The proposal is marginally within this land use zone near the Keys Parade link road. The nearby Bankstown Golf Course is also zoned for private recreation, however the proposal would not affect this land. The proposal once constructed would improve recreational settings through improvements to active transport linkages (including shared paths and footpaths). The construction of the new link road would allow for increased access to recreational areas. The proposal has been designed to minimise impacts on the natural environment and scenic resources.
RU4 Primary Production Small Lots	• to enable sustainable primary industry and other compatible land uses • to encourage and promote diversity and employment opportunities in relation to primary industry enterprises, particularly those that require smaller lots or that are more intensive in nature • to minimise conflict between land uses within this zone and land uses within adjoining zones	The proposed Milperra Sports Centre ancillary facility and part of the Auld Avenue / Keys Parade link road are within this land use zone. Roads are permitted with consent in this land use zone.
SP2 Infrastructure	• to provide for infrastructure and related uses • to prevent development that is not compatible with or that may detract from the provision of infrastructure	The proposal would be consistent with the objectives of this zone as it is road infrastructure.

Under the LEP, development for the purposes of roads is permitted in all land use zones identified in Table 4-1 with consent from Council. However, as the Transport and Infrastructure SEPP overwrites the LEP, the proposal can be approved under Part 5.1 of the EP&A Act and development consent from Council is not required.

There are also a series of additional local provisions in Part 6 of the Bankstown LEP, including provisions relating to:

- acid sulphate soils (clause 6.1)
- earthworks (clause 6.2)
- biodiversity (clause 6.4)
- riparian land and watercourses (clause 6.4A).

Consideration has been given to these provisions in environmental assessment in Chapters 3 and 6 of this REF.

In October 2020, a consolidated LEP for the LGA was drafted by Canterbury Bankstown Council. The Draft Canterbury Bankstown Consolidated Local Environmental Plan (Draft Consolidated LEP) has undergone public consultation and is currently being reviewed by the Department of Planning and Environment.

As the Draft Consolidated LEP has not yet commenced, the provisions of the Bankstown LEP apply to the proposal. However, the Draft Consolidated LEP land zoning map illustrates that land use zones within the proposal are anticipated to remain mostly consistent with the zones identified within Figure 4-1 and Table 4-1.

The part of the Auld Avenue / Keys Parade link road within RU4 Primary Production Small Lots (as per Table 4-1) is anticipated to be rezoned as RE1 Public Recreation under the Draft Consolidated LEP. As the remainder of the link road is currently zoned as RE1 Public Recreation, this would be unlikely to substantially alter the consistency of the proposal with land use zone objectives.

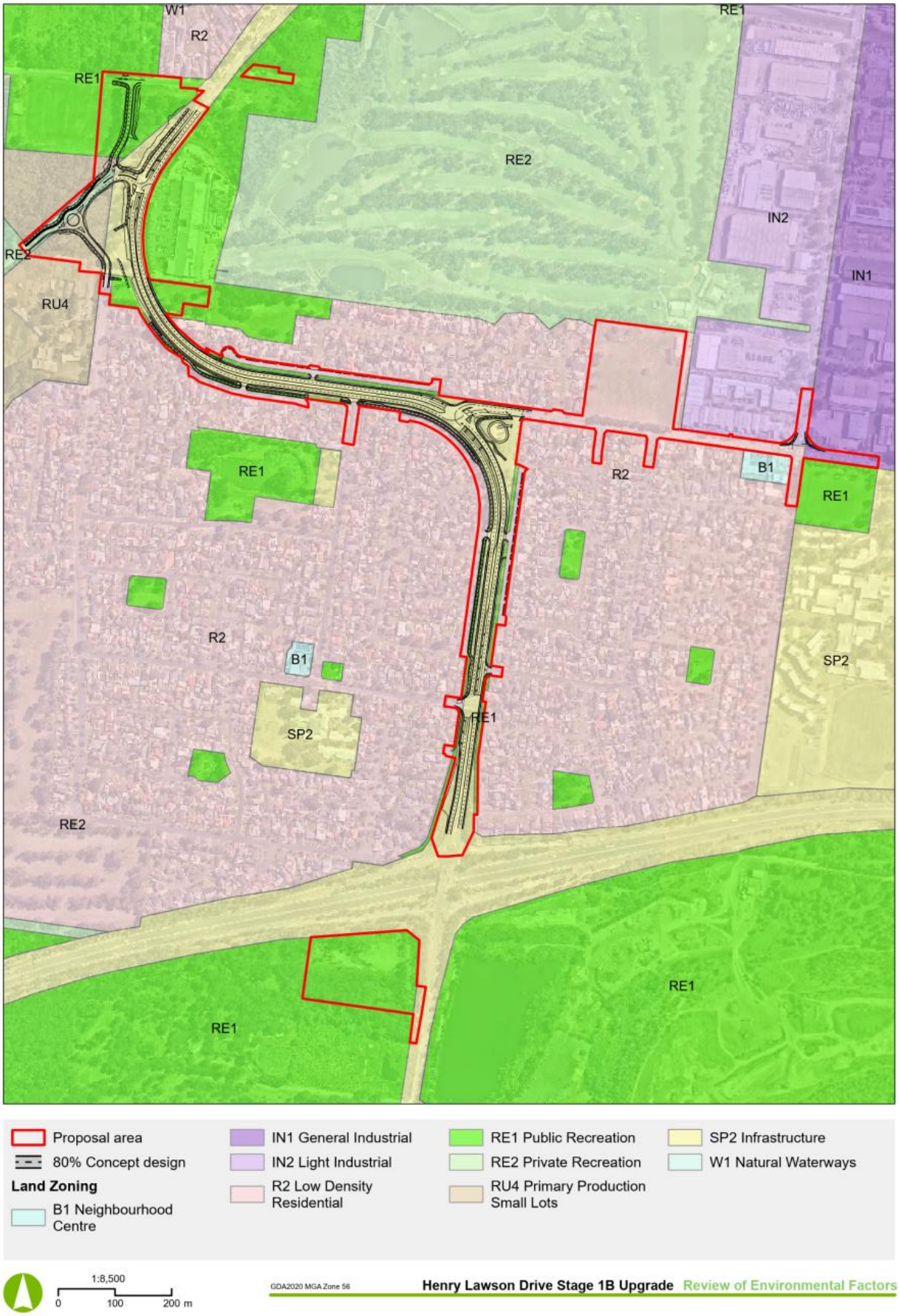


Figure 4-1 Land zoning

4.2 Other relevant NSW legislation

4.2.1 Roads Act 1993

The *Roads Act 1993* (Roads Act) provides guidance on the use and access of public roads, including procedures regarding the opening and closure of public roads. The Act also classifies roads and identifies the functions of road authorities.

The Roads Act states that a road authority may carry out road work on any public road for which it is the road's authority and on any other land under its control (Division 1, Clause 71). If the road is not under the control of the authority carrying out the works, then consent is required.

The proposal is located on both a classified road that is managed by Transport (Henry Lawson Drive) and local roads that are managed by Canterbury Bankstown Council. A Road Occupancy Licence would be required from the relevant roads authority by the contractor prior to work on public roads and any temporary road closures during construction of the proposal.

4.2.2 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) regulates land, air, noise and water pollution in NSW. It also aims to provide opportunity for increased public involvement and access to information regarding environmental protection.

Part 3.2 of the *Protection of the Environment Operations Act 1997* requires an environmental protection licence for scheduled development work and the carrying out of scheduled activities (as set out in Schedule 1 of the POEO Act), which includes road construction. The following scheduled activities potentially apply to the proposed upgrade:

- road construction if it results in four or more traffic lanes (not including bicycle lanes or lanes used for entry or exit), where the road is classified or proposed to be classified as a main road (but not a freeway) for at least 3 km of its length in the metropolitan area, and for at least 5 km in any other area
- extractive activities, where excavation required for the proposed boundary is greater than 150,000 tonnes per year

The proposal does not meet any of the trigger criteria for an EPL. Therefore, an EPL would not be required for the proposal.

Section 148 of the POEO Act requires immediate notification of pollution incidents causing or threatening material harm to the environment to each relevant authority. An Incident Management Plan would be included in the environmental management documentation for the proposed modification, to be prepared during the detailed design phase.

4.2.3 Crown Lands Management Act 2016

The *Crown Land Management Act 2016* provides the legislative framework for the administration of land that is vested in the Crown in NSW. Ministerial approval is required to grant a lease, licence, permit, easement or right of way over a Crown Reserve. Part of the proposal is located on Crown Land located along Henry Lawson Drive, Amiens Avenue, Pozieres Avenue, Bullecourt Avenue, Bullecourt Lane and Ashford Avenue.

Acquisition and leasing of Crown land would be required for the proposal. Land acquisition details are provided in Section 3.6.

Transport would require approval from the Department of Planning and Environment (DPE) for the acquisition and leasing of Crown land.

4.2.4 Aboriginal Land Rights Act 1983

Through the *Aboriginal Land Rights Act 1983*, vacant Crown land not lawfully used or occupied or required for an essential purpose or for residential land, is returned to Aboriginal people (and vested in Aboriginal Land Councils). In line with Section 42B of the Aboriginal Land Rights Act, land vested in an Aboriginal Land Council can only be acquired by Transport through an Act of Parliament.

Under section 39, the Minister may acquire land (including an interest in land) by agreement or by compulsory process in line with the Land Acquisition (Just Terms Compensation) Act 1991. The Minister may only do so if the Minister is of the opinion that there are exceptional circumstances which warrant the acquisition of land for the purpose of satisfying the objectives of this Act.

The proposal would not require a property acquisition of properties that are subject to an Aboriginal land claim. However, Transport would continue to consult with Local Land Councils during the detailed design phase to minimise impacts to any Aboriginal land claim land.

4.2.5 Coastal Management Act 2016

The *Coastal Management Act 2016* (Coastal Management Act) replaces the repealed *Coastal Protection Act 1979*, establishing a strategic framework and objectives for managing coastal issues in NSW. The Coastal Management Act promotes strategic and integrated management, use and development of the coast for the social, cultural and economic wellbeing of the people of NSW.

The Coastal Management Act defines the coastal zone as comprising of the four coastal management areas. The Coastal Management Act establishes management objectives specific to each of the management areas, reflecting their different values to coastal communities and the priorities for those areas.

The proposal is subject to the provisions of the Coastal Management Act as it partially located within proximity to coastal wetlands. The Coastal Management Act has the following management objectives for coastal environment and coastal use areas.

Coastal environment areas management objectives

- to protect and enhance the coastal environmental values and natural processes of coastal waters, estuaries, coastal lakes and coastal lagoons, and enhance natural character, scenic value, biological diversity and ecosystem integrity
- to reduce threats to and improve the resilience of coastal waters, estuaries, coastal lakes and coastal lagoons, including in response to climate change
- to maintain and improve water quality and estuary health
- to support the social and cultural values of coastal waters, estuaries, coastal lakes and coastal lagoons
- to maintain the presence of beaches, dunes and the natural features of foreshores, taking into account the beach system operating at the relevant place
- to maintain and, where practicable, improve public access, amenity and use of beaches, foreshores, headlands and rock platforms

Coastal use areas management objectives

To protect and enhance the scenic, social and cultural values of the coast by ensuring that —

- the type, bulk, scale and size of development is appropriate for the location and natural scenic quality of the coast, and
- adverse impacts of development on cultural and built environment heritage are avoided or mitigated, and
- urban design, including water sensitive urban design, is supported and incorporated into development activities, and
- adequate public open space is provided, including for recreational activities and associated infrastructure, and
- the use of the surf zone is considered to accommodate both urbanised and natural stretches of coastline

Assessment of potential biodiversity, surface and groundwater and socio-economic impacts from the proposal are assessed in Chapter 6.

4.2.6 Heritage Act 1977

The *Heritage Act 1977* (Heritage Act) is concerned with all aspects of conservation ranging from the most basic protection against indiscriminate damage and demolition of buildings and sites, through to restoration and enhancement.

Approval under Section 57(1) is required for works to a place, building, work, relic, moveable object, precinct, or land listed on the State Heritage Register. The Heritage Act states that an excavation permit is required under Section 139 to disturb or excavate any land containing or likely to contain a relic. No heritage approvals are required for the proposal area. An excavation permit under Section 139 would not be required as it is not expected that the proposal would have major adverse impacts on any locally significant relics or archaeological deposits.

Section 170 of the Heritage Act requires that culturally significant items or places managed or owned by Government agencies are listed on the departmental Heritage and Conservation Register (Section 170 Register). Information on these registers has been prepared in line with Heritage Division guidelines.

A Statement of Heritage Impact (SOHI) was carried out for the proposal and found that although there is a moderate potential for historical subsurface archaeology within the proposal area, it is unlikely the proposal would disturb any locally or State significant relics. This is due to the proposal area having seen moderate to high levels of disturbance due to road works and residential developments over the last 70 to 90 years.

As such, at this stage, an excavation permit or an excavation permit exemption would not be required for the proposal. No additional approvals or permits are required under the NSW Heritage Act 1977.

4.2.7 National Parks and Wildlife Act 1979

The *National Parks and Wildlife Act 1979* (NPW Act) provides the basis for legal protection and management of National Parks estate and Aboriginal sites and objects in NSW. Section 86 lists offences relating to harming or desecrating Aboriginal objects. An Aboriginal heritage impact permit (AHIP) is required under Section 90 of the NPW Act to harm an Aboriginal heritage object.

An Aboriginal Cultural Heritage Assessment was carried out for the overall Henry Lawson Drive upgrade. This found various Aboriginal archaeological sites throughout the wider proposal area, which all require an AHIP prior to the commencement of works affecting each site. However, each of the sites were located outside of the Henry Lawson Drive Stage 1B proposal area, meaning no AHIP is required for this proposal.

4.2.8 Water Management Act 2000

The *Water Management Act 2000* (WM Act) aims to provide for the sustainable and integrated management of the water sources of the State for the benefit of both present and future generations. The WM Act is based on the principles of ecologically sustainable development, aiming to ensure the fundamental health of rivers and groundwater systems and associated wetlands, floodplains and estuaries are protected.

The proposal area is covered by the Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011 and so is subject to the provisions of the WM Act.

As mentioned in the Soils, Surface Water and Groundwater working paper for the proposal (Aurecon, 2023c), features of the WM Act (including relation to drainage management, aquifer interference activities) and general principles for design specific to the proposal have been considered (refer Section 6.9).

A controlled activity approval is required from the Department of Planning and Environment (Water) for certain types of developments and activities that are carried out in or near a river, lake or estuary under Section 91E of the WM Act. Transport, as a public authority, is exempt from the requirements to obtain a controlled activity approval under Section 41 of the Water Management (General) Regulation 2018. Aquifer interference approval is therefore not required in regard to the potential impacts to groundwater dependent ecosystems (GDEs).

Elements of the WM Act (including relation to drainage management, aquifer interference activities) and general principles for design specific to the proposal have been considered in this assessment to inform potential construction and operational phase risks of the proposal. The proposal has several direct and indirect impacts relevant to groundwater. Groundwater monitoring and other safeguards are therefore proposed. It is noted that the proposal does not intend to extract large quantities of groundwater that would trigger the need to apply for a water extraction licence (under the NSW AIP (DPI Office of Water, 2012)). There

is potential to encounter groundwater, however, the proposal would not extract groundwater for the purposes of water supply.

The proposal would require management in line with the WM Act, with safeguards and mitigation measures identified in Section 7.2 of this REF.

4.2.9 Fisheries Management Act 1994

The *Fisheries Management Act 1994* (FM Act) aims to conserve, develop and share the fishery resources for the benefit of present and future generations in NSW.

The Georges River is located next to the proposal and is classified as key fish habitat. Milperra Drain is also located within the proposal area, under the box culvert bridge proposed as part of the local link road between Auld Avenue and Keys Parade.

Section 199 of FM Act states that a public authority that proposes to carry out dredging or reclamation must provide the Minister written notice of the proposed work and consider any matters concerning the proposed work that are raised by the Minister within 21 days after the giving of the notice. Dredging and reclamation would not be required for the proposal, therefore notice to the Minister would not be required for these activities.

While the proposal would involve work near the Georges River and over Milperra Drain near Keys Parade, work would not obstruct fish passage as the majority of the river and creek would be passable to fish at any given time. A permit would not be required for this part of the proposal under Section 219 of the FM Act.

4.2.10 Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* (BC Act) became operational in August 2017 to replace the *Threatened Species Conservation Act 1995*. The BC Act promotes the maintenance of a healthy, productive and resilient environment. The BC Act focuses on biodiversity conservation through ecologically sustainable development.

The BC Act applies to the proposal through the requirement to avoid, minimise and offset the impacts of proposed development and land use changes on biodiversity. The proposal would consider potential impacts to biodiversity values and biodiversity and the need for any biodiversity offsets.

A Biodiversity Assessment Report (BAR) was carried out for the REF. Section 7.3 of the BC Act and Part 7A of the FM Act require that the significance of the impact on threatened species, and endangered ecological communities is assessed using a five-part test. Where a significant impact is likely to occur, a species impact statement (SIS) must be prepared by an accredited assessor in line with the Biodiversity Assessment Method (BAM).

A total of four TECs listed under the BC Act were recorded in the BAR study area. TECs in the BAR study area are assigned a conservation status of critically endangered ecological community (CEEC) or endangered ecological community (EEC) under the BC Act. The recorded TECs included:

- Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion (EEC)
- River-flat Eucalypt Forest on Coastal Floodplains of the NSW north coast, Sydney Basin and South East Corner Bioregions (EEC)
- Castlereagh Swamp Woodland Community (EEC)
- Swamp Oak Floodplain Forest of the NSW north coast, Sydney Basin and South East Corner Bioregions (EEC).

No threatened species of flora or fauna were detected within the BAR study area during the survey period. As noted in Section 6.6.1, due to proposal timing not aligning with the optimal timing or conditions to detect some species, targeted surveys have not been conducted for the Cumberland Plain Land Snail or the Southern Myotis. As these species have a moderate to high likelihood of occurrence but have not been adequately surveyed, these species have been assumed present in the proposal area in accordance with Transport guidelines. In addition, as fish passage would not be obstructed in the Georges River or Milperra Drain as a result of the proposal, the species, populations and ecological communities listed as endangered under Schedule 4 of the FM Act would not be further threatened. Further detail on the impacts to biodiversity due to the proposal can be found in Section 6.6.3.

4.2.11 Biosecurity Act 2015

To prevent, eliminate and minimise biosecurity risks posed by biosecurity matter and carriers, the NSW Government established the *Biosecurity Act 2015*. The *Biosecurity Act 2015* promotes biodiversity and the management of:

- pests, diseases, contaminants and other biosecurity matter that are economically significant for primary production industries
- threats to terrestrial and aquatic environments arising from pests, diseases, contaminants and other biosecurity matter
- public health and safety risks arising from contaminants, non-indigenous animals, bees, weeds and other biosecurity matter known to contribute to human health problems
- pests, diseases, contaminants and other biosecurity matter that may have an adverse effect on community activities and infrastructure.

In NSW, all plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.

Weeds were identified within the proposal area and would be managed in line with the requirements of the Biosecurity Act. Further information is provided in Section 6.6.3.

Management measures have been recommended to manage these invasive species in line with the requirements of the Biosecurity Act (refer to Section 6.6.4). Appropriate biosecurity controls would be put in place for the proposed works to minimise the risk of weed transfer.

4.3 Commonwealth legislation

4.3.1 Environment Protection and Biodiversity Conservation Act 1999

Under the *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 – Consideration of section 171 factors and matters of national environmental significance and Commonwealth land and chapter 6 of the REF.

A referral is not required for proposed road activities that may affect nationally-listed threatened species, endangered ecological communities and migratory species. This is because requirements for considering impacts to these biodiversity matters are the subject of a strategic assessment approval granted under the EPBC Act by the Australian Government in September 2015.

Potential impacts to these biodiversity matters are also considered as part of chapter 6 of the REF and Appendix H.

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 Climate Change, Energy, the Environment and Water under the *EPBC Act*.

Findings - nationally-listed biodiversity matters (where the strategic assessment applies)

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.

4.3.2 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 affective 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, with no Native Title holders/claimants identified.

4.4 Confirmation of statutory position

The proposal is categorised as development for the purpose of a road and/or road infrastructure facilities and is being carried out by or on behalf of a public authority. Under section 2.109 of SEPP (Transport and Infrastructure) 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'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.

5 Consultation

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

5.1 Consultation strategy

The proposal has implemented the *Henry Lawson Drive Upgrade Stage 1B: Communication and Stakeholder Engagement Strategy* (consultation strategy). The objective of this strategy is to ensure local residents, businesses and other stakeholders are aware of and are consulted during the development and delivery of the proposal. This includes during the development of the concept design, environmental assessment, detailed design and construction phases. The consultation strategy outlines Transport's milestones, methods and reporting. Communication and consultation milestones include (but are not limited to):

- consultation and reporting on the early concept design (completed)
- public display of the REF, which would include:
  - notifications
  - engagement with local council
  - project web portal
  - public meetings and/or community information events (virtual or otherwise)
  - publication of frequently asked questions (FAQ) documents
  - briefing notes
  - media engagement (coordinated with transport media)
  - publication of outcomes
- targeted community and stakeholder consultation during the detailed design phase
- public engagement during construction:
  - advanced/start of work notifications
  - traffic management notifications, including any lane closures
  - night time work notifications and consultation
  - quarterly project updates
  - responding to enquiries and complaints
  - end of construction
- ongoing construction communication (jointly provided by Transport and the construction contractor).

Other activities include (but are not limited to) separate engagement with local residents, businesses and stakeholders on specific or sensitive aspects of the proposal.

5.2 Community involvement

Transport invited feedback on the design for the proposal during a 'Have Your Say' consultation period from 31 October to 18 November 2022. During the consultation, 118 submissions were received, including 66 via the interactive portal on the proposal webpage, 47 via the project email, and five via phone. A summary of the themes raised during this consultation is included in Table 5-1. Responses to the feedback received are provided in the *Henry Lawson Drive Upgrade Stage 1B, Milperra Consultation Report* (Transport, 2022b), included in Appendix C.

Table 5-1 Summary of themes raised by the community

Category	Sub-category	Theme raised
Traffic and transport	Henry Lawson Drive	Suggestions for alternate proposal design including speed limit alterations and intersection configurations and for weight restrictions to be placed on trucks.
	Local traffic, access and intersection changes	Suggestions about new connections and road closures, including new connections to local roads from Henry Lawson Drive and intersection alterations.
	Keys Parade / Auld Avenue / new local link road design	Suggestions to alter the Keys Parade / Auld Avenue / the new local link road design, which were mainly regarding alterations to the intersection of the new local link road and Keys Parade.
Active transport	Shared path	Suggestions for improved integration of the shared paths with the surrounding active transport network.
	Footpaths	Suggestions were made to retain existing footpaths as well as to convert some paths into shared paths.
	Active transport safety	Safety suggestions for footpaths and shared paths throughout the proposal area.
Environment	Biodiversity	Suggestions for tree retention and the revegetation of the proposal area to reduce noise and pollution.
	Hydrology, flooding and surface water	Concerns about increased flood risk throughout the proposal area, including at the Keys Parade roundabout.
	Noise and vibration	Concerns about increased noise from the increased traffic capacity.
Design and land use	Property and land use	Concerns about property acquisition, particularly surrounding Keys Parade.
	Road design	Suggestions regarding road features were made, including improvements to vehicle safety and to nearby utilities.

5.3 Aboriginal community involvement

An Aboriginal heritage assessment was carried out for the proposal in line with the *Procedure for Aboriginal Cultural Heritage Consultation and Investigations* (PACHCI) (Roads and Maritime, 2011). Effective consultation with Aboriginal people is an important step in the process of identifying and minimising cultural heritage impacts. A summary of the four stages of the PACHCI procedure is provided in Table 5-2.

Table 5-2 Summary of Transport's Procedure for Aboriginal Cultural Heritage Consultation and Investigation

Stage	Description
Stage 1	Initial assessment by Transport.
Stage 2	Site survey and further assessment.
Stage 3	Formal consultation and preparation of a cultural heritage assessment report.
Stage 4	Implement environmental impact assessment recommendations.

Aboriginal community consultation carried out to date for the proposal has involved:

- A site survey carried out in consultation with Aboriginal stakeholders for Stage 2 of the PACHCI assessment for the entire Henry Lawson Drive Upgrade Program in 2018. For this stage, Transport (previously Roads and Maritime) organised the involvement of representatives from the Gandangara Local Aboriginal Land Council (GLALC) and Deerubbin Local Aboriginal Land Council (DLALC). Individuals from both land councils were consulted to assist in the field survey and to identify whether the proposal area held any sites and/or values known to the local Aboriginal community. The results of the survey were also presented to Aboriginal representatives at the end of each day for review and discussion. The findings from this site assessment are documented in the Henry Lawson Drive Upgrade (Hume Highway to M5 Motorway) Aboriginal Archaeological Survey Report (Kelleher Nightingale, 2018).
- As part of the Aboriginal cultural heritage assessment report (CHAR) (refer to Appendix L) prepared in line with Stage 3 of the PACHCI, formal consultation was carried out with Aboriginal stakeholders. Transport invited Aboriginal people who hold relevant knowledge to determine the cultural heritage significance of Aboriginal objects and Aboriginal places in the area to register an interest in a process of community consultation. The investigations included consultation with 18 Aboriginal community groups and individuals. All stakeholders were also provided with a copy of the proposed test excavation methodology and CHAR methodology. Eight formal responses were received, with all stating support or agreement with the proposed assessment methodology.

The formal consultation process for the CHAR has included:

- advertising for registered Aboriginal parties
- government agency notification letters
- notification of closing date for registration
- provision of proposed assessment methodology
- ongoing compilation of registrants list, through continuing to register individuals and groups for consultation on the proposal
- provision of draft CHAR for review
- an Aboriginal Focus Group meeting to discuss investigation results in September 2020, draft CHAR and detailed mitigation strategies
- ongoing consultation with the local Aboriginal community.

5.4 SEPP (Transport and Infrastructure) consultation

Canterbury Bankstown Council has been consulted about the proposal as per the requirements of sections 2.10(1)(a) (stormwater management), (e) (construction that affects traffic) and (f) (excavation of a footpath or road) and section 2.12(2) (development on flood liable land) of SEPP (Transport and Infrastructure). The State Emergency Service (SES) has also been consulted about the proposal as per the requirements of section 2.13(1) (development on flood liable land) of SEPP (Transport and Infrastructure). Appendix B – Statutory consultation checklists contains a SEPP (Transport and Infrastructure) consultation checklist that documents how SEPP (Transport and Infrastructure) consultation requirements have been considered.

Themes raised from this consultation are outlined in Table 5-3.

Table 5-3 Themes raised through SEPP (Transport and Infrastructure) consultation

Group	Theme raised	Response / where addressed in REF
NSW SES	• Consider the impact of flooding on the infrastructure, up to and including the PMF. • Pursue site design and stormwater management that minimises any risk to the community. • Ensure workers and people using the site during and after the upgrades are aware of the flood risk, for example by using signage. • Consider how the proposal accommodate current and future (potentially faster) water flow rates to prevent water pooling from impacting local properties. • Consult local flood rescue operators regarding whether the introduction of a raised central median might impact emergency access to Auld Avenue.	• A hydrology and flooding assessment has been carried out for the proposal (refer to section 6.4). • As is outlined in section 6.4, the flood impacts as a result of the proposal in a one per cent annual exceedance probability flooding event would not be considered adverse. A minor increase in the flood levels of the Milperra Drain would occur but is not considered adverse. Changes in the flooding extent of flood events in the proposal area are negligible and are not considered adverse. • In line with Safeguard GEN3 (refer to Section 7.2), all construction personnel working on site would receive training to ensure awareness of the flood risk within the proposal area. • During operation of the proposal, existing flood signage within the proposal area would be reinstated. • The Australian Rainfall and Runoff 1987 guideline was adopted in the flood modelling carried out for the proposal. This guideline was considered to best align with expected peak flows in current and future flood scenarios and was also consistent with Canterbury Bankstown Council's existing flood mapping and flood planning levels. Refer to Appendix F for further details. • The proposal would provide access to Auld Avenue for vehicles travelling south along Henry Lawson Drive via Keys Parade and the new Auld Avenue link road. As noted in Section 3.2.3, Auld Avenue would be converted to left-in left-out only (as part of the Henry Lawson Drive Upgrade Stage 1A project (subject to a separate planning approval)) once an alternative access (via link road) is constructed. As such, emergency access to Auld Avenue would be maintained during construction and operation of the proposal. • Transport would continue to consult with NSW SES during detailed design and construction.
City of Canterbury-Bankstown	Themes raised by the City of Canterbury-Bankstown as part of the SEPP (Transport and Infrastructure) consultation were largely consistent with those raised in the 'Have Your Say' consultation (outlined in section 5.5). Some additional themes were raised. These are as follows:	

Group	Theme raised	Response / where addressed in REF
	• Council's preference for a bridge to be constructed (instead of a culvert) where the new link road crosses the Milperra Drain, given the advantages of a bridge in terms of maintenance, hydraulic capacity and natural waterway aesthetics	• Transport acknowledges Council's preference for a bridge to be constructed instead of a culvert where the new link road crosses the Milperra Drain. Transport would continue to consult with Council about the drain crossing through detailed design.
	• A request for the footpath along Ingram Avenue and Fromelles Avenue to be 1.5 metres wide.	• Footpath dimensions would continue to be refined through detailed design. Transport would consult with Council as this develops.
	• Council's preference for traffic signals to be included at the Bullecourt Avenue / Dernancourt Parade intersection over a roundabout.	• There is no current proposal for upgrading of this intersection. Transport will continue to engage with Council regarding the operation and any treatments at this existing intersection.
	• Acknowledgement of the need for continued consultation with Council about the ownership and treatment of land adjacent to Raleigh Reserve.	• Transport would continue to consult with Council about the proposal and treatment of this land.

5.5 Government agency and stakeholder involvement

Various government agencies and stakeholders have been consulted about the proposal, including:

- Canterbury Bankstown Council: 'Have your say' consultation feedback, ongoing meetings regarding the proposal
- Riverlands Developer: targeted consultation around the proposal and integration with the Keys Parade intersection
- Anglicare Seniors Living Development: targeted consultation around the use of the site at 27 Bullecourt Avenue as an ancillary facility
- Milperra Sports Centre: targeted consultation around the use of the site at 101 Raleigh Road as an ancillary facility and as the location for the Raleigh Road extension.

Themes that have been raised as a result of consultation with these agencies and stakeholders are outlined in Table 5-4.

Table 5-4 Themes raised through stakeholder consultation

Stakeholder	Category	Theme raised	Response / where addressed in REF
Canterbury Bankstown Council	General – support	General support for the proposal and its design.	Responses to the themes raised by Council are provided in the *Henry Lawson Drive Upgrade Stage 1B, Milperra Consultation Report* (Transport, 2022b).
	Traffic and transport	Queries and suggestions about relating to the integration of the proposal with surrounding development, intersection upgrades, and the installation of traffic management devices throughout the proposal area	
		There may be impacts of the proposal on garbage truck movements.	
	Active transport	Queries and suggestions about shared path and footpath design, including safety of pedestrians and cyclists and opportunities for further footpath reconstruction.	
	Environment and heritage	Request for the Auld Avenue link road to minimise biodiversity and surface water impacts.	
		Suggestion to review the proposed shared path alignment to reduce loss of existing trees.	
		Suggestion to review existing drainage infrastructure near the proposal.	
		Request for the proposal's drainage design to meet design requirements to mitigate the existing flood risk in the area and for further details on surface water impacts of the proposal.	
		Request for the Milperra memorial sign to remain intact and be relocated so it remains next to the shared path and facing Henry Lawson Drive.	
		Request to retain the J Morrison Settler Tree, to carry out root mapping to better identify how to avoid the tree and to change the design to avoid impacts to the structural root zone due to pavement or utility relocations.	
Mirvac	Traffic and transport	The proposal should be consistent and coordinated with the Keys Parade development approvals.	
Anglicare	Property	Use of land owned by Anglicare for an ancillary facility to be through negotiation.	
Milperra Sports Centre	Property	Transport to consider moving Raleigh Road alignment to maximise residual land and reduce acquisition area.	

5.6 Ongoing or future consultation

Transport would continue to consult with the community and relevant stakeholders during design and construction of the proposal.

5.6.1 Consultation during the public display of the REF

The REF will be placed on public display and comments invited. A range of consultation activities will be carried out in line with the consultation strategy and include:

- briefings for stakeholders, local councils and government agencies (as required)
- meetings with directly affected property owners
- communication materials
- community information displays and sessions (online or other format, as relevant)
- door knocks/letter box drops
- website updates.

Following public display, submissions will be collated, and a submissions report prepared to address any themes raised by stakeholders. The submissions report will be made available to the public via the Transport website (*nswroads.work/hld1b*).

Transport will continue to identify and manage themes of interest or concern to the community through the REF display period, through the assessment and determination process. The community will be informed of any major design changes that are required to address concerns raised in submissions to the REF.

5.6.2 Consultation during construction

Following the REF display period and continuing into the construction phase of proposal, Transport will continue to identify and manage themes of interest or concern to the community through the assessment and determination process.

The aims of ongoing communications and consultation are to provide the community with:

- accurate and accessible information regarding the processes and activities associated with the proposal
- information in a timely manner
- appropriate avenues for providing comment or raising concerns, and to ensure they are aware of the avenues
- a high level of responsiveness to their issues and concerns throughout development and delivery of the proposal.

Following determination, the community would continue to be updated about the progress of construction and provided notification of any road closures or night works in advance of the works occurring.

Community engagement through the construction phase for the proposal would be carried out by Transport and the construction contractor. Activities/notifications that could occur include:

- advanced/start of work notifications
- traffic management notifications, including any lane closures
- night time work notifications and consultation
- quarterly project updates
- responding to enquiries and complaints
- end of construction
- ongoing construction communications.

Other activities include (but are not limited to) separate engagement with local residents, businesses and stakeholders on specific or sensitive aspects of the proposal. To effectively manage consultation during the

construction stage of the proposal a *Community and Stakeholder Engagement Plan* would be developed and implemented by the construction contractor.

6 Environmental assessment

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 matters of national environmental significance under the EPBC Act
- the factors specified in the Guideline for Division 5.1 assessments (DPE 2022a) and as required under section 171 of the Environmental Planning and Assessment Regulation 2021 and the Roads and Related Facilities EIS Guideline (DUAP 1996). The factors specified in section 171 of the Environmental Planning and Assessment Regulation 2021 are also considered in Appendix A
- site-specific safeguards and management measures are provided to mitigate the identified potential impacts.

6.1 Arboriculture

An Arboricultural Impact Assessment (AIA) was carried out for the proposal to assess the proposal's design against existing trees within the Henry Lawson Drive road corridor, as well as near the new link road between Auld Avenue and Keys Parade. The existing trees, impact levels, as well as safeguards to mitigate these impacts, are included in this chapter.

6.1.1 Methodology

The aim of the AIA was to identify which trees in close proximity to the project footprint have the potential to be retained and to consider design opportunities to minimise tree loss. The following section outlines the methodology used in the assessment of the trees within and near the proposal.

Defining a tree

The Bankstown Development Control Plan (DCP) 2015 defines a protected tree as a long-lived perennial plant greater than five metres in height with one or relatively few main stems or trunks. Trees and vegetation that fall within these specifications are protected unless listed as an exempt species.

Visual tree assessment

Although not the full extent of vegetation within the proposal area, a total of 109 trees within the proposal area were assessed along Henry Lawson Drive and the Auld Avenue to Keys Parade local link road. These trees are all within the AIA study area. The trees selected for assessment were identified due to their proximity to the edge of proposed design elements that would require excavation during construction such as kerbs or shared paths.

The western side of Henry Lawson Drive features two rows of trees. The assessment assumed that the first row of these trees, closest to the current road corridor, would need to be removed due to the proposed widening, meaning these trees were not included in the assessment. The assessment was also based on the concept design where trees on the eastern side of Henry Lawson Drive were to be retained and therefore not assessed.

The area of the proposed new local link road between Auld Avenue and Keys Parade features mature trees along the edge of Gordon Parker Reserve and surrounding the Milperra Drain. The trees lining Gordon Parker Reserve were included in the assessment given their proximity to the location of the new link road.

Trees which were part of the assessment as well as the AIA study area are shown in Figure 6-1.

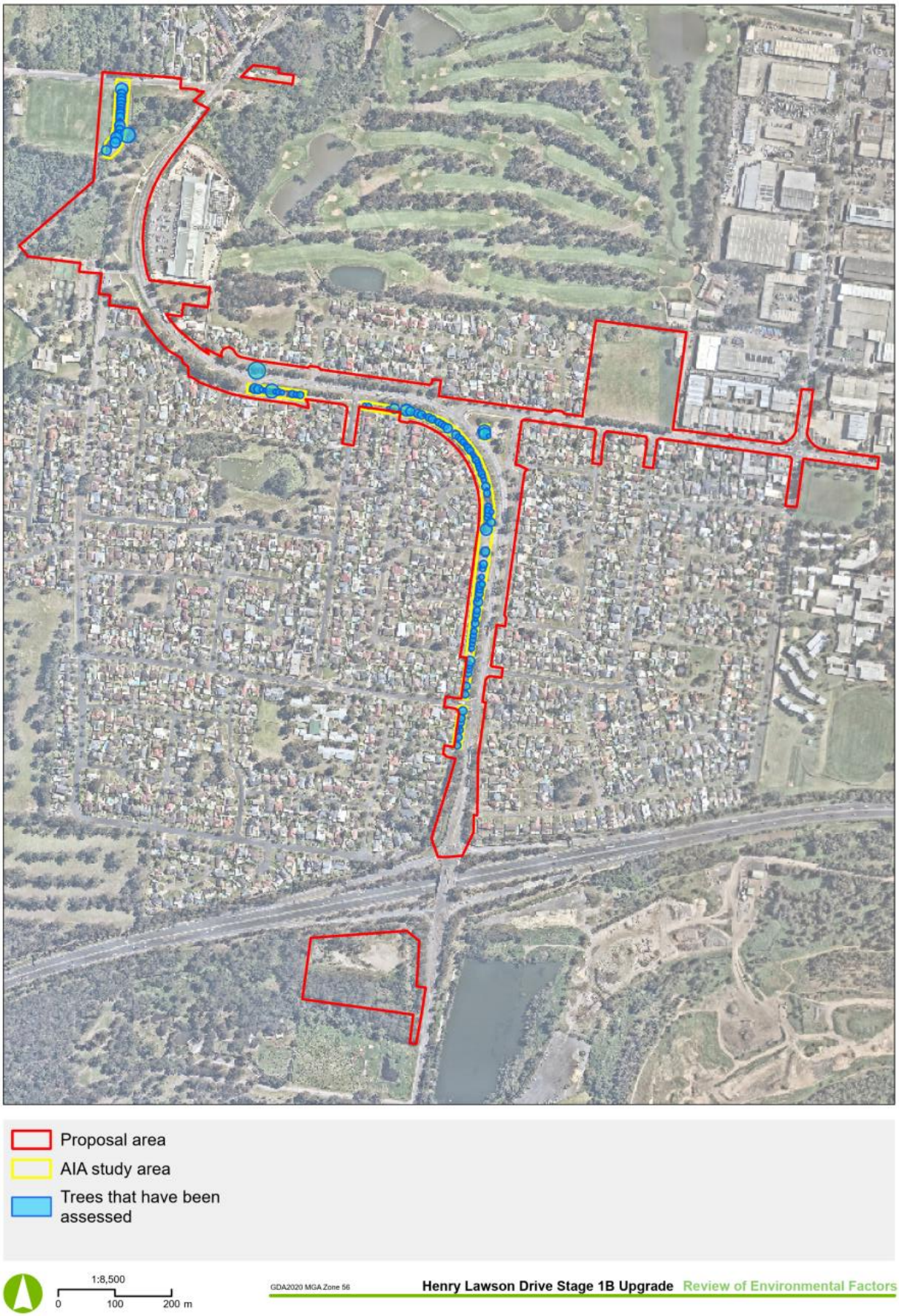


Figure 6-1 Tree impacts – AIA study area

The subject trees were assessed in line with a visual tree assessment (VTA) as formulated by Mattheck & Breloer (1994), and practices consistent with modern arboriculture. The following limitations apply to this methodology:

- trees were inspected from ground level, without the use of any invasive tools and testing. Trees within nearby properties or restricted areas were not subject to a complete visual inspection (i.e., defects may be present but not recorded)
- diameter at breast height (DBH) has been accurately measured using a diameter tape. Tree height and canopy spread were estimated unless otherwise stated
- tree protection zones have been calculated in line with Australian Standard, AS 4970-2009, Protection of Trees on Development Sites using the DBH measurements.

Retention values

A tree retention assessment has been carried out in line with the Institute of Australian Consulting Aboriculturalists (IACA) Significance of a Tree, Assessment Rating System (STARS). The system uses a scale of high, medium, and low significance in the landscape. The retention value of a tree or group of trees is decided using a combination of environmental, cultural, physical, and social values:

- **low**: these trees are not considered important for retention, and do not require special works or design modification to be implemented for their retention
- **medium**: these trees are moderately important for retention. Their removal should only be considered if negatively affecting the proposal and all other alternatives have been considered
- **high**: these trees are considered important for retention and should be retained and protected. Design modification or re-location of building(s) should be considered to accommodate the setbacks as prescribed by Australian Standard, AS4970-2009 Protection of trees on development sites.

Tree protection zones

The Australian Standard, Protection of Trees on Development Sites (AS4970), describes two zones that need to be considered when carrying out an AIA:

- Tree protection zone (TPZ): the TPZ is the combination of crown and root area that requires protection during the construction process so that the tree can remain viable. The TPZ is calculated by measuring the DBH and multiplying it by twelve. The resulting value is applied as a radial measurement from the centre of the trunk to delineate the TPZ.
- Structural root zone (SRZ): The SRZ is the area of the root system used for stability and mechanical support of the tree.

Encroachment within the TPZ is acceptable, providing that the arborist can demonstrate that the tree would remain viable. There are three levels of encroachment defined by AS4970:

- **nil encroachment (0 per cent)**: No encroachment within the TPZ
- **minor encroachment (<10 per cent)**: The encroachment is less than 10 per cent of the TPZ
- **major encroachment (>10 per cent)**: The encroachment is greater than 10 per cent of the TPZ.

An example of these levels of encroachment is shown in Figure 6-2.

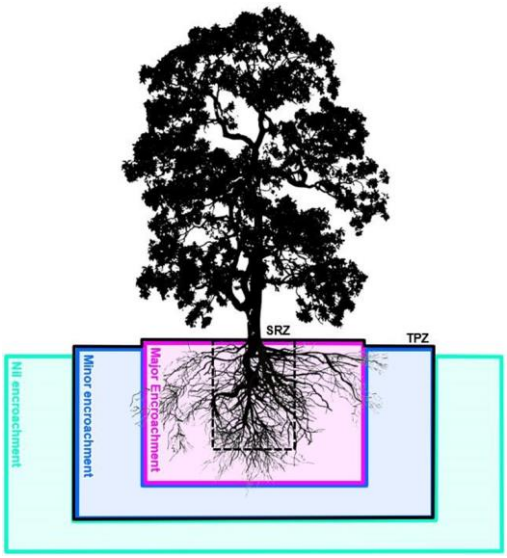


Figure 6-2 Encroachment within the TPZ

6.1.2 Existing environment

The proposal area contains trees along Henry Lawson Drive and in the area proposed for construction of the new local link road between Auld Avenue and Keys Parade. Most trees within the proposal area are located along the western and southern sides of Henry Lawson Drive, with some scattered trees on its eastern and northern side. The trees located in the area of the new local link road line Gordon Parker Reserve between Auld Avenue and Keys Parade.

Most of the trees located along Henry Lawson Drive within the AIA study area are mature trees which are over 10 metres in height. They are either in a good or fair condition and have low or medium significance. Trees located in the AIA study area near the new link road between Auld Avenue and Keys Parade are all mature or semi-mature trees and are almost all over 10 metres in height. They are all in good or fair condition and all have a low or medium significance.

The Milperra Soldier Tree, which was planted in 1917 by Mr J Morrison, an early settler of Milperra, is also within the proposal area. Further details about this tree and its heritage significance can be found in section 6.10.2.

6.1.3 Potential impacts

This section details the impacts to the 109 trees assessed within the proposal area.

Construction

Of the trees assessed, the results indicate that around 19 trees can be retained based on the current design, with 90 trees requiring removal.

Most of the trees identified for removal are located along Henry Lawson Drive. The construction and operation of the proposal would result in major encroachments within the TPZ of 98 trees. Two trees would be subject to minor encroachment and 9 trees would not be subject to encroachment. Only five trees along Henry Lawson Drive would be able to be retained. These are outlined in Figure 6-3c and Figure 6-3d.

Only three trees located near the new link road between Auld Avenue and Keys Parade would be removed, as is outlined in Figure 6-3a. All remaining assessed trees near the new link road would be retained. In addition, the current assessment shows that the Milperra Soldier Tree would need be removed due to the direct impacts to its roots as a result of road widening works. Transport would continue to refine the design to consider other opportunities to retain existing trees, including the Milperra Soldier Tree. A landscaping plan would also be developed for the proposal utilising plans prepared as part of the Landscape Character and Visual Impact Assessment. Details of this can be found in Appendix G.

Details of tree retention and removal throughout the proposal are shown in Figure 6-3a-d. The trees circled are those which have been assessed as part of the AIA.

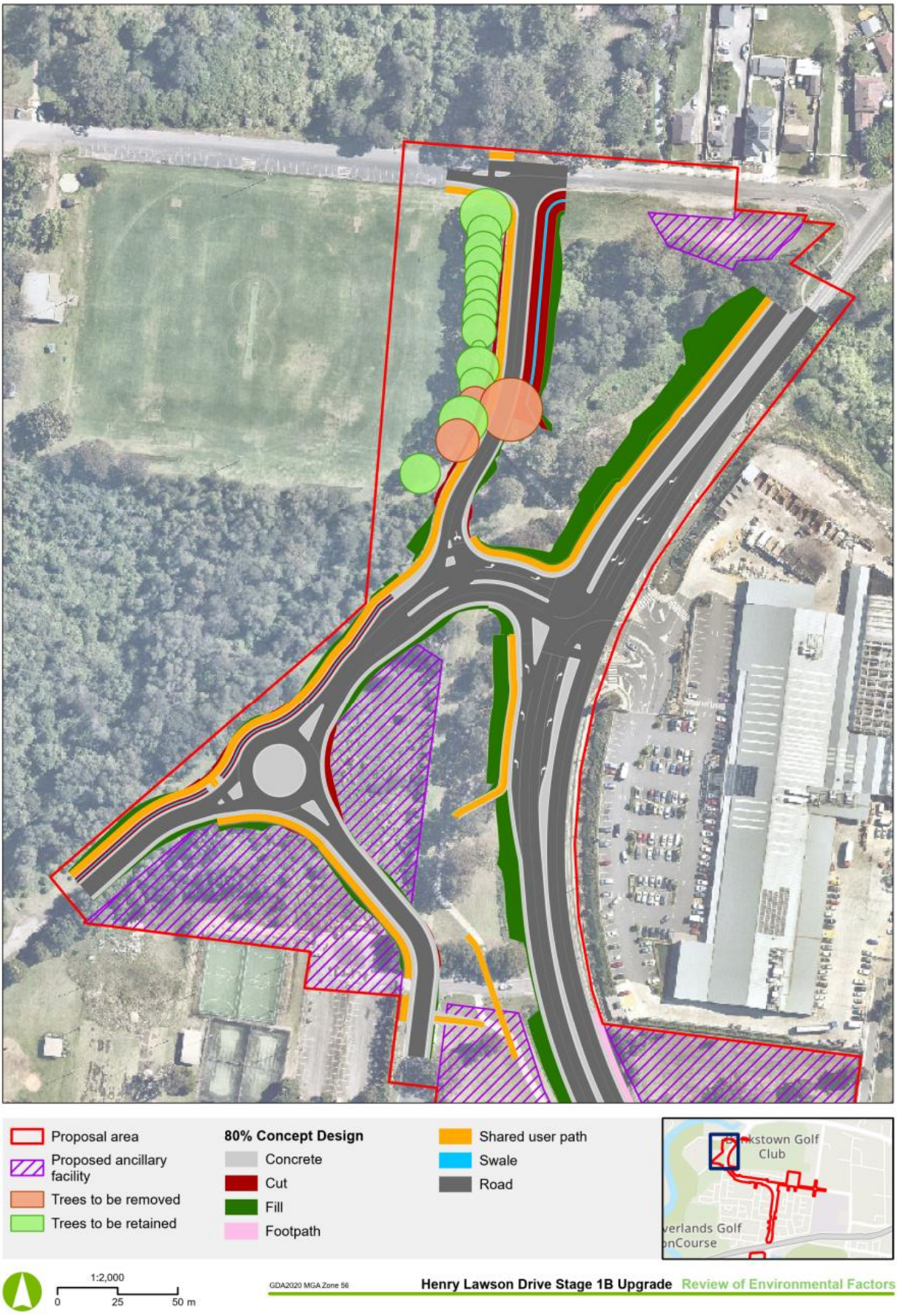


Figure 6-3a Tree impacts

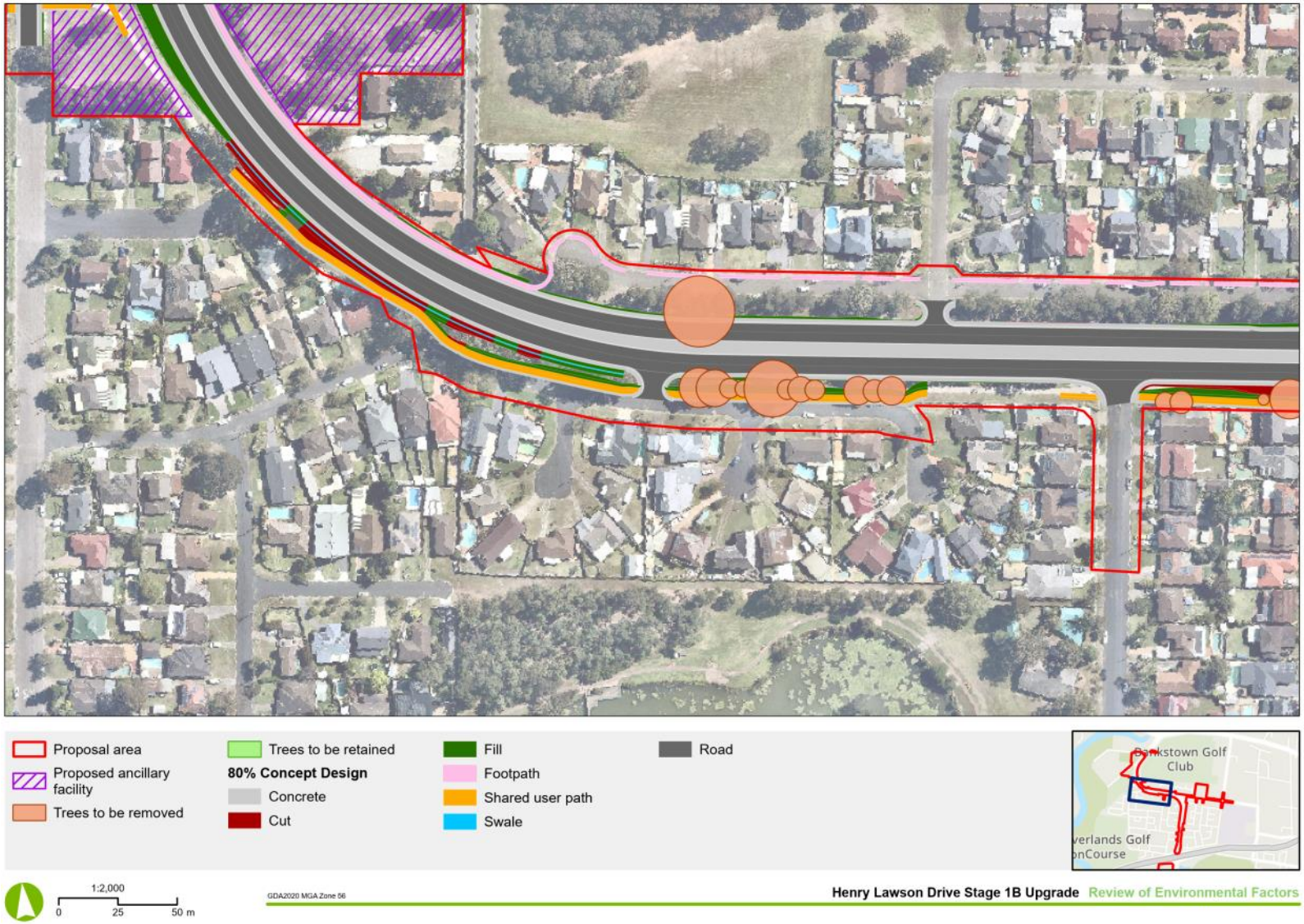


Figure 6-3b Tree impacts

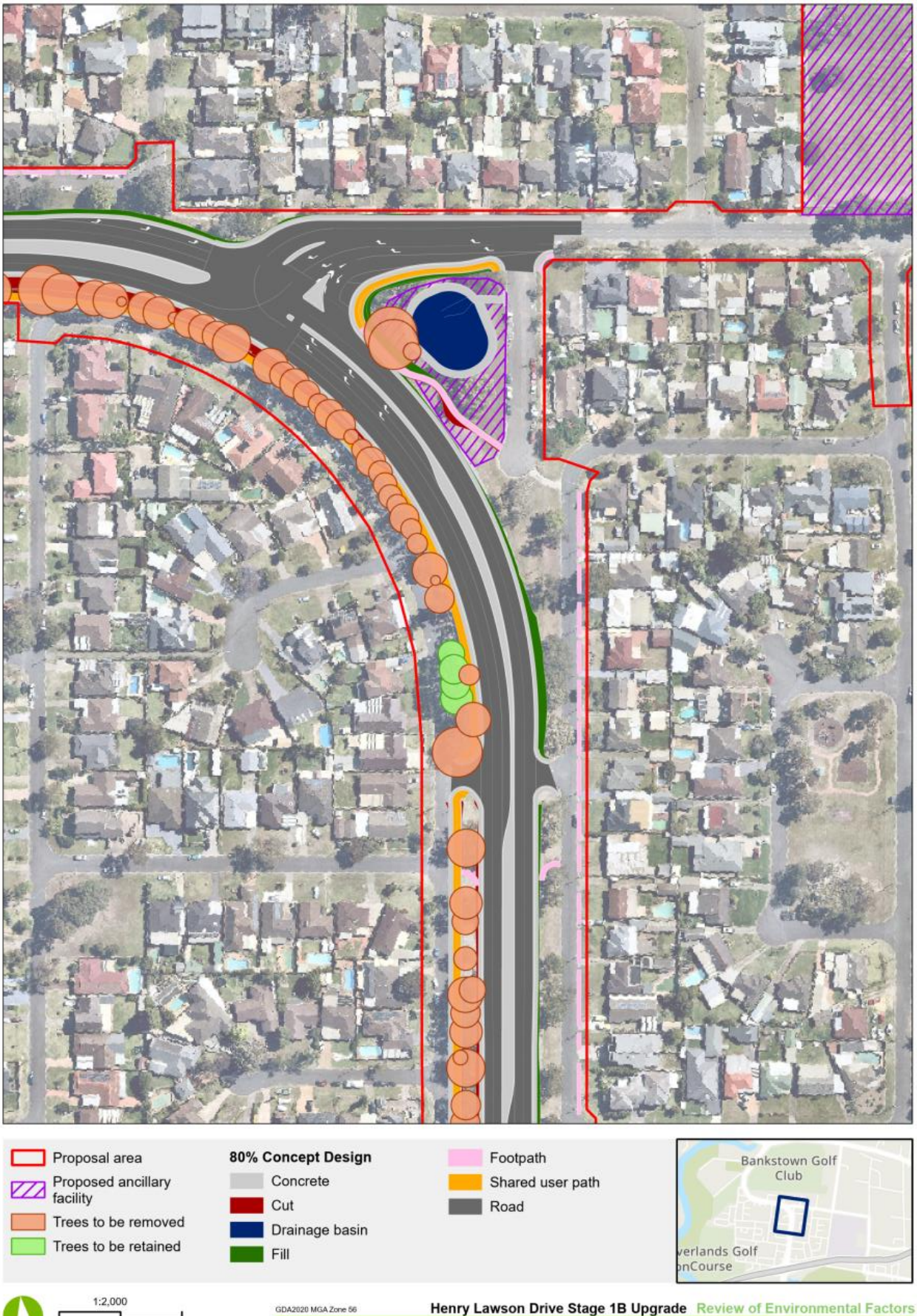


Figure 6-3c Tree impacts

Figure 6-3d Tree Impacts

Operation

The operation of the proposal is not anticipated to impact trees within the proposal area. In line with AS4970, inspections would be conducted by the proposal arborist after all major construction has ceased, following the removal of tree protection. This would be done in addition to inspections in the pre-construction and construction phases of the proposal. No further impacts to existing trees are anticipated during operation.

To minimise the long-term impacts of tree removal to the character of the area, a landscaping and replanting plan would be implemented in accordance with Safeguard V2. The landscaping and replanting plan would further develop the initial plan provided as part of the landscape character and visual impact assessment (refer to Appendix G). It would include:

- planting trees at regular intervals to reinstate the existing characteristic avenue treatment parallel to Henry Lawson Drive
- planting feature trees, shrubs and ground cover planting to provide visual interest and a sense of place
- introducing varied plant species combinations to soften hard elements within the corridor.

Further details are provided in Section 6.5.

In addition, the impacts of the proposal to vegetation and threatened species habitat would be offset in line with Transport's Biodiversity Policy (Transport, 2022c), including consideration of no net loss to biodiversity and tree and hollow replacement. Refer to Section 6.6.5 and Safeguard B5 and B6 in section 7.2 for further details on the proposal's biodiversity offsets.

6.1.4 Safeguards and management measures

Table 6-1 provides a list of environmental safeguards that should be applied during the proposal in response to the listed construction and operation impacts. It should be noted that further assessment would be carried out during detailed design to identify options for tree retention during construction.

Table 6-1 Arboriculture safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
Tree removal	During detailed design, opportunities to reduce the number of trees impacted by the proposal will continue to be explored. Where possible, consideration will be given to refining the proposal's alignment and shared path design options to avoid or minimise impact on root zones.	Transport	Detailed design
TPZ Encroachment	Where minor encroachment with the TPZ occurs, the following measures would be implemented: • the area lost to this encroachment would be compensated for elsewhere near the TPZ • tree protection would be installed. For any works within the TPZ of protected trees, the proposal arborist must be present. Where major encroachment with the TPZ occurs, the following measures would be implemented: • the proposal arborist must demonstrate that the tree(s) would remain viable • root investigations by non-destructive methods may be required for any trees proposed to be retained • the area lost to this encroachment would be compensated for elsewhere near the TPZ • the proposal arborist would be required to supervise any work within the TPZ	Contractor	Pre-construction / construction

Impact	Environmental safeguards	Responsibility	Timing
	• tree protection would be installed.		
Tree removal, pruning and excavation impacts	All tree removal and pruning work is to be carried out by an arborist with a minimum AQF Level 3 qualification in Arboriculture, in line with Australian Standard AS4373-2007, Pruning of Amenity Trees (AS4373), the Work Health and Safety Act 2011, and Work Health and Safety Regulations 2017. The proposal arborist must supervise and certify that all excavations and root pruning are in line with AS4373 and AS4970. All excavations (including root investigations) within the TPZ must be carried out using tree-sensitive methods and be supervised by the proposal arborist.	Contractor	Pre-construction
Construction clearance impacts on trees	Minor vegetation trimming may be required to accommodate construction clearances. Vegetation trimming would follow the following guidelines: • pruning must not exceed 10 per cent of the overall canopy volume • no limbs greater than 100 millimetres in diameter are to be removed • the final pruning cut shall be at the branch collar or growth point in line with AS4373.	Contractor	Pre-construction
Tree protection fencing	Where tree protection is required, tree protection fencing must follow the following guidelines: • temporary mesh panel fencing (minimum height of 1.8 metres) • installed prior to site set up and remain intact until the completion of the proposal • protective fencing must not be removed or altered without the approval of the proposal arborist • prominently signposted with 300 millimetre by 450 millimetre boards stating, “NO ACCESS – TREE PROTECTION ZONE.” • certified and inspected by the proposal arborist. If tree protection fencing is not practical due to site constraints, tree protection delineation must be installed as an alternative. Specifications for tree protection barriers are as follows: • star pickets spaced at 2 metre intervals • connected by a continuous high-visibility barrier/hazard mesh or flagging rope • maintained at a minimum height of 1 metre. Another alternative where tree protection fencing is not practical would be trunk protection. Specifications for trunk protection are as follows: • a thick layer of carpet underfelt, geotextile fabric, or similar wrapped around the trunk to a minimum height of 2 metres • 1.8 metre lengths of softwood timbers aligned vertically and spaced evenly around the trunk	Contractor	Pre-construction

Impact	Environmental safeguards	Responsibility	Timing
	(with a small gap of around 50 millimetres between the timbers) • the timbers must be secured using galvanised hoop strap (aluminium strapping).		
Restricted activities in the TPZ	Activities not allowed in the TPZ (unless otherwise approved under the development consent) include: • machine excavation and trenching • ripping or cultivation of the soil • storage of building materials, waste, and waste receptacles • disposal of waste materials and chemicals including paint, solvents, cement slurry, fuel, oil, and other toxic liquids • movement and storage of plant, equipment, and vehicles • soil level changes, including the placement of fill material • mechanical removal of vegetation • affixing of signage or hoardings to trees • other physical damage to the trunk or root system • any other activity that is likely to cause damage to the tree.	Contractor	Pre-construction / Construction
Root and ground impacts	If temporary access for vehicle, plant or machinery is required within the TPZ, ground protection should be installed. Where possible, areas of the existing pavement should be used as ground protection. The area within the TPZ should be mulched during construction (where practical) with good-quality composted wood chip/leaf mulch and should be maintained at a depth of 150 millimetres to 200 millimetres. Mulching around the base of the tree would provide nutrients and organic matter to the soil as it breaks down, improving and maintaining the overall health of the trees.	Contractor	Pre-construction / construction
Demolition	The demolition of all existing structures inside or directly next to the TPZ of trees to be retained must be carried out in consultation with the proposal arborist. Any machinery is to work from inside the footprint of the existing structures or outside the TPZ, to minimise soil disturbance and compaction. If it is not feasible to locate demolition machinery outside the TPZ of trees to be retained, ground protection would be required. The demolition should be carried out inwards into the footprint of the existing structures, sometimes referred to as the 'top-down, pull back' method.	Contractor	Construction
Underground services	Where possible, the re-location of services underground should be carried out outside of the TPZ of trees. If underground services need to be installed within the TPZ, they must be installed using tree-sensitive excavation methods under the supervision of the proposal arborist. Boring methods such as horizontal directional drilling may be used for underground service installation, provided the installation is at a minimum	Contractor	Construction

Impact	Environmental safeguards	Responsibility	Timing
	depth of 800 millimetres below grade. Excavations for entry/exit pits must be located outside the TPZ. Any conflicting roots greater than 50 millimetres in diameter identified during the relocation of underground services shall be pruned using clean, sharp secateurs or a pruning saw to ensure a clean cut, free from tears. All root pruning (greater than 50 millimetres) must be documented and carried out by the proposal arborist.		
Ongoing impacts	Site inspections would be carried out by the proposal arborist around every 12 weeks during the construction phase. A final site inspection would also be carried out by the proposal arborist after all major construction has ceased, following the removal of tree protection.	Contractor	Construction

6.2 Traffic and transport

A traffic and transport assessment was carried out by Aurecon (2023) for the proposal and is provided in Appendix D – Traffic and Transport Impact Assessment. The existing and proposed traffic conditions on Henry Lawson Drive and surrounding roads are summarised in this section.

6.2.1 Methodology

The methodology for the traffic and transport assessment consisted of:

- reviewing the existing and future conditions of the transport network within and surrounding the proposal using publicly available information as well as data that had been previously collected for the proposal
- preparing a microsimulation traffic model for the concept design of the proposal using AIMSUN 20.0.3 software from TSS (Transport Simulation Systems)
- modelling the traffic performance of the concept design for several scenarios within the proposal area
- assessing the impacts of the proposal on traffic and transport performance during construction and operational stages
- recommending management measures to minimise potential traffic or transport impacts from the proposal.

Traffic modelling adopted a traffic model study area, which included the following roads:

- Henry Lawson Drive between the Hume Highway and the M5 Motorway
- Milperra Road/Newbridge Road between Ashford Avenue and Riverside Road
- Ashford Avenue between Milperra Road and Bullecourt Avenue
- Bullecourt Avenue between Henry Lawson Drive and Ashford Avenue
- the M5 Motorway on and off ramps near Henry Lawson Drive.

The traffic modelling assessed the impacts of the proposal on intersections and the local road network in the proposal area.

Detailed modelling method

AIMSUN microsimulation was carried out to assess the intersection performance at peak hours and on weekends through the proposal area.

The base case traffic model for the proposal was 2022 traffic conditions for the two-hour AM peak period (7:45AM – 9:45AM), PM peak period (3:30PM – 5:30PM) and weekend (Saturday) peak period (11:30AM – 1:30PM). This model was calibrated and validated using traffic surveys carried out for this proposal in 2022 and for Henry Lawson Drive Upgrade Stage 1A in 2018.

In addition, a Strategic Traffic Forecasting Model (STFM) was developed to compare the expected traffic conditions with and without the proposal under forecast traffic volumes. Future year models were developed for the proposal for the following assessment scenarios:

- 2031 AM, PM and Weekend peak period without the proposal
- 2031 AM, PM and Weekend peak period with the proposal
- 2041 AM, PM and Weekend peak period without the proposal
- 2041 AM, PM and Weekend peak period with the proposal

The future year models for 2031 (opening year) and 2041 (ten years after opening) were developed for the future AM, PM and weekend peaks by adding the predicted traffic growth to the existing 2022 calibrated demand volumes.

Level of service criteria for intersections

Intersection performance is evaluated by assessing the intersection turning volumes, vehicle delays and level of service (LOS). LOS is a measure used to determine the effectiveness of intersection operation and is commonly used to analyse intersections by categorising traffic flow conditions. For a signalised intersection, the LOS criteria are related to the average intersection delay measured in seconds per vehicle. Table 6-2 shows Transport's standard LOS criteria for intersection operation.

Table 6-2 Level of service criteria for intersections

Level of service	Average delay per vehicle (seconds per vehicle)	Traffic signals, roundabout
A	<14	Good operation
B	15 to 28	Good with acceptable delays and spare capacity
C	29 to 42	Satisfactory
D	43 to 56	Operating at near capacity
E	57 to 70	At capacity; at signals, incidents would cause excessive delays. Roundabouts require other control measures
F	>70	Unsatisfactory with excessive queueing

6.2.2 Existing environment

Key roads

The proposal area and surrounding network includes several key roads, which are described in the following sections, including:

- State roads – Milperra Road, Henry Lawson Drive, Newbridge Road, M5 Motorway
- Regional roads – Haig Avenue, Ashford Avenue, Bullecourt Avenue
- Local roads – Tower Road, Rabaul Road, Auld Avenue, Raleigh Road, Ruthven Avenue, Whittle Avenue, Amiens Avenue, Ganmain Crescent, Fromelles Avenue, Hermies Avenue, Pozieres Avenue.

Key intersections

Table 6-3 summarises the key intersections of the proposal area and their current features.

Table 6-3 Key intersections within the proposal area

Intersection	Key features - existing
Henry Lawson Drive / Auld Avenue	• Priority T-intersection with one lane approach/exit on all legs, except for the Henry Lawson Drive northbound exit lane which expands to two lanes after the intersection. • All turning movements are permitted. Auld Avenue eastbound onto Henry Lawson Drive is controlled by a give way sign. • This intersection would be converted into a left-in left-out intersection as part of the Henry Lawson Drive Upgrade Stage 1A project. However, this would only occur once alternate access (via the new link road between Auld Avenue and Keys Parade) is provided as part of this proposal.
Henry Lawson Drive / Keys Parade	• Signalised T intersection for access to/from the Flower Power complex and Henry Lawson Drive. • Access to the Flower Power complex from the Henry Lawson Drive northbound carriageway is via a right turn short lane. Access from the southbound carriageway is via a protected short left turn slip lane, with left turn permitted on a red signal.

Intersection	Key features - existing
	• Access from the Flower Power complex to Henry Lawson Drive northbound is via dedicated right turn lane. Access to the southbound carriageway is via a protected left turn slip lane. • Note that the western leg would be constructed by the Riverlands developer prior to the proposal being constructed.
Henry Lawson Drive / Raleigh Road	• Priority T-intersection with one lane approach/exit on the eastbound carriageway (Raleigh Road). The Henry Lawson Drive northbound approach features a through full-length lane and left turn short lane, and two exit lanes merging to one after 35 metres. The Henry Lawson Drive southbound approach features a through full-length lane and right turn short lane, and a one lane exit. • All turning movements are permitted. Raleigh Road westbound onto Henry Lawson Drive is controlled by give way sign.
Henry Lawson Drive / Ruthven Avenue	• Priority T-intersection with one lane approach/exit on all legs. • All turning movements are permitted. Ruthven Avenue onto Henry Lawson Drive is controlled by a give way sign.
Henry Lawson Drive / Whittle Avenue	• Priority T-intersection with one lane approach/exit on all legs, except for the Henry Lawson Drive southbound exit lane which expands to two lanes after the intersection. • All turning movements are permitted. Whittle Avenue onto Henry Lawson Drive is controlled by a stop sign.
Henry Lawson Drive / Amiens Avenue	• Priority T-intersection with one lane approach/exit on all legs, except for the Henry Lawson Drive southbound exit which has two lanes. • All turning movements are permitted. Amiens Avenue onto Henry Lawson Drive is controlled by a give way sign.
Henry Lawson Drive / Bullecourt Avenue	• Signalised T-intersection. • Access to Bullecourt Avenue from the Henry Lawson Drive northbound carriageway is via a right turn short lane. Access from the southbound carriageway is via a left full-length lane. • Access from Bullecourt Avenue to Henry Lawson Drive is via full length (100 metre) dedicated left and right turn lanes.
Henry Lawson Drive / Ganmain Crescent / Fromelles Avenue	• Priority four-way intersection with one lane approach/exit on all legs. • All turning movements are permitted. Ganmain Crescent and Fromelles Avenue onto Henry Lawson Drive are controlled by give way signs.
Henry Lawson Drive / Hermies Avenue	• Priority T-intersection with one lane approach/exit on the westbound carriageway (Hermies Avenue). The Henry Lawson Drive northbound approach features a through full-length lane and shared through-right full-length lane, and two exit lanes. The Henry Lawson Drive southbound approach features a through-left full-length lane and a two-lane exit. • All turning movements are permitted. Hermies Avenue westbound onto Henry Lawson Drive is controlled by a give way sign.
Henry Lawson Drive / Pozieres Avenue	• Signalised T-Intersection. • Access to Pozieres Avenue from the Henry Lawson Drive northbound carriageway is via a through-left full-length lane. Access from the southbound carriageway is via a through-right full-length lane.

Intersection	Key features - existing
	• Access from Pozieres Avenue to Henry Lawson Drive is via full length (50 metre) dedicated left and right turn lanes.

The traffic performance of key intersections within the proposal area for the 2022 peak periods have been analysed. Table 6-4 presents a LOS summary of these key intersections during the weekday AM and PM peak period. Although not part of the proposal area, the Henry Lawson Drive / Milperra Road intersection has been included given it is a major nearby intersection to the north of the proposal area.

Most intersections within the proposal area perform at a good level according to the LOS criteria. The Henry Lawson Drive / Bullecourt Avenue intersection during the PM peak period is the only intersection not operating at an acceptable level of service during the weekday peak periods. During the first PM peak hour (3:30PM – 4:30PM), the intersection operates at near capacity (LOS D) and during the second peak hour (4:30PM – 5:30PM), the intersection operates satisfactorily (LOS C). This is caused by high demand on Bullecourt Avenue for vehicles turning into Henry Lawson Drive, resulting in congestion on Bullecourt Avenue leading up to the intersection. The Henry Lawson Drive / Milperra Road intersection also operates below an acceptable level of service, however this intersection is outside of the proposal area.

Table 6-4 Existing traffic intersection performance

Intersection	AM peak 7:45-8:45	AM peak 8:45-9:45	PM peak 3:30-4:30	PM peak 4:30-5:30
	LOS	LOS	LOS	LOS
Henry Lawson Drive / Milperra Road	F	F	F	F
Henry Lawson Drive / Auld Avenue	A	A	A	A
Henry Lawson Drive / Keys Parade	A	B	A	B
Henry Lawson Drive / Raleigh Road	A	A	A	A
Henry Lawson Drive / Ruthven Avenue	A	A	A	A
Henry Lawson Drive / Whittle Avenue	A	A	A	A
Henry Lawson Drive / Amiens Avenue	A	A	A	A
Henry Lawson Drive / Bullecourt Avenue	B	B	D	C
Henry Lawson Drive / Fromelles Avenue	A	A	A	A
Henry Lawson Drive / Hermies Avenue	A	A	A	A
Henry Lawson Drive / Pozieres Avenue	B	B	A	A

For the weekend peak period, the intersections within the proposal area perform at a good level according to the LOS criteria. This is presented in Table 6-5.

Table 6-5 Weekend peak intersection LOS summary

Intersection	11:30AM – 12:30PM	12:30PM – 1:30PM
	LOS	LOS
Henry Lawson Drive / Milperra Road	D	F
Henry Lawson Drive / Auld Avenue	A	A
Henry Lawson Drive / Keys Parade	B	B
Henry Lawson Drive / Raleigh Road	A	A
Henry Lawson Drive / Ruthven Avenue	A	A
Henry Lawson Drive / Whittle Avenue	A	A
Henry Lawson Drive / Amiens Avenue	A	A
Henry Lawson Drive / Bullecourt Avenue	B	B
Henry Lawson Drive / Fromelles Avenue	A	A
Henry Lawson Drive / Hermies Avenue	A	A
Henry Lawson Drive / Pozieres Avenue	A	A

Existing traffic volumes

The existing traffic volumes per hour along Henry Lawson Drive during peak hours are outlined in Table 6-6.

Table 6-6 Existing traffic volumes per hour on Henry Lawson Drive

Peak period (one hour)	Existing traffic volume per hour
AM peak	Up to about 2200
PM peak	Up to about 2300
Weekend peak	Up to about 2100

Heavy vehicle numbers

Henry Lawson Drive is an important route for freight and industrial type business operations that connects the surrounding large industrial areas of Milperra, Revesby, Chipping Norton and Moorebank, which are made up of warehouses, manufacturing, storage and logistics businesses. As a result, a range of vehicles including heavy vehicles travel throughout the local road network. Table 6-7 shows the estimated heavy vehicle volumes along different sections of Henry Lawson Drive for a typical weekday during the AM, PM and weekend peaks based on traffic survey data collected in 2022. The proportion of heavy vehicles during peak periods along Henry Lawson Drive is high compared to the average of four per cent across Greater Sydney.

Table 6-7 Average weekday estimated heavy vehicle volumes – combined directions

Henry Lawson Drive section	7:45AM – 9:45AM		3:30PM – 5:30PM		11:30AM – 1:30PM	
	Volume	Proportion (per cent)	Volume	Proportion (per cent)	Volume	Proportion (per cent)
Henry Lawson Drive between Milperra Road and Bullecourt Avenue	516	13	342	8	341	12
Henry Lawson Drive between Bullecourt Avenue and M5 Motorway	632	16	412	10	441	14

The modelled demand of heavy vehicles along Henry Lawson Drive during the weekday AM and PM peak periods is lower than the volumes included in Table 6-7. This is due to congestion at the Milperra Road / Henry Lawson Drive intersection, which limits traffic entering Henry Lawson Drive from Milperra Road in both the northbound and southbound directions during the model simulation period. The number of vehicles, including heavy vehicles, that were unable to enter the network due to queues extending beyond the Milperra Road area is up to 883 vehicles (around 97 heavy vehicles) in the weekday AM period and up to 1454 vehicles (around 117 heavy vehicles) in the weekday PM peak period. However, this issue does not exist in the weekend model, meaning heavy vehicle volumes during the weekend peaks are similar or higher than the weekday AM and PM peak periods.

Access and routes

Figure 6-4 shows the approved B-Double routes for vehicles up to 26 metres in length on the road network surrounding the proposal area, based on the Transport Restricted Access Vehicles map. This shows that the proposal area is well serviced by roads suitable for heavy vehicles, including Henry Lawson Drive, Newbridge Road, Milperra Road, Ashford Avenue and the M5 Motorway.

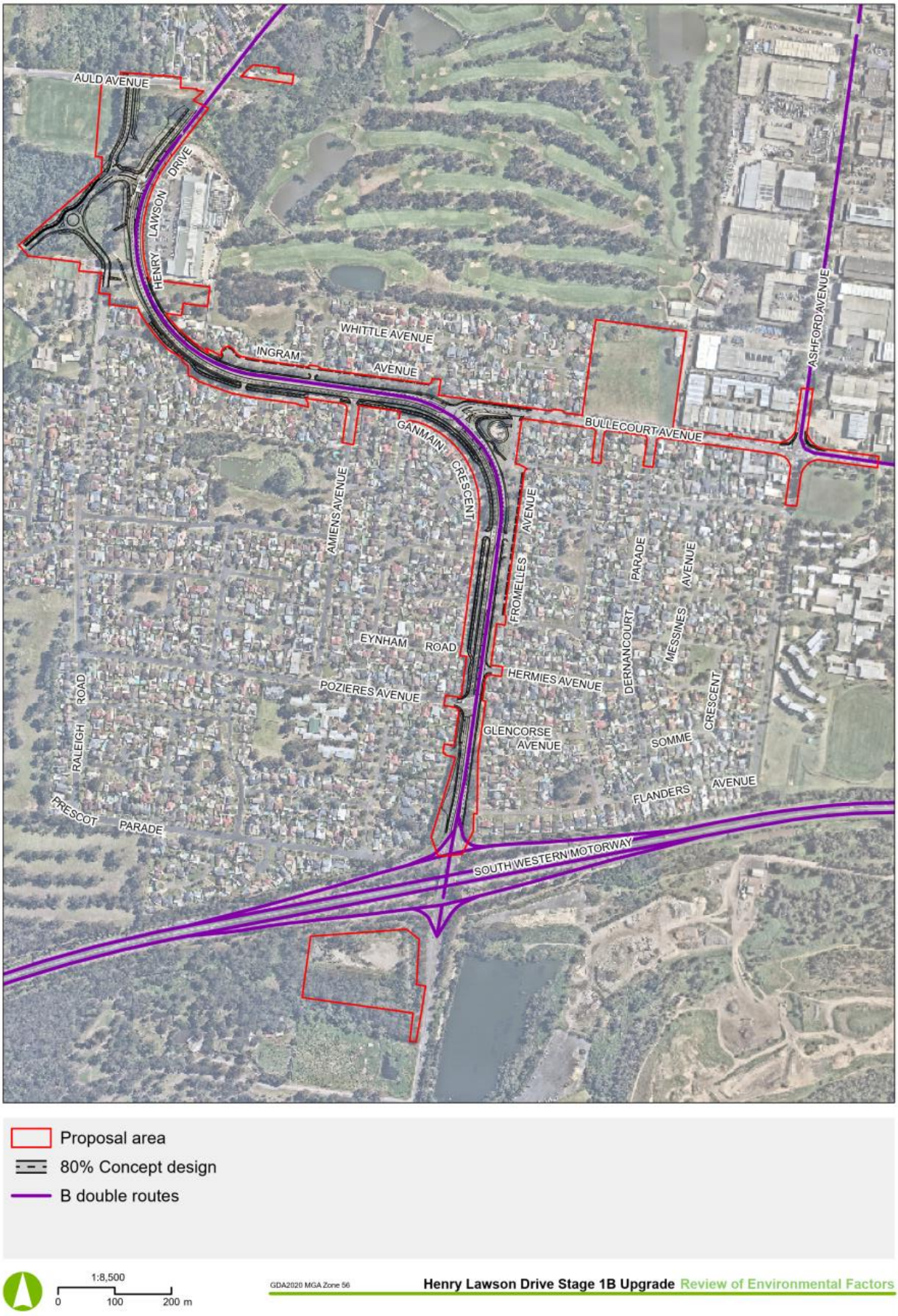


Figure 6-4 B-double routes

Crash data analysis

Crash data for the existing road corridor is summarised in section 2.2.2.

The crash history data shows an average of 28 crashes and 19 casualties per year within the proposal area. Rear end crashes make up the majority of crashes (37 per cent), which reflects the high number of intersections that require vehicles to queue in the through traffic lane on Henry Lawson Drive to turn into local roads. This is followed by crashes involving an 'other angle' first impact between two vehicles (i.e., not a head-on, right angle or rear end impact), which accounts for 31 per cent. Most crashes occur within 10 metres of an intersection (50 per cent).

Parking

There is no on-street parking along Henry Lawson Drive. On-street and dedicated parking is available along the local road network, including:

- On-street parking along Bullecourt Avenue between Henry Lawson Drive and Ashford Avenue, providing both for residential and commercial parking. There are no limitations on parking along Bullecourt Avenue.
- On-street parking along Raleigh Road, Ruthven Avenue, Ingram Avenue, Ganmain Crescent and Fromelles Avenue, providing parking for local residents. There are no limitations on parking along these local roads.
- Dedicated parking bays on Auld Avenue associated with the playing fields. These are marked car bays with no restrictions.
- A private car park at the Milperra Sports Centre off Raleigh Road.

Public transport

There is no rail network within the proposal area. The nearest train stations are Panania Station, about two kilometres to the southeast, East Hills Station, about four kilometres to the south, Revesby Station, about three kilometres to the southeast, and Holsworthy Station, about three kilometres to the southwest.

The proposal area is serviced by the following bus routes:

- 922 – Bankstown to East Hills
- 962 – East Hills to Miranda
- M90 – Burwood to Liverpool
- S120 – Beaconsfield Street after Marigold Street, Revesby to Georges River Grammar
- S129 – WSU Bankstown to Picnic Point High School
- S162 – WSU Bankstown to Mount St. Joseph Secondary School
- S163 – Mount St Joseph Secondary School to East Hills Girls Technology High School
- S510 – Delfin Drive at Collie Court, Moorebank to East Hills Boys High School
- S617 – Nuwarra Police Station to De La Salle College

Nearby transport routes to the proposal area are shown in Figure 6-5.

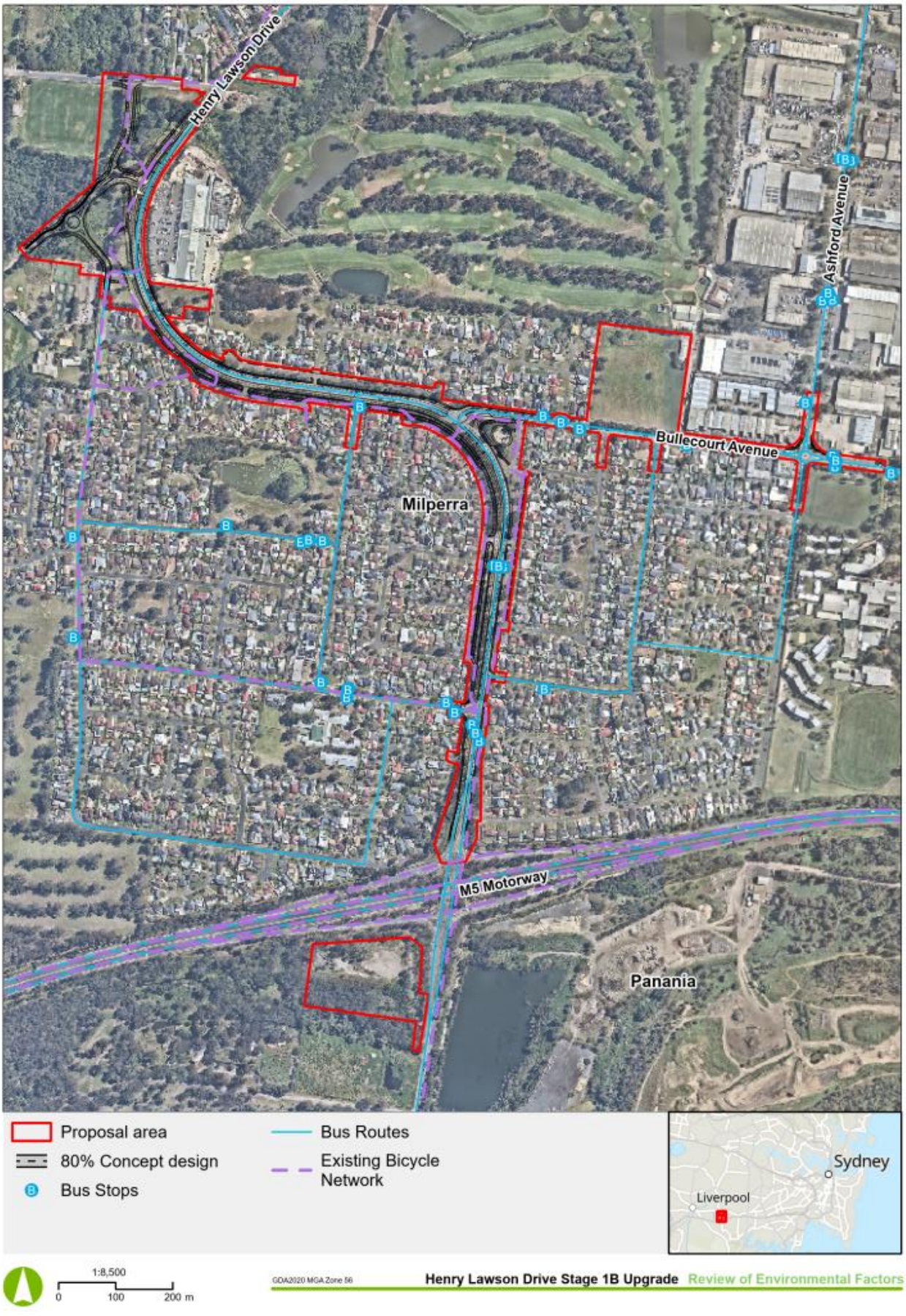


Figure 6-5 Nearby transport routes to the proposal

Active transport

There are existing footpaths and shared paths across the proposal area, including:

- an existing shared path along the eastern side of Henry Lawson Drive between the M5 Motorway and Pozieres Avenue
- a short section of footpath from Ganmain Crescent to the intersection at Pozieres Avenue
- sections of footpath along the western side of Henry Lawson Drive that connect the playing fields along Auld Avenue to local roads including Raleigh Road, Borella Road, Ruthven Avenue, Amiens Avenue and Ganmain Crescent
- a short section of footpath outside the Flower Power complex at the Keys Parade intersection
- shared paths that run through the reserves and playing fields around Raleigh Road to Auld Avenue
- existing paths that run along local roads within the proposal area.

Henry Lawson Drive does not have a continuous cycling path through the proposal area. There is an existing concrete shared path along the length of Henry Lawson Drive between the M5 Motorway and Pozieres Avenue, between the northern end of Ganmain Crescent and the eastern end of Ruthven Avenue, and between the western end of Ruthven Avenue and Keys Parade. Cyclists use the residential streets of Ganmain Crescent and Ruthven Avenue to access the cycling path.

6.2.3 Potential impacts

Construction

Construction traffic impacts

Construction of the proposal would generate light and heavy vehicle movements on the surrounding road network associated with the delivery or removal of construction materials and equipment and construction worker movements to and from the construction site. Construction traffic for delivery or removal of construction materials and equipment would generally be staged throughout the day. The construction workers would generally arrive and leave site at the start and end of each shift.

As noted in Table 3-9 in Section 3.3.7, it is estimated that construction traffic volumes would include 43 heavy vehicle movements, 54 light vehicle movements and 96 construction worker vehicle movements during the AM peak and 29 heavy vehicle movements, 36 light vehicle movements and 64 construction worker vehicle movements during the PM peak. During these same periods, the overall existing traffic volumes are about 4400 vehicles for the two hour AM peak period and about 4200 vehicles for the two hour PM peak period (refer to Table 6-6).

While the construction workforce traffic would likely be noticeable, the additional volume of vehicles would be relatively small compared to the existing traffic volumes of vehicles on Henry Lawson Drive. The construction site is well serviced by surrounding roads that can handle construction light and heavy vehicles. Where possible, local roads would not be used by heavy vehicles and limited to short sections of local roads required to access the construction zones.

Some roads would be used for construction vehicles to turn around, such as the roundabout at Bullecourt Avenue / Ashford Avenue intersection.

Any impact on the surrounding road network performance associated with construction traffic from the proposal is expected to be minor to moderate.

Impacts associated with site access

The construction and all associated works would result in temporary changes in road and property access, as well as pedestrian and cyclist access near the proposal.

The construction site would be appropriately fenced and traffic deflection barriers would be installed to avoid public vehicles accidentally accessing the site. While the roads would remain operational, there may be a need for temporary lane closures at times during the construction period. In addition, as sections of the upgrade are completed, traffic switches may occur to shift traffic onto new sections of the road to enable works on existing pavement to be completed. All impacts to the road network would be carried out in line with a Road Occupancy Licence (ROL) to be obtained from the Traffic Management Centre. Access for emergency vehicles would be maintained along affected roads.

There may be short periods of time where local roads may need to be closed or opened only for residents. These periods would, where possible, be carried out outside of peak traffic periods, especially on weekends where the playing fields are in use by community sports. Construction would be staged as outlined in Section 3.3.1 so access from the local roads to Henry Lawson Drive southbound are not affected concurrently. This would maintain access through the construction period and prior to the opening of the new link road between Auld Avenue and Keys Parade.

The construction contractor would confirm the need and duration of any road closures through notification of the community and in line with any required council road opening permit.

Access to properties would be maintained during construction, though it may need to be disturbed on a short-term basis. Landowners and occupiers would be consulted by the construction contractor about any potential impacts to access and methods to minimise these impacts. Consultation would be carried out well in advance of property accesses being impacted.

Impacts on parking

While there is no parking on Henry Lawson Drive, there may be temporary disruptions to parking on local roads within the proposal area during construction. Activities which may disrupt local road parking include:

- installation of the footpath on Ingram Avenue and Fromelles Avenue
- work on Auld Avenue, Raleigh Road and Bullecourt Avenue associated with upgrades to these roads
- work adjacent to Ruthven Avenue and Ganmain Crescent associated with the widening of Henry Lawson Drive, installation of a shared path and tie-ins to local roads.

In addition, during construction, up to eight parking spaces on Auld Avenue near the Auld Avenue link road would be removed to allow construction of the link road to tie-in with Auld Avenue.

To minimise impacts of parking disruptions to the community, off-road parking for construction vehicles would be provided within the proposal's ancillary facilities. In addition, a Traffic Management Plan would be developed and implemented during construction. This would include requirements to consult with and inform the community of impacts to the local road network, including disruptions to parking, and implement traffic control measures to manage these impacts.

Impacts on public transport

Access to public transport would be maintained around the construction site during construction. There are seven bus stops within the construction area. These would be temporarily relocated to safe locations to allow for continued access. During the construction of the proposal, the impacts on buses and passengers would potentially include:

- longer travel times when travelling through construction areas from speed reductions and additional construction vehicles
- temporary relocation of bus stops away from construction zones. Passengers may be required to walk further to relocated bus stops.

Any change to bus stops in the proposal area would be confirmed by the construction contractor and would be discussed with the bus operator.

Impacts on active transport

Detours for pedestrian and cyclist access would be implemented within the proposal area. In particular, the following routes may be affected:

- existing shared path between the M5 Motorway and Pozieres Avenue
- existing shared path (running alongside Henry Lawson Drive) between Ruthven Avenue and Keys Parade.

The above routes lie within the zone of road widening works and would be temporarily removed as part of construction. Pedestrian and cyclist access would be detoured, and alternative arrangements managed through signage and wayfinding.

Operation

Weekday intersection performance

Table 6-8 to Table 6-11 summarise the LOS results for the weekday 2031 and 2041 'without proposal' and 'with proposal' scenarios for intersections in the proposal area. Except for the Milperra Road intersection, these intersections were found to be performing at a good level but with acceptable delays and spare capacity, or

below, under existing conditions in section 6.2.2. Other intersections detailed in section 6.2.2 would become left-in left-out as a result of the proposal, meaning the existing conditions would not carry through to the 2031 and 2041 scenarios.

For the 2031 AM peak period, intersection LOS at Keys Parade and Bullecourt Avenue have similar results for the 'without proposal' and 'with proposal' scenarios. This is because a large proportion of vehicles who would use Milperra Road to reach Bullecourt Avenue without proposal would reroute to use Henry Lawson Drive in the 'with proposal' scenario.

For the 2041 AM peak period, in the 'with proposal' scenario, the Bullecourt Avenue intersection would operate at LOS C in the first hour and deteriorate to LOS F in the second hour. This is because the right turn traffic movement from the Henry Lawson Drive northbound carriageway onto Bullecourt Avenue queues back due to capacity constraints along Bullecourt Avenue between Henry Lawson Drive and Ashford Avenue. Demand at this intersection would be increased as vehicles would use Henry Lawson Drive rather than Ashford Avenue to reach Bullecourt Avenue during the 'with proposal' scenario. There would also be additional demand from northbound vehicles on Henry Lawson Drive wishing to access the local road network as right turn movements into local roads would be removed as part of the proposal. The Pozieres Avenue intersection would deteriorate from LOS B in the first hour to LOS F in the second hour with the proposal due to traffic congestion queuing back from the Bullecourt Avenue intersection. Without the proposal, Bullecourt Avenue would be less constrained because more vehicles would use Ashford Avenue to reach Bullecourt Avenue.

In general, 2041 AM results show that the delays would increase, which would impact the LOS in comparison to 2031 AM given the increase in traffic volumes between 2031 and 2041.

For the 2031 PM peak period, the Bullecourt Avenue intersection would perform at LOS B due to the increased capacity along Henry Lawson Drive as a result of the proposal compared to LOS C during the first hour, deteriorating to LOS F in the second hour without the proposal.

The Pozieres Avenue intersection would perform LOS A with the proposal, compared to LOS B in the first hour and LOS F in the second hour in the 'without proposal' scenario. The improvement in performance is due to the increased capacity and dedicated right turn southbound lane along Henry Lawson Drive as a result of the proposal.

For the 2041 PM peak period, with the proposal, the Bullecourt and Pozieres Avenue intersections LOS would improve in both peak hours compared to without the proposal. The Keys Parade intersection LOS would improve in the first peak hour. However, the results suggest that increasing delays would impact the LOS at these intersections in comparison to the 2031 PM peak period.

For both 2031 and 2041 scenarios, the results suggest overall better performance for the 'with proposal' scenario in comparison to the 'without proposal' scenario in the PM peak period.

Table 6-8 LOS results for 'without proposal' 2031 scenario (weekday)

Intersection	AM peak 7:45-8:45	AM peak 8:45-9:45	PM peak 3:30-4:30	PM peak 4:30-5:30
	LOS	LOS	LOS	LOS
Henry Lawson Drive / Milperra Road	F	F	F	F
Henry Lawson Drive / Keys Parade	C	C	C	D
Henry Lawson Drive / Bullecourt Avenue	C	D	C	F
Henry Lawson Drive / Pozieres Avenue	B	C	B	F

Table 6-9 LOS results for 'with proposal' 2031 scenario (weekday)

Intersection	AM peak 7:45-8:45	AM peak 8:45-9:45	PM peak 3:30-4:30	PM peak 4:30-5:30
	LOS	LOS	LOS	LOS
Henry Lawson Drive / Milperra Road	F	F	F	F
Henry Lawson Drive / Keys Parade	C	C	B	D
Henry Lawson Drive / Bullecourt Avenue	B	D	B	B
Henry Lawson Drive / Pozieres Avenue	B	B	A	A

Table 6-10 LOS results for 'without proposal' 2041 scenario (weekday)

Intersection	AM peak 7:45-8:45	AM peak 8:45-9:45	PM peak 3:30-4:30	PM peak 4:30-5:30
	LOS	LOS	LOS	LOS
Henry Lawson Drive / Milperra Road	F	F	F	F
Henry Lawson Drive / Keys Parade	B	D	C	D
Henry Lawson Drive / Bullecourt Avenue	C	D	C	E
Henry Lawson Drive / Pozieres Avenue	C	D	D	F

Table 6-11 LOS results for 'with proposal' 2041 scenario (weekday)

Intersection	AM peak 7:45-8:45	AM peak 8:45-9:45	PM peak 3:30-4:30	PM peak 4:30-5:30
	LOS	LOS	LOS	LOS
Henry Lawson Drive / Milperra Road	F	F	F	F
Henry Lawson Drive / Keys Parade	D	C	B	F
Henry Lawson Drive / Bullecourt Avenue	C	F	B	C
Henry Lawson Drive / Pozieres Avenue	B	F	B	B

Weekend intersection performance

Table 6-12 to Table 6-15 summarises the LOS results for the weekend 2031 and 2041 'without proposal' and 'with proposal' scenarios for intersections in the proposal area.

The Milperra Road intersection would perform at LOS F in all modelled scenarios, apart from the 2031 'without proposal' scenario (first hour) and the 2031 'with proposal' scenario, where would improve to LOS E.

Analysis of 2031 weekend peak modelling results for other intersections in the proposal area shows that:

- the Keys Parade intersection would perform at LOS B in the 'without proposal' scenario and LOS C in the 'with proposal' scenario due to an increase in traffic
- the Bullecourt Avenue intersection would perform at LOS B in all scenarios and time periods
- the Pozieres Avenue intersection is expected to operate at LOS A in all scenarios and time periods.

In 2041 weekend for the 'without proposal' and 'with proposal' scenario, the overall LOS would not differ from the 2031 modelled values for Keys Parade, Bullecourt Avenue or Pozieres Avenue.

Table 6-12 LOS results for 'without proposal' 2031 scenario (weekend)

Intersection	Weekend peak 11:30-12:30	Weekend peak 12:30-1:30
	LOS	LOS
Henry Lawson Drive / Milperra Road	E	F
Henry Lawson Drive / Keys Parade	B	B
Henry Lawson Drive / Bullecourt Avenue	B	B
Henry Lawson Drive / Pozieres Avenue	A	A

Table 6-13 LOS results for 'with proposal' 2031 scenario (weekend)

Intersection	Weekend peak 11:30-12:30	Weekend peak 12:30-1:30
	LOS	LOS
Henry Lawson Drive / Milperra Road	E	E
Henry Lawson Drive / Keys Parade	C	C
Henry Lawson Drive / Bullecourt Avenue	B	B
Henry Lawson Drive / Pozieres Avenue	A	A

Table 6-14 LOS results for 'without proposal' 2041 scenario (weekend)

Intersection	Weekend peak 11:30-12:30	Weekend peak 12:30-1:30
	LOS	LOS
Henry Lawson Drive / Milperra Road	F	F
Henry Lawson Drive / Keys Parade	B	B
Henry Lawson Drive / Bullecourt Avenue	B	B
Henry Lawson Drive / Pozieres Avenue	A	A

Table 6-15 LOS results for 'with proposal' 2041 scenario (weekend)

Intersection	Weekend peak 11:30-12:30	Weekend peak 12:30-1:30
	LOS	LOS
Henry Lawson Drive / Milperra Road	F	F
Henry Lawson Drive / Keys Parade	C	C
Henry Lawson Drive / Bullecourt Avenue	B	B
Henry Lawson Drive / Pozieres Avenue	A	A

Travel time

Future travel times along Henry Lawson Drive for the 'with proposal' scenario have been assessed against the 'without proposal' scenario for the years 2031 and 2041 for the AM, PM and weekend peaks.

For the weekday AM period, the northbound and southbound travel times along Henry Lawson Drive for each modelled scenario are presented in Table 6-16.

During the AM peak in 2031, the average northbound travel time along Henry Lawson Drive is likely to decrease by about one minute for the 'with proposal' scenario compared to the 'without proposal' scenario. The difference in average southbound travel times along Henry Lawson Drive for both scenarios is likely to be negligible (seven seconds difference).

In 2041, there would be an increase in travel times in the northbound direction in the 'with proposal' scenario compared to the 'without proposal' scenario, with the opposite result in the southbound direction. This is due to queue spill back at the Henry Lawson Drive / Bullecourt Avenue intersection.

Table 6-16 Modelled weekday AM peak travel times

Direction	Existing	2031		2041	
		Without proposal	With proposal	Without proposal	With proposal
7:45AM – 8:45AM					
Northbound	04:03	05:54	04:23	06:29	08:10
Southbound	04:26	04:35	04:33	04:37	04:32
8:45AM – 9:45AM					
Northbound	05:38	07:08	06:50	09:45	08:35
Southbound	04:22	04:48	04:37	05:20	04:35
Average					
Northbound	04:51	06:31	05:37	08:07	08:23
Southbound	04:24	04:42	04:35	04:59	04:33

For the weekday PM peak, the northbound and southbound travel times along the Henry Lawson Drive corridor for each of the modelled scenarios are presented in Table 6-17.

During PM peak periods, Henry Lawson Drive average northbound travel time is expected to decrease by more than three minutes in 2031 and by about three minutes in 2041 in the 'with proposal' scenario compared to the 'without proposal' scenario. This is due to there being higher demand for northbound traffic in 2041. The average southbound travel time along Henry Lawson Drive is expected to decrease by about 30 seconds in the 'with proposal' scenario compared to the 'without proposal' scenario in both 2031 and 2041. The network would be able to accommodate southbound demand in both 2031 and 2041.

Table 6-17 Modelled weekday PM peak travel times

Direction	Existing	2031		2041	
		Without proposal	With proposal	Without proposal	With proposal
3:30PM – 4:30PM					
Northbound	03:55	06:02	04:46	09:02	06:04
Southbound	04:26	04:10	03:43	04:18	03:44
4:30PM – 5:30PM					
Northbound	03:54	14:22	08:47	16:30	13:29
Southbound	04:23	04:07	03:41	03:58	03:42
Average					
Northbound	03:54	10:12	06:47	12:46	09:47
Southbound	04:24	04:09	03:42	04:08	03:43

For the weekend peak period, the northbound and southbound travel times along the Henry Lawson Drive corridor for each modelled scenario is presented in Table 6-18.

In the absence of available weekend travel time data and for the purpose of comparison, AM travel time data was used for the existing scenario. This adopts the worst-case existing travel time, which is expected to be a conservative estimate of existing travel time for the weekend peak hours.

During the weekend peak in 2031, the average northbound and southbound travel times along Henry Lawson Drive are likely to be similar in both the 'without proposal' and 'with proposal' scenarios ('with proposal' showing an improvement of about 10 seconds in either direction).

In 2041, the average northbound travel time is also expected to be about the same in both the 'with proposal' and the 'without proposal' scenarios. The average southbound travel times improve by about 20 seconds in the 'with proposal' scenario on average compared to the 'without proposal' scenario in 2041. This is due to the proposed network being able to accommodate weekend demand in 2041.

Table 6-18 Modelled weekend peak travel times

Direction	Existing	2031		2041	
		Without proposal	With proposal	Without proposal	With proposal
11:30AM – 12:30PM					
Northbound	04:03	03:57	03:41	03:59	03:49
Southbound	04:26	04:27	04:23	04:30	04:22
12:30PM – 1:30PM					
Northbound	05:38	04:06	04:07	04:01	04:03
Southbound	04:22	04:41	04:19	04:59	04:20
Average					
Northbound	04:51	04:02	03:54	04:00	03:56
Southbound	04:24	04:34	04:21	04:42	04:21

Impacts on local road access

The proposal would install a raised concrete median along Henry Lawson Drive within the proposal area which would convert the Henry Lawson Drive intersections with Ruthven Avenue, Whittle Avenue, Amiens Avenue, Ganmain Crescent, Fromelles Avenue and Hermies Avenue to be left-in left-out only. Local residents wishing to turn right from Henry Lawson Drive into these local roads would need to turn right at the signalised intersections of Keys Parade, Bullecourt Avenue or Pozieres Avenue to access the local road network. Local road detour routes are detailed in Table 6-19.

The Henry Lawson Drive / Hermies Avenue intersection would only permit left turning vehicles into the kerbside lane to travel south through the Pozieres Avenue intersection. Vehicles would not be permitted to cross traffic to turn right into Pozieres Avenue

The local link road between Auld Avenue and Keys Parade, extension of Raleigh Road to Keys Parade and roundabout at the Raleigh Road / Keys Parade intersection would provide new local road access routes to the southwest of Henry Lawson Drive to minimise disruption to motorists due to the local road access changes.

While there are a number of local road access routes that motorists could take due to left-in and left-out arrangements, the shortest new local access routes and additional travel distances are shown in Table 6-19, Figure 3-8a-b and Figure 3-9a-b.

Table 6-19 Operational detour routes

Left-in left-out intersection	Impacted right turn direction	Detour route	Estimated detour distance (metres)
Henry Lawson Drive / Ruthven Avenue	Southbound	• Right turn at the Henry Lawson Drive / Keys Parade intersection • Access to Raleigh Road and Ruthven Avenue	100
Henry Lawson Drive / Whittle Avenue	Northbound	• Right turn at the Henry Lawson Drive / Bullecourt Avenue intersection • Left turn at Keysor Place • Left turn to Whittle Avenue	250
Henry Lawson Drive / Amiens Avenue	Southbound	• Right turn at the Henry Lawson Drive / Keys Parade intersection • Access to Raleigh Road and Newland Avenue	1300
Henry Lawson Drive / Fromelles Avenue	Northbound	• Right turn at the Henry Lawson Drive / Bullecourt Avenue intersection • Right turn at Armentieres Avenue • Right turn to Fromelles Avenue	1000
Henry Lawson Drive / Ganmain Crescent	Southbound	• Right turn at the Henry Lawson Drive / Pozieres Avenue intersection and right turn at Amiens Avenue. Alternatively, access Amiens Avenue via Keys Parade (as per the Amiens Avenue access route) • From Amiens Avenue, use access via Joynt Avenue or Oakleigh Avenue to Eynham Road and/or Treadgold Street to Ganmain Crescent	750 - 900
Henry Lawson Drive / Hermies Avenue	Northbound	• Right turn at the Henry Lawson Drive / Bullecourt Avenue intersection • Right turn at Dernancourt Parade (or use Armentieres Avenue and Bapaume Place to access Dernancourt Parade) • Right turn onto Hermies Avenue	1300

Impacts on property access

During operation, the proposal would maintain access to all properties within the proposal area.

There are five residential properties within the proposal area with direct access to Henry Lawson Drive (497, 499, 503, 553 and 553A Henry Lawson Drive, Milperra). 497, 499 and 503 Henry Lawson Drive are located south of the Flower Power complex and 553 and 553A Henry Lawson Drive are located south of the Henry Lawson Drive / Hermies Avenue intersection.

For 497, 499 and 503 Henry Lawson Drive, due to the installation of a raised concrete median along Henry Lawson Drive, driveway access would be converted to left-in left-out only. Residents wishing to turn right into their properties from the northbound carriageway would need to use local road detours to access their properties. Local road detours for northbound vehicles would involve either:

- turning left at the Henry Lawson Drive / Keys Parade intersection and then using the roundabout to turn around and access the southbound carriageway of Henry Lawson Drive (about 850 metres additional driving distance)
- turning left at the Henry Lawson Drive / Ruthven Avenue intersection to travel to Raleigh Road, before turning onto Keys Parade to access the southbound carriageway of Henry Lawson Drive (about one kilometre additional driving distance).

Residents leaving these properties wishing to travel north along Henry Lawson Drive would need to detour via Whittle Avenue and Keysor Place to access the Henry Lawson Drive / Bullecourt Avenue intersection (about 1.6 kilometres additional driving distance).

There would also be adjustments to driveway connections for these properties within the existing road reserve owned by Transport.

For 553 and 553A Henry Lawson Drive, driveway access would also be converted to left-in left-out only. This would be due to the Henry Lawson Drive / Hermies Avenue intersection only permitting left turning vehicles into the kerbside lane to travel south through the Pozieres Avenue intersection. To access the northbound carriageway of Henry Lawson Drive, residents would need to turn around at either Bransgrove Road or Maxwell Avenue, Panania (about 750 metres south of their properties). For residents travelling northbound along Henry Lawson Drive, access to the properties would be via the Henry Lawson Drive / Bullecourt Avenue intersection. Vehicles would need to turn right at this intersection, then turn right into Dernancourt Parade before using Hermies Avenue to access the southbound carriageway of Henry Lawson Drive.

The proposal would require adjustments to driveway connections to local roads to the Milperra Sports Centre, at the BP Service Station (5 Bullecourt Avenue, Milperra) and at some residential properties next to road or footpath work on Ingram Avenue and Fromelles Avenue. These driveway connections would be within the existing road reserve owned by Canterbury Bankstown Council.

The shortest new access routes for these residents are shown in Figure 3-10. Landowners and occupiers would be consulted about any potential access impacts prior to and during construction.

Impacts on parking

To safely connect the Auld Avenue link road with Auld Avenue, up to eight parking spaces on Auld Avenue next to Gordon Parker Reserve would be permanently removed. This would reduce the number of parking spaces available to community members using the parklands during sport events and other busy periods. During detailed design, Transport would consider opportunities to minimise the number of parking spaces that need to be removed.

There would be no other changes to parking due to the proposal.

Impacts on public transport

The operation of the proposal would not result in any changes to existing public or school bus services. Most bus stops within the proposal area would be retained with like-for-like replacement of the existing bus stop (where relevant). However, the bus stop located on the Henry Lawson Drive northbound carriageway south of the Henry Lawson Drive / Pozieres Avenue intersection would be relocated about 25 metres north of Pozieres Avenue.

Impacts on active transport

There is a proposed 3-metre-wide concrete shared path along the western/southern side of Henry Lawson Drive between the M5 Motorway and Keys Parade. This would connect into the shared path across the new Milperra Drain bridge and along Henry Lawson Drive to connect into existing Council paths.

In addition, new footpaths would be constructed along Ingram Avenue and Fromelles Avenue to provide additional access for pedestrians along the corridor. This would tie into existing lengths of footpaths to the north and south along Henry Lawson Drive.

Operational road safety

While no dedicated road safety upgrades would be carried out as part of the proposal, the increased intersection capacity and smoother operation of the network in general is expected to substantially improve road safety. The proposal is expected to reduce the likelihood of head-on collisions due to the physical separation of the opposing carriageways. Rear end collisions are also expected to reduce due to limiting right turn movements to dedicated right turn lanes at intersections only.

In addition, the following intersection upgrades are expected to improve road safety:

- Henry Lawson Drive intersections with Auld Avenue, Ruthven Avenue, Whittle Avenue, Amiens Avenue, Ganmain Crescent, Fromelles Avenue and Hermies Avenue.
  - The conversion of intersections into left-in left-out would reduce the risk of vehicles turning into oncoming traffic
- Henry Lawson Drive / Bullecourt Avenue intersection
  - The provision of additional right turn bays would increase turn storage capacity and reduce the risk of road blockages and rear end collisions.
  - The conversion of the left turn exit lane from Bullecourt Avenue into a slip lane would improve the safety of that turn.
- Henry Lawson Drive / Pozieres Avenue intersection
  - The provision of right and left turn bays would increase turn storage capacity and reduce the risk of road blockages and rear end collisions.
  - The relocation of the Pozieres Avenue bus stop about 25 metres north from its current location would improve passenger embarkation and disembarkation and would improve traffic and pedestrian movements at the Henry Lawson Drive / Pozieres Avenue intersection.

6.2.4 Safeguards and management measures

Table 6-20 Traffic and transport safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
Traffic and transport	A Traffic Management Plan (TMP) would be prepared and implemented as part of the CEMP. The TMP would be prepared in line with the Transport *Traffic Control at Work Sites Manual* (RTA, 2010) and *QA Specification G10 Control of Traffic* (Transport for NSW, 2008). The TMP would include: • confirmation of haulage routes • swept path analysis of haulage vehicles using the Bullecourt Avenue / Ashford Avenue intersection • measures to maintain access to local roads and properties • site-specific traffic control measures (including signage) to manage and regulate traffic movement • measures to maintain pedestrian and cyclist access • requirements and methods to consult and inform the local community of impacts on the local road network, including disruptions to parking • access to construction sites including entry and exit locations and measures to prevent construction vehicles queuing on public roads. • a response plan for any construction traffic incident • 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 • monitoring, review, and amendment mechanisms.	Contractor	Pre-construction / construction

Impact	Environmental safeguards	Responsibility	Timing
Construction site access	Construction site access would be designed and implemented with consideration of: • road design guidelines and turning paths for heavy vehicles • appropriate sight distances to allow traffic to safely enter and exit • visibility of compliant warning and wayfinding signs • use of accredited traffic controllers, where appropriate and/or other controls to separate, slow down or temporarily stop traffic for safe entry/exit • minimising use of local roads, where practical • provision of deceleration lanes at accesses next to highly trafficked roads.	Contractor	Pre-construction / construction
Traffic impacts	Further traffic modelling would be carried out during detailed design following confirmation of the construction methodology and traffic staging to confirm the potential for traffic impacts and identify whether any additional mitigation measures or traffic control measures would be required.	Contractor	Detailed design
Impact on bus stops or routes	Temporary and permanent bus stop relocation would be discussed with the relevant bus operator and the community would be notified.	Transport / contractor	Detailed design / pre-construction
Temporary access changes	Detours during temporary access changes would be implemented with directional signage along alternate routes.	Contractor	Construction
Heavy vehicle movements	Heavy vehicle movements would be limited during peak traffic periods (i.e., between 7:45 AM to 08:45 AM and 3:30 PM to 5:30 PM on weekdays, and 11:30 AM to 1:30 PM on weekends), where practical.	Contractor	Construction
Traffic management measures	Any temporary traffic diversions, clearways and road closures would be implemented in line with Transport Management Centre (TMC) and Canterbury Bankstown City Council requirements.	Contractor	Construction
Property access	• Property access would be maintained where feasible and reasonable and property owners would be consulted well in advance of work starting that may temporarily restrict or control access. • Consultation would be carried out with the community regarding alternate access arrangements during operation associated with the provision of left-in left-out intersections. • Notification would be issued to emergency services about changes in traffic conditions.	Transport / contractor	Construction
Local road or shared path closures	Relevant councils would be consulted with prior to any local road or shared path closures to identify suitable mitigation measures such as detour routes.	Contractor	Construction

Impact	Environmental safeguards	Responsibility	Timing
Parking	Off-road parking for construction vehicles would be provided within the ancillary facility and construction areas.	Contractor	Construction
Damage to local roads	Any damage to the local road network identified to be caused by construction vehicles for the proposal would be remediated by the contractor to be similar to the existing road condition.	Contractor	Construction
Auld Avenue parking	During detailed design, Transport will consider opportunities to minimise the number of parking spaces that need to be removed on Auld Avenue.	Transport	Detailed design

6.3 Noise and vibration

A Noise and Vibration Impact Assessment (SLR Consulting, 2023) was prepared for the proposal. The assessment is provided in Appendix E – Noise and Vibration Impact Assessment and is summarised in this section.

6.3.1 Methodology

The methodology for assessing construction noise involved:

- Completing unattended noise monitoring in the proposal area to determine the existing noise environment and to set the criteria used to assess the potential impacts from the proposal.
- The use of a noise model of the proposal area to predict noise levels from the proposal to all surrounding receivers.
- Development of representative scenarios to assess the likely impacts from the various construction phases of the proposal. The assessment uses 'realistic worst-case' scenarios to determine the impacts from the noisiest 15-minute period that are likely to occur for each work scenario, as required by the Interim Construction Noise Guideline (ICNG) (NSW DECC, 2009). The impacts represent construction noise levels without mitigation applied.
- Comparison of predicted noise levels against applicable assessment criteria in line with Transport's Construction Noise and Vibration Guideline (CNVG) (RMS, 2016) and the ICNG. Appropriate control measures have also been considered in line with Transport's Noise Mitigation Guidelines (RMS, 2015a).
- Assessment of potential impacts during vibration intensive work using the CNVG minimum working distances for human response.

The methodology for assessing operational noise involved:

- The use of a noise model to predict noise levels from the operation of the proposal to surrounding receivers. All major roads in the proposal area have been modelled together with major roads on the surrounding road network to determine the contributions from 'proposal' and 'non-proposal' roads at individual receivers.
- Investigation of transition zones in the proposal area to understand road traffic noise levels in areas where road categories change from 'new' to 'redeveloped'. A key transition zone that was investigated was the new link road between Auld Avenue and Keys Parade.
- Modelling of the existing noise scenario compared with existing noise measurements to validate the operational road traffic noise model.
- Investigation into appropriate operational noise mitigation measures using the Road Noise Mitigation Guideline (RNMG) (Transport, 2022d), which involves the use of triggers for where a nearby sensitive receiver may qualify for additional noise mitigation measures.
- Determination of the maximum noise level as a result of changes to the proposal area. This was done only as a tool to help prioritise noise mitigation strategies.

6.3.2 Existing environment

The area surrounding the proposal has been divided up into Noise Catchment Areas (NCAs) as shown in Figure 6-6. These NCAs are grouped based on similar land use and location and are described in Table 6-21.

Table 6-21 Noise catchment area descriptions

NCA	Description
NCA01	This NCA contains mainly residential receivers as well as some commercial receivers. It is next to Henry Lawson Drive in the north of the proposal area and includes the Georges River. Sensitive receivers in NCA01 are directly beside Henry Lawson Drive and to the north of the proposal area along Newbridge Road.
NCA02	This NCA contains mainly residential receivers. It also contains a commercial receiver (the Flower Power complex) and an outdoor active receiver (the Bankstown Golf Course). It is northeast of the proposal area between Henry Lawson Drive and Milperra Road. The sensitive receivers within NCA02 would be affected by the change in operational traffic noise and the construction noise and vibration of the proposal.

NCA	Description
NCA03	This NCA contains mainly residential receivers as well as some other sensitive receivers, including Newland Reserve and KU Milperra Preschool. It is located west of Henry Lawson Drive and north of Pozieres Avenue. The sensitive receivers within NCA03 would be affected by the change in operational traffic noise and the construction noise and vibration of the proposal.
NCA04	This NCA contains the Western Sydney University campus as well as residential and outdoor receivers. It is located east of Henry Lawson Drive between Bullecourt Avenue and the M5 Motorway. Sensitive receivers would be affected by upgrades to the Bullecourt Avenue / Ashford Avenue intersection.
NCA05	This NCA contains mainly residential receivers, as well as some educational and childcare receivers, including Milperra Public School and SDN Milperra. It is located to the west of Henry Lawson Drive between Pozieres Avenue and the M5 Motorway. Sensitive receivers directly next to Henry Lawson Drive would be most affected by construction noise and vibration and ongoing operational noise as a result of the upgrade.
NCA06	This NCA contains mainly residential receivers, as well as some outdoor receivers such as Tompson Reserve and Frank Moulang Reserve. It is located east of Henry Lawson Drive between Fromelles Avenue and the M5 Motorway. Receivers directly next to Henry Lawson Drive would be most affected by construction and operational noise and vibration.

Note: NCA07 was nominated to ensure coverage across the whole proposal area. However, it is noted that this section only contains a temporary construction ancillary facility and there are no residential receivers in NCA07.

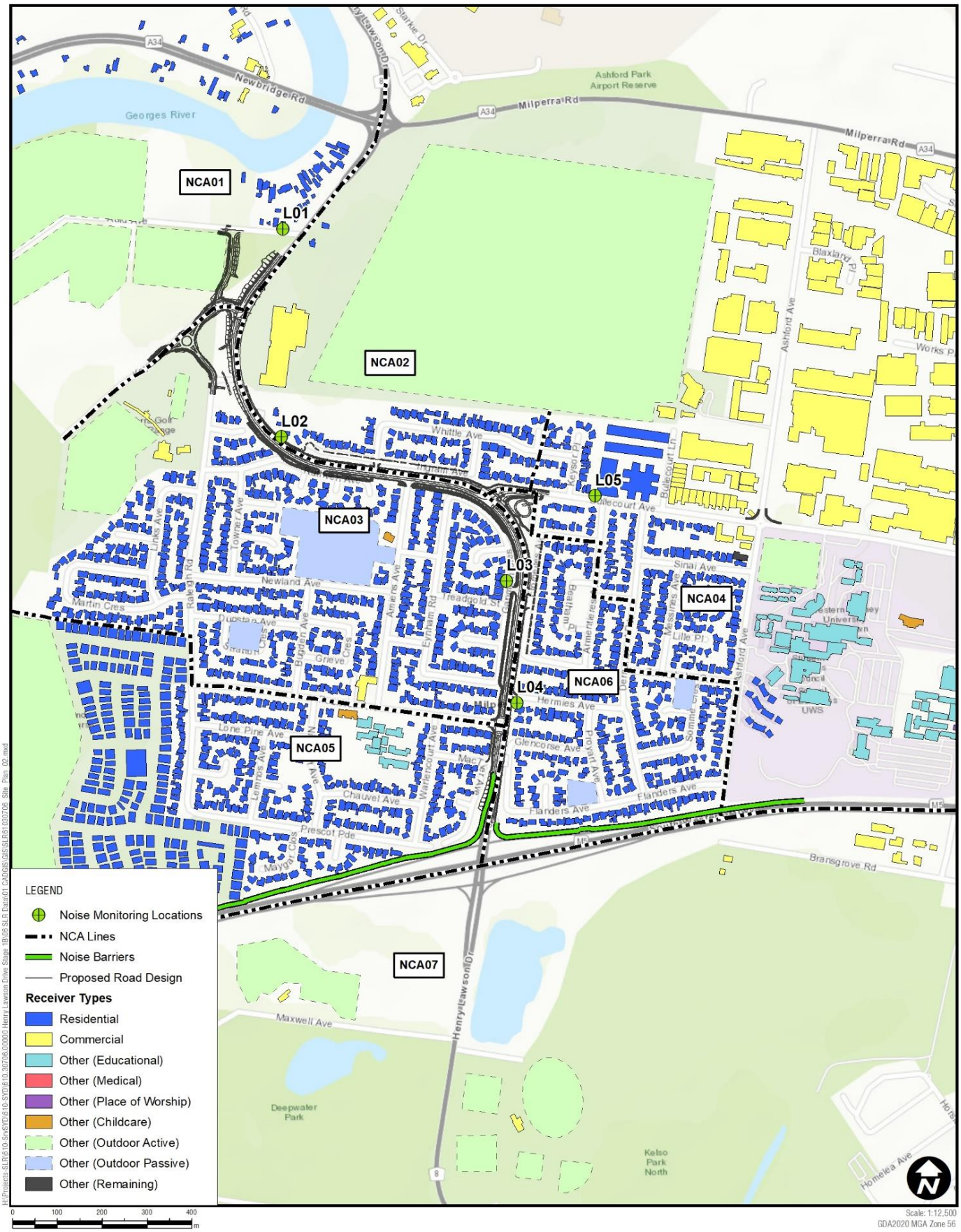


Figure 6-6 Noise catchment areas

Unattended noise monitoring was completed in the proposal area between 22 March 2022 and 5 April 2022. The locations of noise monitoring sites are included in Figure 6-6. The measured noise levels have been used to determine the existing noise environment and to set the criteria used to assess the potential impacts from the proposal. The measured existing noise levels are representative of the background noise levels at receivers that would likely be most affected by the construction and operation of the proposal in each NCA. The results of the noise monitoring are detailed in Table 6-22.

Table 6-22 Summary of unattended noise monitoring results

Address	Measured noise level (dBA)							
	Construction						Operational	
	Background noise (RBL)			Average noise (L_{Aeq})			Average noise (L_{Aeq})	
	Day	Evening	Night	Day	Evening	Night	Day	Night
5 Auld Avenue, Milperra	50	46	40	62	60	58	62	58
503 Henry Lawson Drive, Milperra	58	48	41	74	72	69	74	69
20 Ganmain Crescent, Milperra	55	46	35	63	61	58	63	58
23 Hermies Avenue, Milperra	57	48	39	68	65	63	67	63
Bullecourt Avenue, Milperra	50	45	39	66	63	59	65	59

6.3.3 Criteria

Construction

Recommended standing hours

The ICNG applies to the management of construction noise in NSW. This guideline provides recommendations on standard construction hours and construction noise management levels (NMLs).

Construction noise management levels

The construction noise criteria are defined as NMLs. The NMLs represent a noise level that, if exceeded, would require management measures including the following:

- reasonable and feasible work practices
- contact with residences to inform them of the nature of works to be carried out, the expected noise levels and durations, and contact details.

The ICNG sets the NMLs for residential receivers as well as other receivers. Table 6-23 and Table 6-24 are extracted from the ICNG and identify the NMLs for residential receivers as well as other land uses applicable for the proposal. These NMLs use a rating background level (RBL) which represents the background noise level for assessment purposes (NSW EPA, 2017).

Table 6-23 NMLs at residential receivers

Time of day	NML, dB $L_{Aeq\ (15\ min)}$
Standard construction hours Monday to Friday: 7:00am to 6:00pm Saturday: 8:00am to 1:00pm No work on Sundays or public holidays	Noise affected RBL + 10dB
	Highly noise affected 75dBA
Outside standard construction hours	Noise affected RBL + 5dB

Table 6-24 NMLs at other land uses

Time of day	NML, dB $L_{Aeq\ (15\ min)}$
Active recreation areas (characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion)	External noise level 65dBA
Commercial premises	External noise level 70dBA

Construction traffic noise criteria

The potential impacts from construction traffic associated with the proposal are assessed under the NSW EPA Road Noise Policy (RNP) and the CNVG.

An initial screening test is first applied to evaluate if existing road traffic noise levels are expected to increase by more than 2dB as a result of construction traffic. Where this is considered likely, further assessment is required using the RNP and Transport's Road Noise Criteria Guideline (RNCG) base criteria.

This initial screening involved a comparison of construction induced traffic with current traffic volumes on Henry Lawson Drive.

Construction sleep disturbance

Infrastructure projects often require certain work to be completed during the night-time. Where night work is located close to residential receivers, there is potential for sleep disturbance impacts.

Where construction work is planned to extend over more than two consecutive nights, the ICNG recommends that an assessment of sleep disturbance impacts should be completed. The ICNG refers to the NSW Environmental Criteria for Road Traffic Noise (ECRTN) for assessing the potential impacts, which notes that to limit the level of sleep disturbance, the L_1 level (or L_{Amax}) should not exceed the existing L_{90} background noise level by more than 15dB. The ECRTN has since been superseded by the RNP, which concludes the following regarding research on sleep disturbance:

- Maximum internal noise levels below 50 dBA to 55 dBA are unlikely to awaken people from sleep. This equates to an upper acceptable range external noise level of 65 dBA when assuming a conservative 10 dB loss for open windows.
- One or two events per night with maximum internal noise levels of 65-70 dBA are not likely to affect health and wellbeing significantly.

The above guidance results in the following assessment requirements:

- The 'sleep disturbance screening level' of RBL +15 dB (external), which is used to identify receivers where there is potential for sleep disturbance.
- Where the sleep disturbance screening level is predicted to be exceeded, further assessment may be required to determine if the 'awakening reaction' level of L_{Amax} 65 dB (external) is likely to be exceeded. The awakening reaction level is the level above which sleep disturbance is considered likely.

Proposal construction noise criteria

Based on the noise management levels for residential receivers and other sensitive receivers, the specific noise management levels for the proposal are detailed in Table 6-25.

Table 6-25 Residential receiver construction NMLs

NCA	Representative background monitoring location	Noise Management Level (Laeq(15minute) – dBA)				Sleep disturbance screening criteria	
		Standard construction (RBL +10 dB)	Out of Hours (RBL + 5 dB)				
		Daytime	Daytime	Evening	Night-time	Screening level (RBL +15 dB)	Awakening reaction
NCA01	L01	60	55	51	45	55	65
NCA02	L02	68	63	53	46	56	65
NCA03	L03	65	60	51	40	50	65
NCA04	L05	60	55	50	44	54	65
NCA05	L03	65	60	51	40	50	65
NCA06	L05	67	62	53	44	54	65

Construction vibration criteria

The effects of vibration from construction include:

- Human comfort – those in which the occupants of buildings are disturbed. People can sometimes perceive vibration impacts when vibration-generating construction work is located close to occupied buildings. Vibration from construction work tends to be intermittent in nature and the EPA's *Assessing vibration: a technical guideline* (2006) provides criteria for intermittent vibration based on the vibration dose value.
- Structural/cosmetic damage – those where the integrity of the building may be compromised. If vibration from construction work is sufficiently high, it can cause cosmetic damage to elements of affected buildings. Structural/cosmetic damage criterion are based on British Standard BS 7385 and German Standard DIN 4150.

Road and intersection work during peak periods (refer to scenario W.03 in section6.3.4) is noted as the scenario with the most vibration intensive equipment use. Other scenarios would use vibration-generating equipment, however they are expected to be less vibration intensive. Table 6-26 features the minimum working distances for the peak road and intersection work scenario which has been used as criteria for the vibration impact assessment.

Table 6-26 Minimum working distances

Scenario	Vibration intensive equipment	Minimum working distances (m)		
		Cosmetic damage	Heritage items	Human response
Road and intersection work – peak	Vibratory roller (13-18 tonne)	20	40	100

Other construction vibration criteria are outlined in Appendix E.

Operation

The RNP is used to assess and manage potential airborne noise impacts from new and redeveloped road projects. This assessment is carried out with guidance from the RNCG.

Where a project results in road traffic noise levels which are predicted to be above the criteria, the project should investigate feasible and reasonable noise mitigation measures to minimise the impacts.

A road is 'redeveloped' where work is in an existing road corridor and the existing road is not realigned. A road is 'new' when a project proposes road construction in an undeveloped corridor or changes the functional class of a road. The proposal would 'redevelop' Henry Lawson Drive and construct a 'new' link road between Auld Avenue and Keys Parade. The relevant criteria for residential receivers affected by traffic noise are shown in Table 6-27.

Table 6-27 RNCG criteria for residential receivers

Road category	Type of project/land use	Assessment criteria (dBA)	
		Daytime (7am – 10pm)	Night time (10pm – 7am)
Freeway / arterial / sub-arterial roads	Existing residences affected by noise from redevelopment of existing freeway/arterial/sub-arterial roads	$L_{Aeq(15\ hour)}$ 60 (external)	$L_{Aeq(9\ hour)}$ 55 (external)
	Existing residences affected by increases in traffic noise of 12dB or more from redevelopment of existing freeway/arterial/sub-arterial roads	Between $L_{Aeq(15\ hour)}$ 42 – 60 (external)	Between $L_{Aeq(9\ hour)}$ 42 – 55 (external)
Local roads	Existing residences affected by noise from redevelopment of existing local roads	$L_{Aeq(1\ hour)}$ 55 (external)	$L_{Aeq(1\ hour)}$ 50 (external)

The criteria are lower for night-time due to the greater sensitivity of communities to noise impacts during this period.

The RNP and RNCG require noise to be assessed at project opening and for a future design year, which is typically ten years after opening. For this proposal, the at opening year is 2031 and the future design year is 2041.

Several 'other sensitive' non-residential land uses have been identified near the proposal area. The noise criteria for these receivers are shown in Table 6-28. The RNCG does not consider commercial and industrial receivers as being sensitive to operational airborne road traffic noise impacts.

Table 6-28 RNCG criteria for other sensitive receivers

Existing sensitive land use	Assessment criteria (dBA)	
	Daytime (7am – 10pm)	Night time (10pm – 7am)
School classrooms	$L_{Aeq(1\ hour)}$ 40 (internal)	-
Hospital wards	$L_{Aeq(1\ hour)}$ 35 (internal)	$L_{Aeq(1\ hour)}$ 35 (internal)
Places of worship	$L_{Aeq(1\ hour)}$ 40 (internal)	$L_{Aeq(1\ hour)}$ 40 (internal)
Open space (active use)	$L_{Aeq(15\ hour)}$ 60 (external)	-
Open space (passive use)	$L_{Aeq(15\ hour)}$ 55 (external)	-
Child care facilities	Sleeping rooms $L_{Aeq(1\ hour)}$ 35 (internal) Indoor play areas $L_{Aeq(1\ hour)}$ 40 (internal) Outdoor play areas $L_{Aeq(1\ hour)}$ 55 (external)	-
Aged care facilities (the criteria for residential receivers should be applied to these facilities)	-	-

Where a project results in traffic redistribution, noise impacts can occur on the surrounding road network due to vehicles using different routes after the project is complete. The RNCG criteria are therefore to be applied to the surrounding road network where a road project generates an increase in road traffic noise of more than 2dB.

It should also be noted that the RNMG provides three triggers where a receiver may qualify for consideration of 'additional noise mitigation'. These are:

- **trigger 1** – the predicted 'build' noise level exceeds the RNCG controlling criterion and the noise level increase due to the project is greater than 2dB

- **trigger 2** – the predicted noise level is 5dB or more above the RNCG controlling criterion and the receiver is significantly influenced by operational road noise, regardless of the incremental impact of the project
- **trigger 3** – the noise level contribution from the road project is acute (daytime $L_{Aeq(15\ hour)}$ 65 dBA or higher, or night-time $L_{Aeq(9\ hour)}$ 60dBA or higher) even if noise levels are controlled by a non-project road.

6.3.4 Potential impacts

Construction

The predicted construction scenarios required for the proposal include:

- W.01 – Preliminary work, utilities, earthwork and drainage – peak
- W.02 – Preliminary work, utilities, earthwork and drainage – typical
- W.03 – Road and intersection work – peak
- W.04 – Road and intersection work – typical
- W.05 – Compound operation – peak
- W.06 – Compound operation – typical
- W.07 – Landscaping and finishing work – peak
- W.08 – Landscaping and finishing work – typical.

These scenarios would not all occur at the same time or during all working hours, and construction activities would vary in distance to the nearest sensitive receivers. As such, impacts from these scenarios would not be experienced concurrently by each receiver.

Construction impacts at sensitive receivers within each NCA have been evaluated for each of these scenarios. Impacts are based on the worst-case situation for the most affected receiver in each NCA, which would involve construction equipment at the closest point to each receiver. For most work, the construction noise impacts would frequently be lower than predicted as the worst-case situation is typically only apparent for a relatively short period when noisy equipment is in use nearby.

CNVG perception categories were used to categorise NML exceedance for the different scenarios. These are outlined in Table 6-29.

Table 6-29 NML exceedance levels for construction

CNVG perception categories	NML exceedance	
	Daytime – standard construction hours	Out of hours period
Noticeable	N/A	1 – 5dBA
Clearly audible	1 – 10dBA	6 – 15dBA
Moderately intrusive	11 – 20dBA	16 – 25dBA
Highly intrusive	>20dBA	>25dBA

The assessment for worst-case scenario construction impacts shows that:

- The work areas are close to sensitive receivers on Henry Lawson Drive, Bullecourt Avenue, Ashford Avenue, Raleigh Road and Auld Avenue, which results in 'highly intrusive' to 'moderately intrusive' noise levels and impacts at some of the nearest receivers. The highest noise levels and impacts would be experienced by receivers next to noisy construction when work is nearby. Where receivers are further away, or when less noise intensive work is being completed, the predicted noise impacts are correspondingly lower.
- The highest impacts are expected to occur when noise intensive equipment is being used such as chainsaws, chippers and concrete saws. However, these items would only be required occasionally and would be unlikely to be in use for long periods of time.

- The impacts during the daytime are predicted to be 'highly intrusive' at the nearest receivers in several NCAs during the 'peak' work scenarios. During 'typical' work, impacts would be reduced to be 'moderately intrusive' or 'clearly audible', or be compliant with NMLs.
- The night-time impacts are expected to be 'highly intrusive' at certain times during all work scenarios when noisy work is being completed near to receivers.

A summary of each NCA's noise impacts under the different scenarios is outlined in Table 6-30. Additionally, the number of receivers predicted to have 'noticeable', 'clearly audible', 'moderately intrusive' and 'highly intrusive' impacts during both day and night periods under scenarios W.01 and W.02, as examples, are shown in Figure 6-7 to Figure 6-10.

Table 6-30 Construction noise impacts for each NCA

NCA	Construction noise predictions
NCA01	NCA01 is most affected by the W.01 and W.07 scenarios during standard working hours. These scenarios would result in 'highly intrusive' impacts, while other scenarios such as W.02, W.03, W.05 and W.08 would result in 'moderately intrusive' impacts. Almost all scenarios would result in 'highly intrusive' impacts for this NCA during out of hours work.
NCA02	The W.01, W.03, W.05 and W.06 scenarios would result in 'highly intrusive' impacts for NCA02 during standard working hours. 'Highly intrusive' impacts would be caused by all construction scenarios during out of hours work.
NCA03	The W.01, W.03 and W.07 scenarios would cause 'highly intrusive' impacts for NCA03 during standard working hours. All construction scenarios would cause 'highly intrusive' impacts during out of hours work.
NCA04	NCA04 would experience 'highly intrusive' impacts during the W.01, W.03, W.05 and W.07 scenarios during standard working hours. All other scenarios would result in 'moderately intrusive' impacts during the daytime for this NCA. All scenarios would cause 'highly intrusive' impacts for NCA04 during out of hours work.
NCA05	Scenarios W.01, W.03 and W.07 would cause 'highly intrusive' impacts for NCA05, while scenarios W.05 and W.06 would only cause 'noticeable' noise impacts during standard hours. Only scenarios W.05 and W.06 would cause less than 'highly intrusive' impacts during out of hours work.
NCA06	Scenarios W.01, W.03 and W.07 would cause 'highly intrusive' impacts for NCA06, while scenarios W.05 and W.06 would only cause 'noticeable' noise impacts during standard hours. Only scenarios W.05 and W.06 would cause less than 'highly intrusive' impacts during out of hours work.

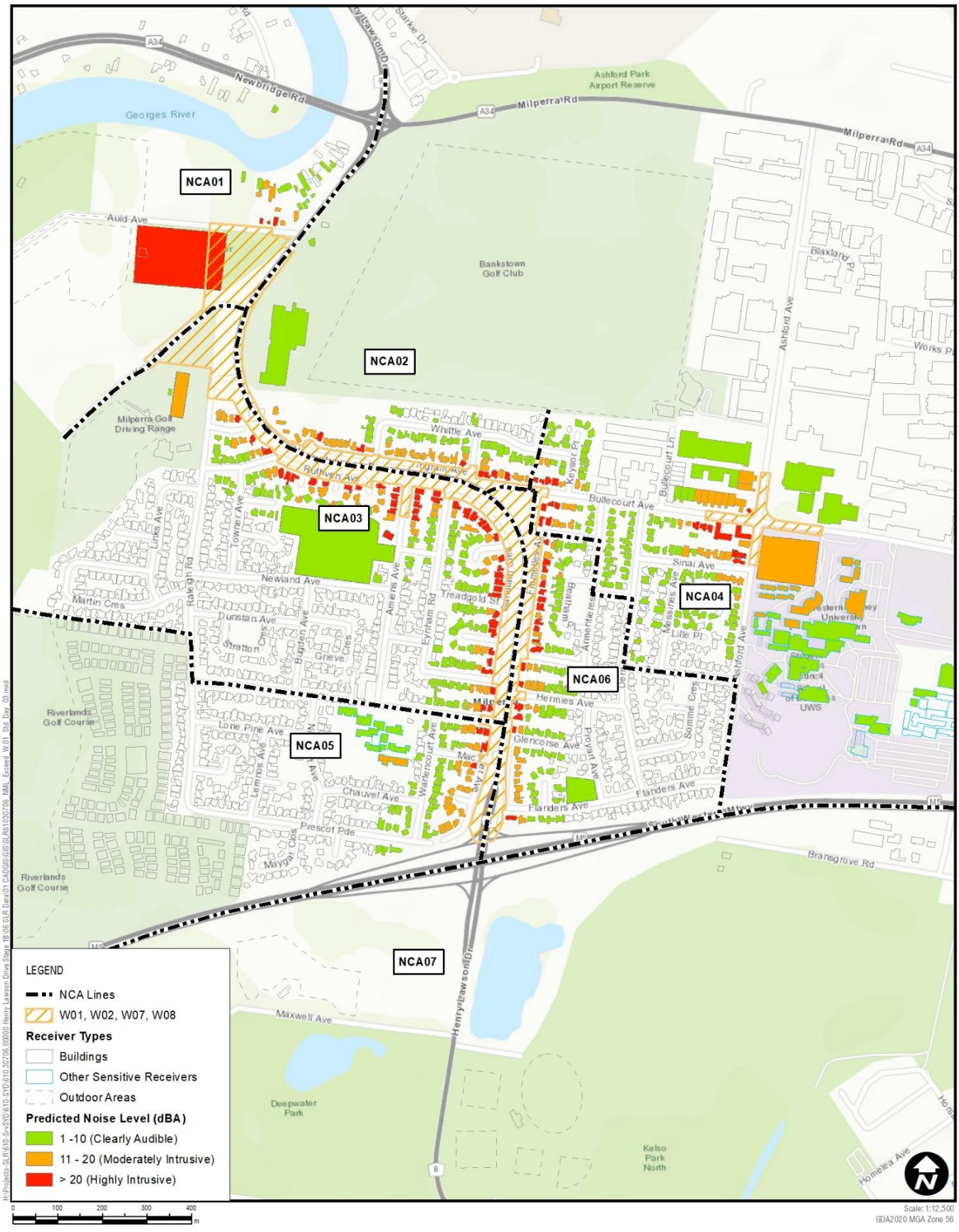


Figure 6-7 Predicted impacts during 'W.01 – Preliminary work, utilities, earthwork and drainage – peak' (daytime)

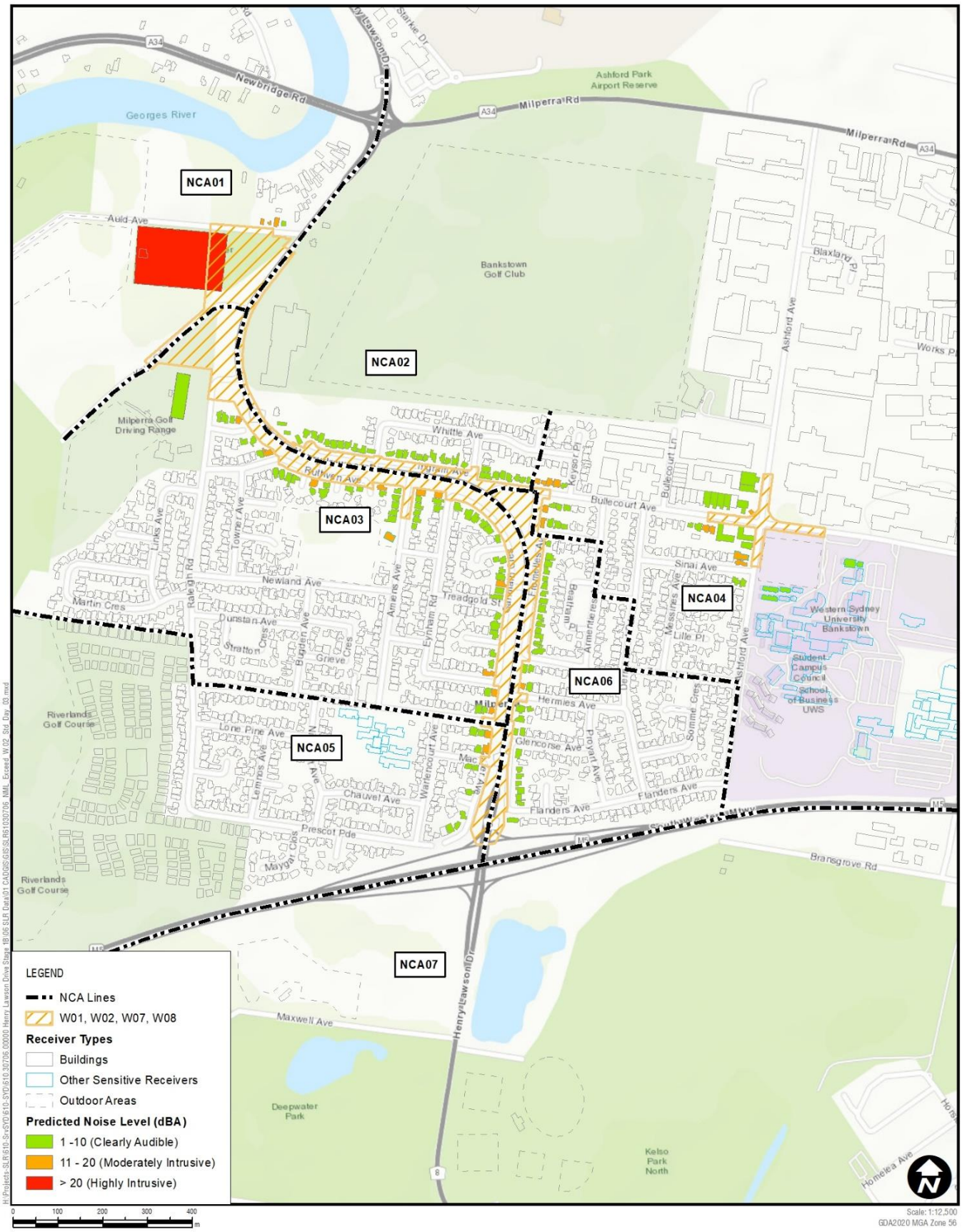


Figure 6-8 Predicted impacts during 'W.02 – preliminary work, utilities, earthwork and drainage – typical' (daytime)

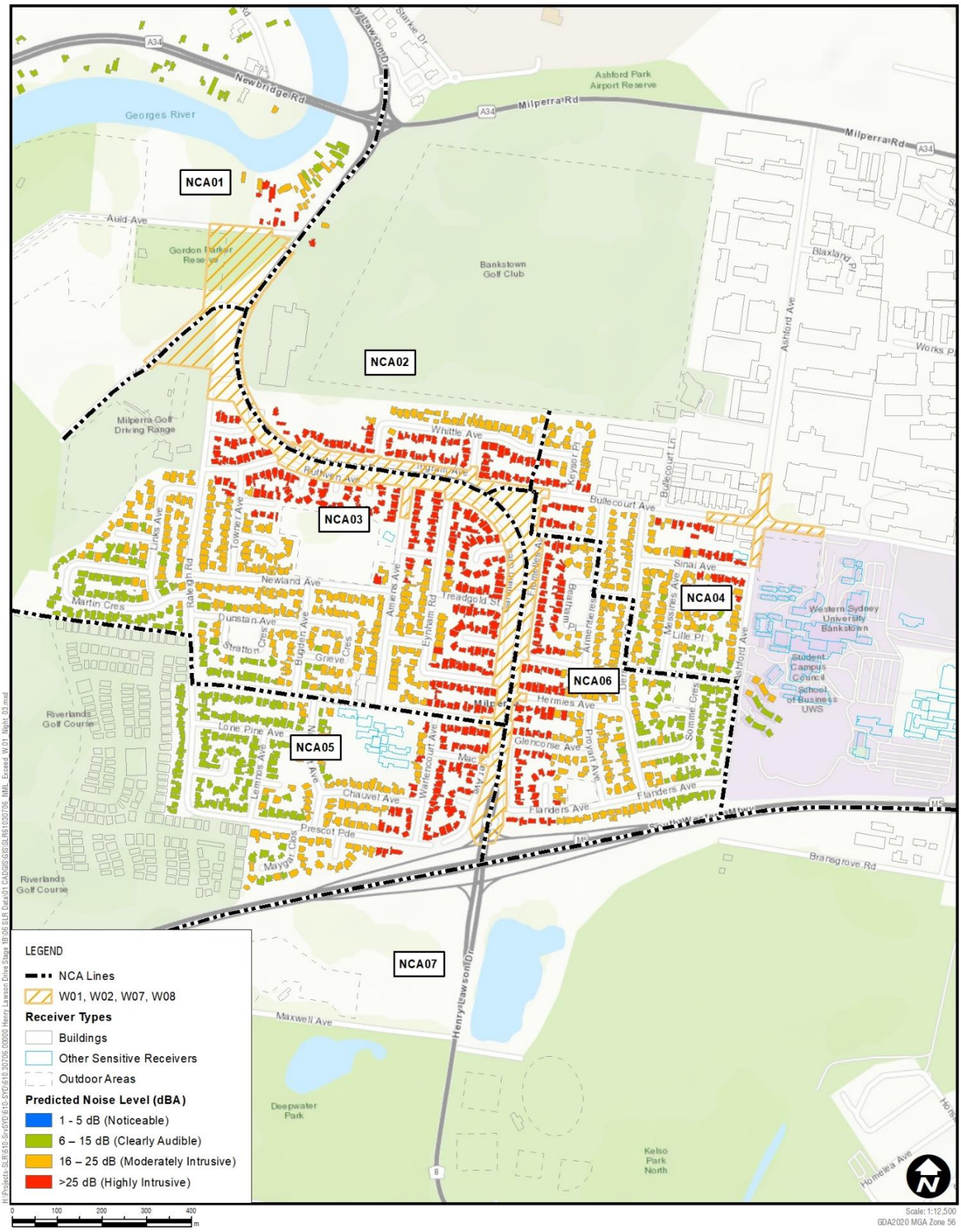


Figure 6-9 Predicted impacts during 'W.01 – preliminary work, utilities, earthwork and drainage – peak' (night-time)

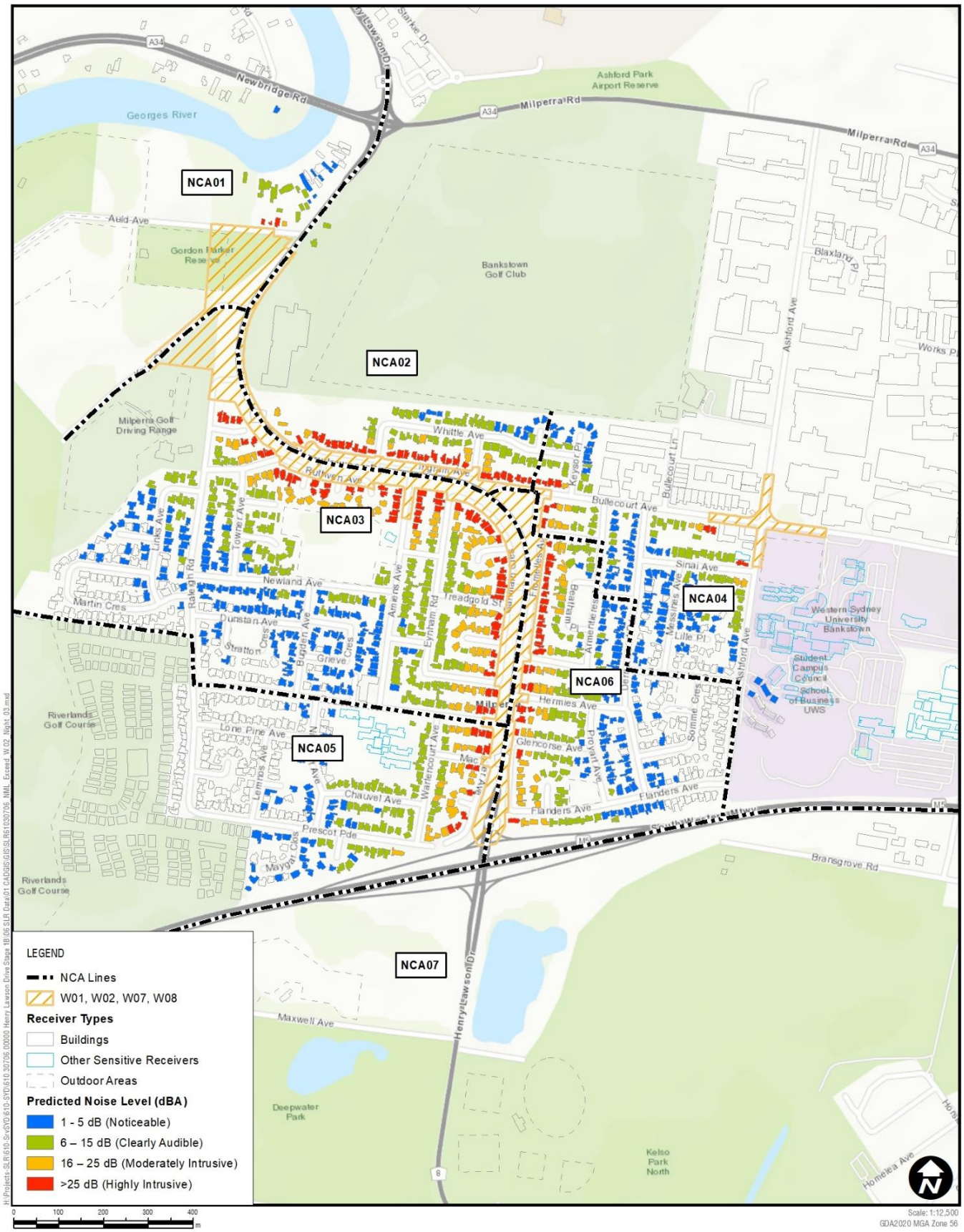


Figure 6-10 Predicted impacts during 'W.02 – Preliminary work, utilities, earthwork and drainage – typical' (night-time)

Sleep disturbance assessment

A review of the scenarios shows that the sleep disturbance screening criterion is likely to be exceeded when night work occurs near residential receivers. The receivers which would potentially be affected by sleep disturbance impacts are generally the same receivers where out of hours impacts have been predicted. The number of receivers predicted to exceed the sleep disturbance screening level and awakening reaction threshold by more than 20dB in each NCA under each scenario is summarised in Table 6-31 . It should be noted that these exceedances are based on the worst-case predicted noise levels with plant operating simultaneously, and so would not be true at all times.

Table 6-31 Number of receivers exceeding the sleep disturbance level by more than 20dB in each NCA

Scenario	Number of receivers											
	Exceedance of screening level (RBL + 15dB)						Exceedance of awakening reaction (65dB)					
	NCA 01	NCA 02	NCA 03	NCA 04	NCA 05	NCA 06	NCA 01	NCA 02	NCA 03	NCA 04	NCA 05	NCA 06
W.01	10	63	195	46	65	92	4	36	62	13	12	39
W.02	4	36	93	15	24	39	-	1	14	2	2	4
W.03	4	54	161	37	46	75	-	29	28	10	4	29
W.04	-	29	64	11	12	33	-	6	-	4	-	4
W.05	4	3	4	20	-	-	-	2	-	1	-	-
W.06	4	3	4	20	-	-	-	2	-	1	-	-
W.07	6	42	134	23	33	65	3	31	44	10	6	26
W.08	3	32	70	12	16	35	-	-	-	-	-	1

Construction traffic noise assessment

Construction related traffic has the potential to temporarily increase road traffic noise levels at receivers that are near to haulage routes. The maximum number of heavy construction vehicles travelling through the proposal area per day has been estimated at 72, while the maximum number of light construction vehicles travelling through the proposal area per day has been estimated at 250. These estimates show that the proposal would require relatively low numbers of construction traffic compared to existing traffic volumes in the proposal area. The potential increase in noise due to construction traffic on major arterial and sub-arterial roads is predicted to be less than 1dB and not likely to result in any noticeable traffic noise impacts.

Smaller local roads such as Raleigh Road and Auld Avenue have relatively low existing traffic volumes with a smaller proportion of heavy vehicles (about 300 to 1,000 vehicles daily). The increase in noise due to construction traffic on these local roads is predicted to potentially be greater than 2dB depending on the percentage of construction traffic that uses these roads. The existing and construction traffic noise levels on the local roads have been predicted based on the worst-case peak hour volumes and are summarised in Table 6-32. It is assumed that both the AM and PM peak movements would occur during the daytime period of 7 am –10 pm as defined in the RNP.

Table 6-32 Construction traffic noise on local roads

Road	Criteria	Predicted daytime noise level ($L_{Aeq\ (1\ hour)}$ dBA)	
		Existing	With construction traffic
Auld Avenue	Greater than 2dB increase and $L_{Aeq\ (1\ hour)}$ 55dBA	53	57
Raleigh Road		57	60

The assessment of worst-case construction traffic shows that a noticeable increase in road traffic noise is likely and noise levels are predicted to exceed the relevant criteria at receivers near Auld Avenue and Raleigh Road if they are used as part of the proposed construction traffic routes. Feasible and reasonable mitigation measures should be considered to minimise noise impacts to sensitive receivers.

Construction vibration assessment

Using the CNVG minimum working distances for cosmetic damage and human response, vibration offset distances have been set. Front-row receivers near Henry Lawson Drive and the intersection of Bullecourt Avenue / Ashford Avenue are likely to be within the minimum working distance for cosmetic damage (i.e., 20 metres for a vibratory roller). Other receivers near the proposal area are within the human comfort minimum working distance (i.e., 100 metres), meaning vibration impacts maybe felt when vibration intensive equipment is in use. This is anticipated to only be for short periods of time. Due to the potential impacts, Transport would implement management measures to mitigate or manage these impacts where possible.

Some non-residential sensitive receivers are likely to experience construction vibration impacts, including the Flower Power complex, Gordon Parker Reserve and the Western Sydney University campus, which would all be within the human comfort minimum working distance. Receivers and sites within minimum working distances from equipment working at the closest point to these receivers are shown in Figure 6-11.

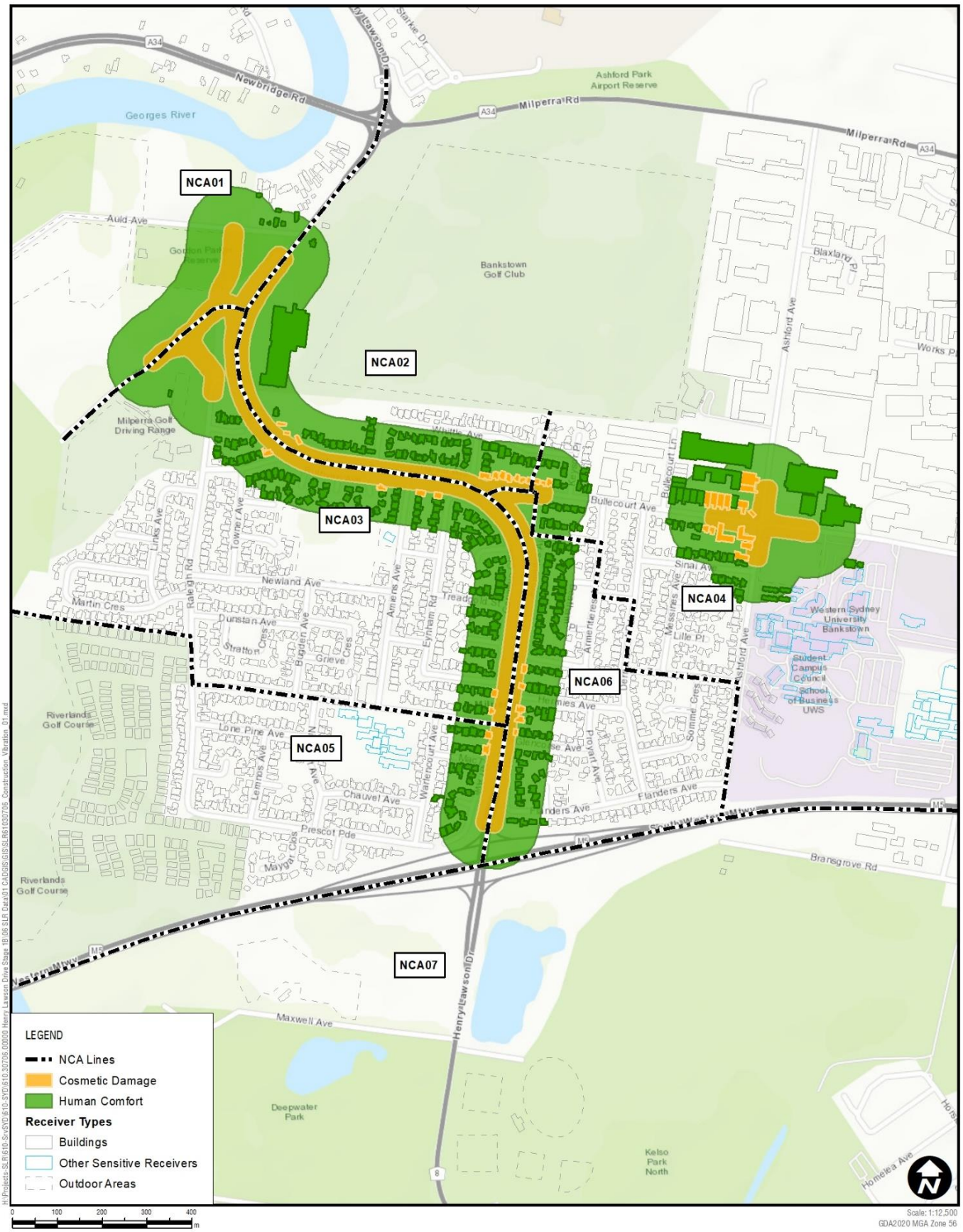


Figure 6-11 Construction vibration assessment (based on vibratory roller)

Operation

Operational road traffic noise impacts from the proposal 'without mitigation' have been predicted for all sensitive receivers near the proposal area.

Residential receivers

The predicted road traffic noise levels at the most affected residential receivers in each NCA show that:

- The nearest residential receivers to the proposal are subject to relatively high existing road traffic noise levels, which already exceed the RNCG criterion in many cases. Receivers on Henry Lawson Drive, Hermies Avenue and Bullecourt Avenue already experience acute noise levels during the day, with Henry Lawson Drive and Hermies Avenue also experiencing acute noise levels at night-time. Local roads such as Auld Avenue and Ganmain Crescent experience noise levels in exceedance of noise criteria during the day and night. The number of receivers with noise exceedances in each NCA as a result of the proposal's operation is summarised in Table 6-33.
- The proposal is generally not predicted to substantially alter operational road traffic noise levels in and near the proposal area, with the majority of receivers predicted to experience operational noise levels that are within 1dB of existing noise levels. Noise levels are, however, predicted to increase by slightly more than 2dB in NCA03 where widening work would bring Henry Lawson Drive closer to nearby receivers.
- The majority of front-row residential receivers are predicted to be subject to existing acute noise levels (i.e., daytime noise levels are 65dBA or higher, or night-time noise levels are 60 dBA or higher).

In summary, the proposal is predicted to result in:

- 3 residential receivers experiencing increases in operational traffic noise of greater than 2dB
- 113 residential receivers experiencing operational acute noise levels
- In total, 116 residential receiver buildings are considered eligible for consideration of additional noise mitigation, as per the operational road traffic noise criteria. These exceedances are generally due to relatively high road traffic levels (both with and without the proposal).

Table 6-33 Number of receivers with noise exceedances in each NCA

NCA	Number of receivers with noise exceedances			
	Trigger 1 (>2dB)	Trigger 2 (cumulative)	Trigger 3 (acute)	Total
NCA01	-	-	-	-
NCA02	-	31	31	31
NCA03	3	39	39	39
NCA04	-	7	6	7
NCA05	-	6	4	6
NCA06	-	33	33	33
Total				116

It is noted that certain areas of residential properties next to Henry Lawson Drive have existing private fencing along the boundary with the road corridor between the M5 Motorway and Pozieres Avenue, and between Amiens Avenue and Whittle Avenue on the southern side of the road corridor, which would likely provide some degree of noise shielding to the residential receivers themselves. Noise walls also exist near the intersection between Henry Lawson Drive and the M5 Motorway. It is likely that the existing boundary fences could provide at least 5dB additional attenuation of the noise levels presented in this report at front row receivers that have existing private fences. Therefore, the operational noise assessment results are considered conservative for these receivers, where private boundary fences exist and are in good condition.

Other sensitive receivers

The criteria for certain 'other' sensitive receivers are specified as internal noise levels. As the noise model predicts external noise levels, assumptions have been made regarding the likely facade performance of these receivers. 'Other' sensitive receivers have been conservatively assumed to have openable windows, which corresponds to a 10dB outside-to-inside reduction in noise through the building facade.

One 'other' sensitive receiver building is predicted to have exceedances of the operational road traffic noise criteria. This is SDN Milperra Children's Education and Care Centre in NCA03.

The impacts at 'other sensitive' receivers should be reviewed as the proposal progresses to determine the eligibility of each receiver for noise mitigation measures. The eligibility would be based on further inspections of each receiver to confirm the assumptions made in the noise modelling.

Maximum noise level assessment

As the proposal would widen and realign certain roads, there is potential for changes to maximum noise level events in the proposal area due to vehicles being closer to receivers. A summary of the predicted changes is provided in Table 6-34.

Table 6-34 Predicted change in maximum noise levels

NCA	Worst-case change (dB)	Discussion
NCA01	15	Maximum noise levels are predicted to increase by up to 15dB at the Gordon Parker Reserve due to the new link road between Auld Avenue and Keys Parade. No sensitive receiver buildings are predicted to have increased maximum noise levels in this NCA.
NCA02	1	Maximum noise levels are predicted to increase by up to 1dB at sensitive receivers in this NCA due to the horizontal alignment of the southbound lanes on Henry Lawson Drive moving up to around 1 metre closer to some of these receivers.
NCA03	4	Maximum noise levels are predicted increase by up to 4dB at sensitive receivers in this NCA due to the horizontal alignment of the northbound lanes on Henry Lawson Drive moving up to around 13 metres closer to some of these receivers.
NCA04	0	Negligible change in maximum noise levels is predicted at sensitive receivers in this NCA.
NCA05	3	Maximum noise levels are predicted increase by up to 3dB at sensitive receivers in this NCA due to the horizontal alignment of the northbound lanes on Henry Lawson Drive moving up to around 8 metres closer to some of these receivers.
NCA06	0	Negligible change in maximum noise levels is predicted at sensitive receivers in this NCA.
NCA07	0	Negligible change in maximum noise levels is predicted at sensitive receivers in this NCA.

6.3.5 Safeguards and management measures

Table 6-35 Noise and vibration safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
Noise and vibration	A Construction Noise and Vibration Management Plan (CNVMP) should be prepared before any work begins which would include: • identification of nearby sensitive receivers • description of works, construction equipment and hours that work would be completed in • criteria for the proposal and relevant licence and approval conditions • requirements for noise and vibration monitoring • details of how community consultation would be completed • procedures for handling complaints • details on how respite would be applied where ongoing high impacts are seen at certain receivers • preparation of an out of hours works assessment and application.	Contractor	Pre-construction / construction
	Location and activity specific noise and vibration impact assessments should be carried out prior to activities: • with the potential to result in noise levels at or above 75dBA at any receiver • required outside standard construction hours likely to result in noise levels greater than the relevant NMLs • with the potential to exceed relevant criteria for vibration. The assessments should confirm the predicted impacts at the relevant receivers near activities to aid the selection of appropriate management measures, consistent with the requirements of the CNVG.	Contractor	Pre-construction
	Notification should be given to noise-affected residents in the form of letter-box drops or equivalent. The notification would detail work activities, time periods over which these would occur, impacts and mitigation measures. Notification should be a minimum of 5 working days prior to the start of works.	Contractor	Pre-construction
	A record of all complaints received, and the subsequent action taken, should be maintained.	Contractor	Construction
Construction noise exceedances	Where noise intensive equipment is to be used near sensitive receivers, the work should be scheduled for standard construction hours, where possible. If it is not possible to restrict the work to the daytime then it should be completed as early as possible in each work shift. Appropriate respite should also be provided to affected receivers in line with the CNVG and/or the proposal's conditions of approval.	Contractor	Construction

Impact	Environmental safeguards	Responsibility	Timing
	Monitoring should be carried out at the start of noise and/or vibration intensive activities to confirm that actual levels are consistent with the predictions and that appropriate mitigation measures from the CNVG have been implemented.		
Ancillary facilities with long term work	Hoarding, or other shielding structures, should be used where receivers are impacted near ancillary facilities with long durations. To provide effective noise mitigation, the barriers should break line-of-sight from the nearest receivers to the work and be of solid construction with minimal gaps.	Contractor	Pre-construction / construction
Construction traffic	The potential impacts from construction traffic should be reviewed at a later stage when more information is available, particularly where it is required to access local roads.	Transport	Detailed design / construction
Vibration work within minimum working distance	Where work is within the minimum working distances and considered likely to exceed the cosmetic damage criteria: • different construction methods with lower source vibration levels should be investigated and implemented where feasible • vibration measurements should be carried out at the start of construction to determine actual vibration levels throughout the proposal area. Work should be ceased if monitoring indicates that vibration levels do, or are likely to, exceed the relevant criteria. The potential human comfort impacts should also be reviewed as the proposal progresses. Dilapidation reports should also be prepared for properties identified as being within the minimum working distances for cosmetic damage.	Contractor	Pre-construction / construction
Out of hours work	Out of hours works will be undertaken in accordance with the Construction Noise and Vibration Guideline (for road and maritime works) (Transport, 2022e). This includes: • Offer respite and/or restricted construction hours where noise intensive works are planned over extended periods, especially where they occur outside of standard hours. This may include moving the construction work front to different areas so that sensitive receivers are not impacted for longer than two consecutive days • No more than two consecutive nights of noise with special audible characteristics and/or vibration generating work may be undertaken in the same NCA over any 7-day period, unless otherwise negotiated with affected receivers.	Contractor	Construction
	Noisiest activities will be limited to standard construction hours, where practicable.	Contractor	Construction

Impact	Environmental safeguards	Responsibility	Timing
Operational road traffic	Appropriate noise mitigation measures should be implemented where receivers are likely to exceed NMLs. This could include: • at-source mitigation (quieter road pavement surfaces) • in-corridor mitigation (noise mounds, noise barriers) • at-receiver mitigation (at-property treatments). Appendix D of the RNCG contains road traffic noise assessment criteria to guide this mitigation.	Contractor	Detailed design / construction
	Further assessment of operational road traffic noise impacts would be carried out to inform consideration of appropriate noise mitigation during detailed design.	Transport	Detailed design

6.4 Hydrology and flooding

The potential impacts on hydrology and flooding during construction and operation of the proposal have been assessed as part of the Henry Lawson Upgrade Stage 1B Hydrology and Flooding Assessment (Aurecon, 2023a), provided in Appendix F. The existing hydrology of the proposal area and its surrounds, impacts of the proposal on flooding conditions and proposed mitigation measures for these impacts are summarised in this section.

6.4.1 Methodology

A hydrology and flooding assessment was carried out to understand the impacts of different flooding scenarios on the proposal area. TUFLOW models completed as part of Henry Lawson Drive Stage 1A were used as a basis for this assessment. The TUFLOW models include the following:

- TUFLOW model for the Georges River (regional flooding)
- TUFLOW model for the Milperra Drain (local flooding)

The overall approach for flood modelling was to adopt the supplied TUFLOW models, review their suitability for the assessment and then simulate the models for establishing the flooding behaviour in the proposal area. Once the flood models were developed, flood modelling showing flood behaviour under existing conditions and under proposal construction and operation conditions was prepared for design floods with annual exceedance probabilities (AEPs) of 20 per cent, 10 per cent, 5 per cent, one per cent. Details of flood modelling and flood scenarios are included in Table 6-36. Detailed flood mapping can be found in Appendix F of this REF.

Table 6-36 Hydrology and flooding assessment methodology

Step	Details
1 – Sanity checking of the supplied TUFLOW models	The supplied models were reviewed for their suitability and updated/refined, if necessary, before adoption for the assessment for the proposal.
2 – Establishment of the existing environment flood regime	The Henry Lawson Drive Stage 1A proposal was incorporated into the baseline TUFLOW model to represent the existing environment for the purpose of this assessment as it would be constructed prior to the proposal. The establishment of the existing flood regime is required to compare with the post-proposal flooding. The Milperra Catchment models were simulated for 20 per cent, 10 per cent, 2 per cent and one per cent Annual Exceedance Probability (AEP) flood events as well as the probable maximum flooding (PMF) event, and the Georges River model is simulated for 20 per cent, 10 per cent, 5 per cent, 2 per cent and one per cent AEP flood events, as well as the PMF event.
3 – Establishment of the proposed environment	The existing environment models were modified to represent the proposed environment by introducing the proposed road design surface for the proposal including the proposed cross-drainage elements. The impervious area was adjusted to reflect the changes associated with the proposal extent.
4 – Assessment of flood impact of the proposed flood regime	The impacts of the proposed design were determined by comparing the flood behaviour of the existing environment with the proposed environment. The comparison focused on flood levels, flow velocity and flood hazard for the proposal area and nearby properties.
5 – Assessment of sensitivity	Flood behaviour can be influenced by potential blockages in the hydraulic structures. Sensitivity tests were carried out to assess the potential impacts as a result of blockages in the proposed cross-drainage culverts under the Auld Avenue link road and the proposed Milperra Drain bridge.

6.4.2 Existing environment

The flooding in the proposal area is characterised by regional flooding from the Georges River and local flooding from the Milperra Drain. Existing flooding under different scenarios for both catchments is outlined below.

Georges River

Catchment overview

The Georges River catchment encompasses an area of around 960 square kilometres, located in the southwest of the Sydney CBD. The river meanders through one of Sydney's largest floodplain areas. The total Georges River catchment area covers a broad geographical extent from Appin, south of Campbelltown, to the coastal outlets at Botany Bay. Major tributaries to drain to the Georges River within this extent include the catchments of Bow Bowing Creek, Cabramatta Creek, Prospect Creek, Salt Pan Creek and the Woronora River. The Georges River is located west of the proposal area and extends along its entire length.

Existing flooding

The Georges River breaks its eastern banks in a 5 per cent AEP flood event and Henry Lawson Drive is inundated south of the existing Milperra Drain bridge with a maximum depth of around 900 millimetres and an inundation length of around 300 metres (this includes a stretch of Henry Lawson Drive between the Keys Parade intersection and the Raleigh Road intersection).

The Georges River also starts flowing back into the Milperra Drain in a 5 per cent AEP flood event extending into the Milperra Drain catchment to the east of Henry Lawson Drive and submerging the existing Milperra Drain bridge (and therefore Henry Lawson Drive) by around 300 millimetres.

These road inundations are of a hazardous nature and are unsafe for both vehicles and people accessing Henry Lawson Drive. This is due to the high flood depth as the flow velocities are generally low and below 0.5 metres per second.

A one per cent AEP flooding event from the Georges River results in:

- sections of Henry Lawson Drive to the south of the Milperra Drain bridge becoming inundated by a maximum depth greater than 1.7 metres and an inundation length of 460 metres
- a number of residential properties south of the Newbridge Road bridge and west of Henry Lawson Drive becoming inundated (to the north of the proposal)
- a number of commercial/industrial properties east of Henry Lawson Drive and east of the Bankstown Golf Course becoming inundated
- a number of residential properties to the east of Henry Lawson Drive and to the south of the Bankstown Golf Course becoming inundated (areas north of Ingram Avenue).

It is noted that flow velocities are low and generally less than 0.5 metres per second.

The low-lying nature of the proposal area relative to the Georges River system results in the region experiencing frequent inundation due to floodwaters, meaning the proposal is limited in its ability to improve flood immunity. It is noted that flood immunity is controlled by the inundation depth (rather than flow velocities or a combination of them) as the flow velocities are low.

Milperra Drain

Catchment overview

The Milperra Drain catchment forms part of the larger Georges River catchment area of around 10 square kilometres. The Milperra Drain runs from east to west for a length of about 4.5 kilometres, discharging into the eastern bank of the Georges River about 1.7 kilometres downstream of the Newbridge Road bridge. The terrain is relatively flat along the downstream regions. The Milperra Drain is located within the proposal area north of the Flower Power complex and near to the new link road.

Existing flooding

The Milperra Drain breaks its banks west of Henry Lawson Drive, inundating a section of Auld Avenue next to Gordon Parker Reserve and sections of Keys Parade next to the Milperra Sports Centre in a 20 per cent AEP flood event.

In a one per cent AEP flood event from the Milperra catchment (and adopting a coincidental 5 per cent AEP Georges River tailwater condition), the peak flood levels are controlled by the Georges River. Under these conditions, the Milperra Drain bridge is inundated by around 300 millimetres above the deck level along with sections of Henry Lawson Drive to the south of the Milperra Drain bridge (for a length of around 320 metres). No inundation of the Milperra Drain bridge or its approaches is predicted for the Milperra Drain in 20 per cent or 10 per cent AEP flood events.

It is noted that the REF for Henry Lawson Drive Stage 1A identified the 6-hour storm duration as the critical duration for flood events up to and including the one per cent AEP flood event. Flood modelling for the

proposal adopts similar critical storm durations as the entire flood modelling area (including Stage 1A and 1B) is controlled by the same flooding system. Figure 6-12 illustrates the existing flooding environment in a worst-case scenario (one per cent AEP flood event). Other flood mapping is included in the hydrology assessment in Appendix F.

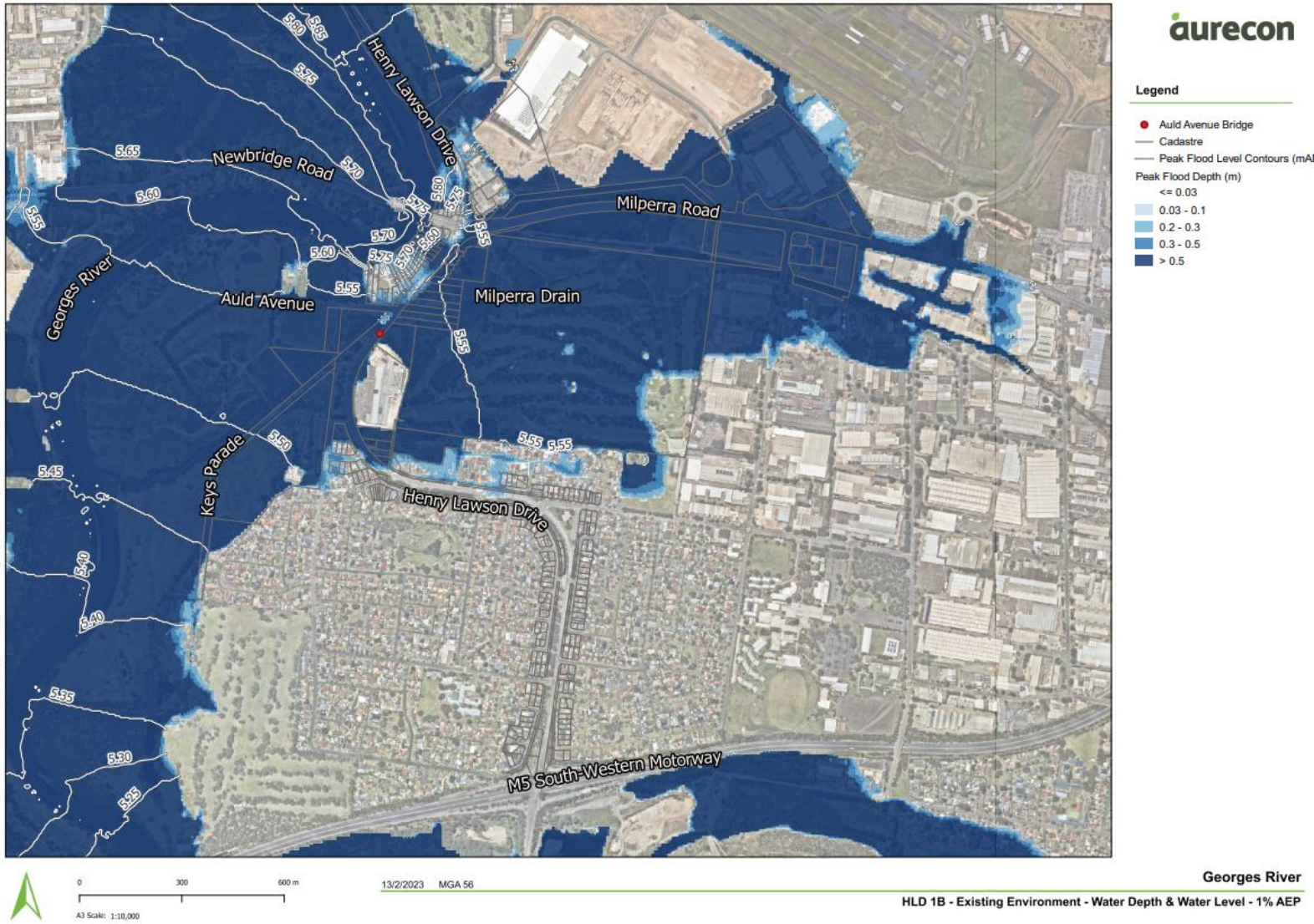


Figure 6-12 Existing flooding from the Georges River in a one per cent AEP flood event

6.4.3 Potential impacts

Construction

The assessment of potential flooding impacts during the construction of the proposal is based on a review of the likely construction works and their potential impact on the existing surface water behaviour. A number of construction activities could potentially be prone to flooding risks in the north of the proposal area. These include any temporary earthworks as part of the construction activities, temporary buildings and site sheds, and construction plant and storage facilities that are located within flow paths and have the potential to impact flooding conditions by altering flow depths, velocities or flow paths.

Where it is required to build temporary works in the floodplain (e.g., waterway crossings) during the construction phase, these could also potentially alter flooding conditions. While facilities and materials located within the floodplain have the potential to displace floodwater from both the Georges River and Milperra Drain floodplains, impacts on flood behaviour for events up to the 10 per cent AEP are expected to be minor. A Flood Management Plan would be developed to manage potential risks of flooding on construction compounds (refer to section 6.4.4). This would include provision for only materials which can be easily relocated (e.g., plant) to be stored in flood prone areas. Portable buildings and large unsecured construction objects have the greatest potential to be affected by flooding.

The proposal construction footprint in relation to the 10 per cent AEP flooding events for the Milperra Drain and the Georges River are outlined in Figure 6-13 and Figure 6-14. Table 6-37 lists each of the ancillary facilities included in these figures and outlines whether or not they would be flooded under the proposed 10 per cent AEP scenario, as well as the specific construction impacts for each facility.

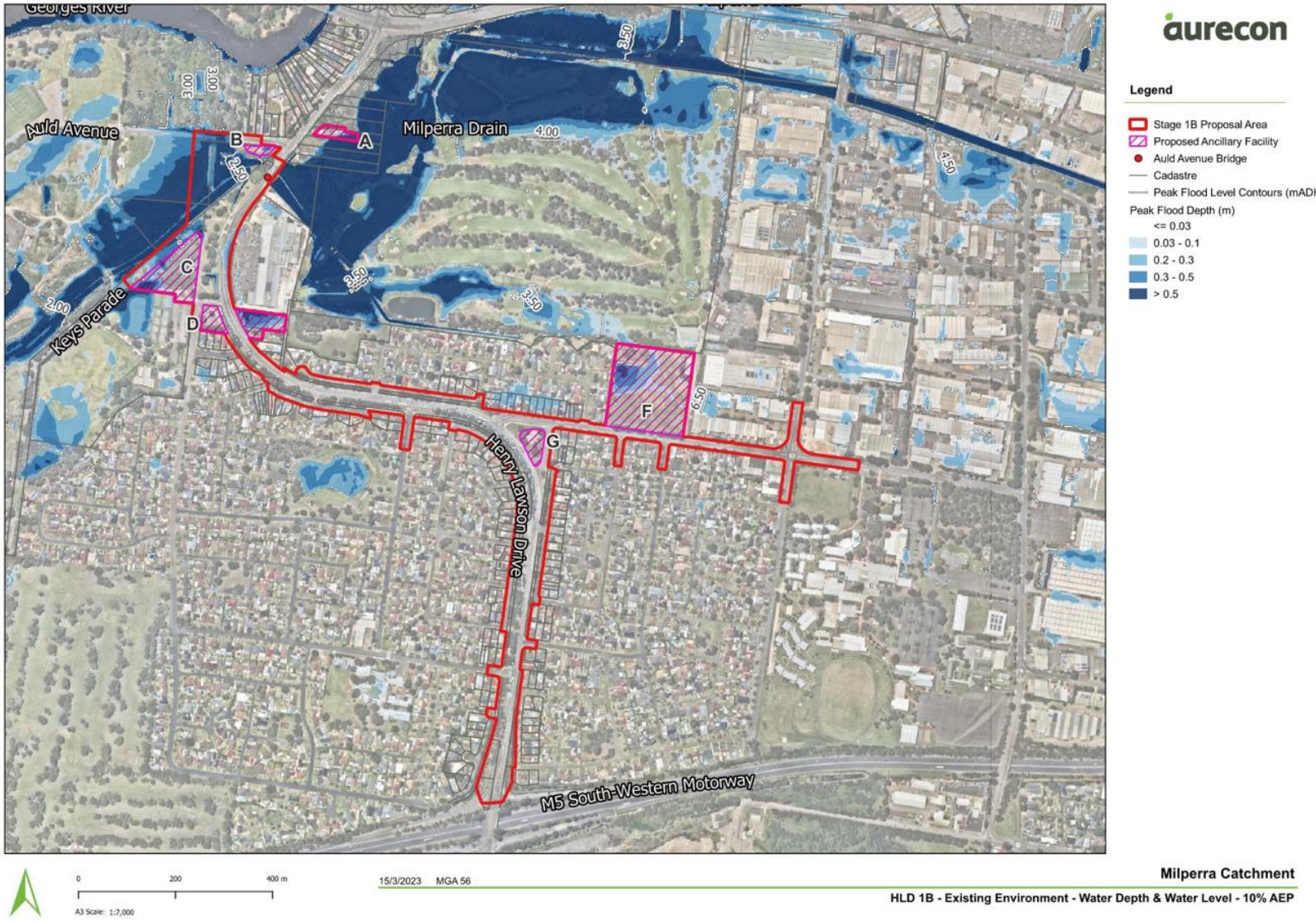


Figure 6-13 Proposal construction footprint in relation to 10 per cent AEP flooding events for the Milperra Drain

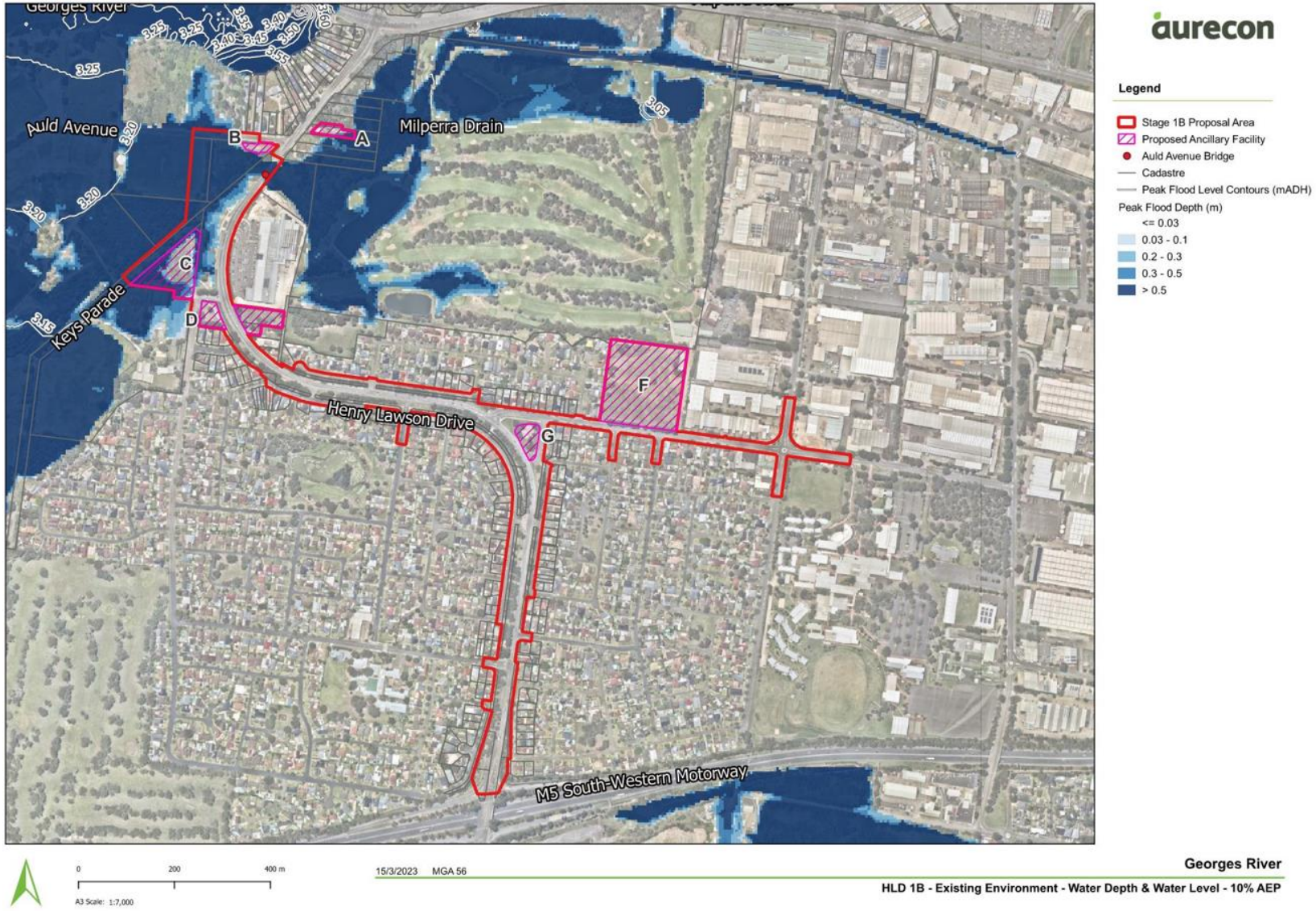


Figure 6-14 Proposal construction footprint in relation to 10 per cent AEP flooding events for the Georges River

Table 6-37 Impacts of 10 per cent AEP flooding event on ancillary facilities

Proposed ancillary facility	10 per cent AEP Milperra Drain flooding event	10 per cent AEP Georges River flooding event	Impacts
A	Flooded	Flooded	This site is located within the flood zone for the 10 per cent Georges River flood level of 3.2 metres AHD. The site would be used for temporary structures, meaning the floor level would be required to be set just above this flood level to minimise flood impacts in this facility. This facility should only be used to store materials that can be easily relocated (e.g., plant) and these should be stored towards the front of the property.
B	Flooded	Flooded	This site is located within the flood zone of the 10 per cent AEP Milperra Drain flood level of 3.9 metres AHD. The site would be used for stockpiling material, meaning any materials stored at this site could become waterlogged and lighter materials could wash away. The contractor should take into the account the potential effects of the flooding on the stockpiled material and also the potential for the material to be washed away. This facility should only be used to store materials that can be easily relocated (e.g., plant) and these should be stored towards the front of the property.
C	Flooded	Flooded	This site is located within the flood zone of the 10 per cent AEP Georges River flood level of 3.2 metres AHD. The site would be used for stockpiling material, meaning any materials stored at this site could become waterlogged and lighter materials could wash away. The contractor should take into the account the potential effects of the flooding on the stockpiled material and also the potential for the material to be washed away. This facility would therefore only be used for materials which can easily be relocated (e.g., plant).
D	N/A	N/A	Not flooded during the 10 per cent AEP flood events.
E	Flooded	N/A	This site is located within the flood zone of the 10 per cent AEP Milperra Drain flood level of 3.8 metres AHD. This flood level should be considered in the proposed activities within this site to minimise the flooding impacts.
F	Flooded	N/A	This site is located within the flood zone of the 10 per cent AEP Milperra Drain flood level of 4.9 metres AHD. This flood level should be considered in the proposed activities within this site to minimise the flooding impacts.
G	N/A	N/A	Not flooded during the 10 per cent AEP flood events.

Operation

Milperra Drain flooding

The flooding impacts caused by the proposal during flooding of the Milperra Drain are summarised in Table 6-38.

Table 6-38 Milperra Drain flooding impacts

Flood event	Flood level	Flow velocities	Flood hazards
One per cent AEP flood event	The flood results show an increase in maximum flood levels in the proposed environment compared to the existing environment in the vicinity of the proposal (mostly upstream of the proposal) in the one per cent AEP flood event. Impacts include: • An increase in the flood level of around 25 millimetres to two residential properties east of the Henry Lawson Drive / Auld Avenue intersection. It is noted that one of these properties is taken up for the proposal, meaning only one residential property is left within the afflux zone. However, as this area has an existing flood depth of around 2.4 metres, the increase in afflux would not present an additional flood hazard. • An increase in the flood level of around 20 millimetres in the industrial area upstream of the proposal and east of the Bankstown Golf Course. This area has an existing flood depth of around 600 millimetres, meaning the increase in flood level as a result of the proposal would not present an additional flood hazard. • No increase in the flood level to the west of Henry Lawson Drive and the Milperra Drain bridge. • No increase in the flood level in the Flower Power complex or its access from Henry Lawson Drive. Further assessment of potential flooding impacts should be carried out during detailed design, including obtaining building floor information.	• The increase in peak flow velocities in the proposed environment compared to the existing environment would be generally less than 0.1 metres per second in the areas upstream and downstream of the proposal (considered insignificant). • No increase in the flow velocities at the access to the Flower Power complex from Henry Lawson Drive is predicted.	No worsening of the flood hazard category is shown in the proposed environment compared to the existing environment. This is mainly due to the existing high flood levels experienced across the proposal area.
10 per cent AEP flood event	The flood results show an increase in maximum flood levels in the proposed environment compared to the existing environment in the vicinity of the proposal (mostly upstream of the proposal) in the 10 per cent AEP flood event. This event would see increases in flood levels of around 18 millimetres along sections of Auld Avenue and Keys Parade to the west of Henry Lawson	The increase in velocities would be less than 0.1 metres per second which is considered minimal.	No worsening of the flood hazard category is shown in the proposal area compared to the existing environment. This is due to minimal increases in the flood depth and flow velocities as a result of the proposal.

Flood event	Flood level	Flow velocities	Flood hazards
	Drive in the vicinity of Gordon Parker Reserve. This afflux is induced by the new local link road between Auld Avenue and Keys Parade. Additionally, affluxes of around 15 millimetres are modelled within Gordon Parker Reserve. It is noted that in the existing flood scenario, Gordon Parker Reserve is inundated by up to around 1 metre in this flood event.		
20 per cent AEP flood event	Increases in flood levels of up to 23 millimetres are shown along sections of Auld Avenue and Keys Parade to the west of Henry Lawson Drive in the vicinity of Gordon Parker Reserve. This increase in flood level is caused by the new local link road between Auld Avenue and Keys Parade. It should be noted that Auld Avenue and Keys Parade show flood depth in the order of 300 millimetres in the existing environment. The increases in the 20 per cent AEP flooding from Milperra Drain would generally be bound to the area between Keys Parade and Auld Avenue and would not extend to areas such as the Milperra Sports Club.	The increase in velocities would be less than 0.1 metres per second which is considered minimal.	No worsening of the flood hazard category is shown.

Based on the flood level, flow velocities and flood hazard changes, the flood impacts as a result of the proposal in a one per cent, 10 per cent and 20 per cent AEP flooding event would not be considered adverse. A minor increase in the flood levels of the Milperra Drain is not considered adverse. Changes in the flooding extent of flood events in the proposal area are negligible and are not considered adverse.

Georges River flooding

No significant impacts are anticipated as a result of the proposal in flood events simulated for the Georges River. This is because of the nature of Georges River flooding in the proposal area which comprises floods backing up from the Georges River into the Milperra Drain with relatively low velocities of generally less than 0.5 metres per second.

A review of the Georges River flood modelling results for the proposal identified:

- no increase in the flood levels
- only minimal increases in flood velocities of less than 0.1 metres per second
- no worsening of flood hazards
- no increase in flood extent.

6.4.4 Safeguards and management measures

Table 6-39 Hydrology safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
Overall flood risk	Further flood impact assessment would be carried out to quantify the flood risk to construction activities and to surrounding areas from the proposal.	Contractor	Detailed design / pre-construction
	A Flood Management Plan would be developed for the construction area and would include details and procedures to minimise the potential for construction activities to adversely impact on flood behaviour in neighbouring properties. Measures to manage residual flood impacts would include: • staging construction to limit the extent and duration of temporary works on the floodplain • ensuring construction equipment and materials are removed from floodplain areas at the completion of each work activity or when a weather warning of impending flood-producing rain is issued • providing temporary flood protection to properties identified as being at risk of adverse flood impacts during any stage of construction of the proposal • developing flood emergency response procedures to remove temporary works during periods of heavy rainfall. For the ancillary facilities located within the floodplain, the Flood Management Plan would include the following additional requirements: • limits to the extent of works located in floodway areas • a procedure to monitor weather conditions (existing and forecast conditions), including minor rain events, local weather warnings and river water level data • a communication protocol to disseminate warnings to construction personnel of impending flood producing rain or predicted flooding in the Georges River or Milperra Drain and actions required to make construction areas stable and safe • an evacuation plan for construction personnel should a severe weather warning or flood alert for the Georges River or Milperra Drain be issued.	Contractor	Construction
	Transport would continue to consult with the NSW SES around any anticipated flood risks throughout the detailed design and construction phases of the proposal.	Transport	Detailed design / construction
Location of construction activities	To the extent practicable, construction compounds, site sheds, stockpiles and laydown areas would be located outside flood prone areas.	Contractor	Pre-construction / construction

Impact	Environmental safeguards	Responsibility	Timing
and materials	Placement of stockpiles, fuels, contaminating material and loose equipment would be avoided within the ancillary facilities affected by flood waters or would be located as far away as is practicable. At ancillary facilities which have the greatest potential to be affected by floodwaters (i.e., the 439 Henry Lawson Drive, Milperra, Auld Avenue, Milperra and Milperra Sports Centre, Milperra ancillary facilities), only materials and buildings which can easily be relocated should be stored, and materials should be stored towards the front of the properties or as far away from potential floodwaters as possible.	Contractor	Pre-construction / construction
Construction activities in flood prone land	The timing and duration of the construction activities in the vicinity of waterways would be planned, where possible, to occur at times of year when the chance of major flood events is low.	Contractor	Detailed design
	Where ancillary facilities are located on flood prone land and adverse flood impacts are not acceptable, the use of elevated site sheds that are designed to allow the passage of floodwater beneath the structures should be considered.	Contractor	Detailed design / pre-construction
Management of impacts to existing environment	To the extent practicable, the ground surface slopes and imperviousness at the construction sites would be maintained close to existing conditions.	Contractor	Construction
	Flood impacts would be minimised and managed through documentation and implementation of an approved environmental management plan.	Contractor	Detailed design / construction
Milperra Drain bridge impacts	Further design would be carried out to consider alternatives to the Milperra Drain bridge design to reduce the bridge deck depth to minimise flood impacts.	Transport	Detailed design
	Further design would be carried out to consider approaches to the Milperra Drain bridge to be reduced where possible to maintain existing ground levels.	Transport	Detailed design

6.5 Landscape character and visual impacts

The potential visual impacts during construction and operation of the proposal have been assessed as part of the Henry Lawson Drive Upgrade, Stage 1B: Urban Design Report including landscape character and visual impact assessment (SCAPE Design, 2023), provided in Appendix G – Landscape Character and Visual Impact Assessment.

6.5.1 Methodology

The methodology adopted for the assessment is consistent with Environmental Impact Assessment Practice Note: Guideline for Landscape Character and Visual Impact Assessment – EIA NO4 (Transport, 2020a). Further detail can be obtained by reviewing the Urban Design Report provided in Appendix G.

The assessment comprises of:

- Landscape character assessment – the overall impact of a project on an area's character and sense of place; and
- Visual assessment – the proposal's impact on views.

The assessment of landscape character and visual impacts has been carried out with the aim of fulfilling the proposal's urban design objectives (refer to Section 2.3.2).

Landscape character assessment

To assess impacts from the proposal on the surrounding landscape, the proposal area has been classified into distinct landscape character zones (LCZ). These zones are defined as having a distinct, recognisable and consistent pattern of elements, including natural (soil, vegetation, landform) and/or human built form, distinguishing one zone as different from another.

The landscape character of each zone, key landscape elements including landform, hydrology, vegetation, land use and built form were identified during site visits. Two primary factors are used to determine landscape impacts – sensitivity and magnitude.

Visual impact assessment

This assessment is based on visual impacts of the proposal from a range of key viewpoints. Six viewpoints have been selected to assess potential visual impacts, including:

- Publicly accessible locations that are representative of residential properties and businesses
- Heritage items and precincts
- Public domain, including parks, footpaths, shared paths and lookouts
- Popular destinations and tourist attractions
- Road user views from the existing road.

Impact assessments are based on a qualitative assessment of the sensitivity of the view and magnitude of the proposal potentially visible in that view. This enables the development of a mitigation strategy to address the impacts identified. The two primary factors of sensitivity and magnitude were also used in the visual impact assessment.

Landscape character and visual assessment matrix

Both the landscape character assessment and visual impact assessment use the two primary factors of sensitivity and magnitude to determine impacts. Sensitivity is the degree to which a particular landscape type can absorb and accommodate change arising from a project, as well as a measure of the extensiveness of the perceived value of an existing view. It refers to how sensitive the character or scenic value of the setting is to the proposed change, which may also include the sensitivity of regular users and viewers of the zone. For example, a pristine natural environment would be more likely to be sensitive to change than an industrial area.

Magnitude is a study of the bulk scale and form. It reflects the degree of physical change between the proposal and the landscape setting. In the case where future development is already approved, for example rezoning, this context is used in the assessment. Consideration is given to existing built form in the landscape and how closely the proposal matches this in bulk, scale and form.

Table 6-40 summarises the ranking of the assessment of the two criteria and how they are combined to provide an overall impact assessment.

Table 6-40 Landscape character and visual assessment matrix

	Magnitude				
Sensitivity		High	Moderate	Low	Negligible
	High	High	High-moderate	Moderate	Negligible
	Moderate	High-moderate	Moderate	Moderate-low	Negligible
	Low	Moderate	Moderate-low	Low	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

6.5.2 Existing environment

Regional context

Stage 1B of the Henry Lawson Drive upgrade is located in Milperra within the City of Canterbury Bankstown LGA around 20 kilometres southeast of the Sydney CBD. It extends around 1.8 kilometres, between Keys Parade and the approach to the M5 Motorway. Henry Lawson Drive is a key transport corridor providing connections to the Western Sydney Employment Area, Bankstown Airport and southwest urban growth areas.

Considerable population and employment growth is expected across not only the City of Canterbury Bankstown LGA but the wider Western Sydney region. Major regional development areas include:

- Western Sydney University
- Bankstown Airport
- Sydney Airport
- Holsworthy Airport

Proposal area context

The proposal area is surrounded by predominantly R2 low density residential lots and sporadic recreational reserves. On the western edge of the proposal area there is avenue tree planting dominating the landscape character, creating an edge between the urban density and the existing road infrastructure.

The road corridor acts as a main link between the M5 Motorway and the Hume Highway and would be a critical transport link for the planned development of the Bankstown Airport.

Surrounding the proposal area there is a mixed use setting of low-density peri-urban residential housing, light commercial, industrial estates, environmental conservation areas, green corridors and public recreation. Infrastructure within the proposal area includes arterial and local road networks, water supply pipelines and high voltage power (11kV). Important regional landmarks in the local context of the proposal area include:

- local heritage (being the former Milperra Solider Settlement), as a part of the Bankstown LEP, located in multiple locations as extensive as Amiens Avenue, Ashford Avenue and Bullecourt Avenue
- Western Sydney University
- Georges River National Park.

The future north-south rail link of the Sydney Metro alignment would include Metro stops from Sydenham to Bankstown, including Punchbowl, Wiley Park, Lakemba, Belmore, Campsie, Canterbury, Hurlstone Park, Dulwich Hill and Marrickville.

Topography, drainage and vegetation

The terrain of the site is impacted by the surrounding catchment found within the Canterbury Bankstown region, which is comprised of the Cooks River, Wolli Creek as it's tributary, flowing into Botany Bay and Salt Pan Creek and lastly feeding into the Georges River. The Georges River is the major catchment area to the proposal area. Topography is gently undulating encased with clay soils created by Wianamatta Shale. The dominant vegetative community is the Turpentine-Ironbark Forest. Avenue planting of native vegetation in the form of mature canopy trees with exotic mown grass or groundcover understorey forms a key view within the proposal area. The Cooks River, once a saltwater body, has been infiltrated by freshwater with the construction of a dam in 1870. Salt Pan Creek, which feeds into the Georges River, remains closest to its

original habitat, with remnant mangroves and smaller saltmarsh vegetation. This habitat does, however, remain in threat of increasing road infrastructure and landfill. The Georges River, which is closest to the proposal area, is also tidal and contains saltwater.

Signage

Existing street signage is located throughout the proposal area and forms part of the landscape character. Street signs throughout the proposal area feature names of early soldier settlers. Of note is the Milperra Soldier Settlement sign, located at the Henry Lawson Drive / Amiens Avenue intersection.

Landscape character zones

Four LCZs were identified during desktop studies and confirmed during the site visit where they were recorded and photographed. Each is represented in Figure 6-15 and Table 6-41 and include:

- LCZ 1: Residential estate
- LCZ 2: Light commercial
- LCZ 3: Existing road corridor
- LCZ 4: Public open space.

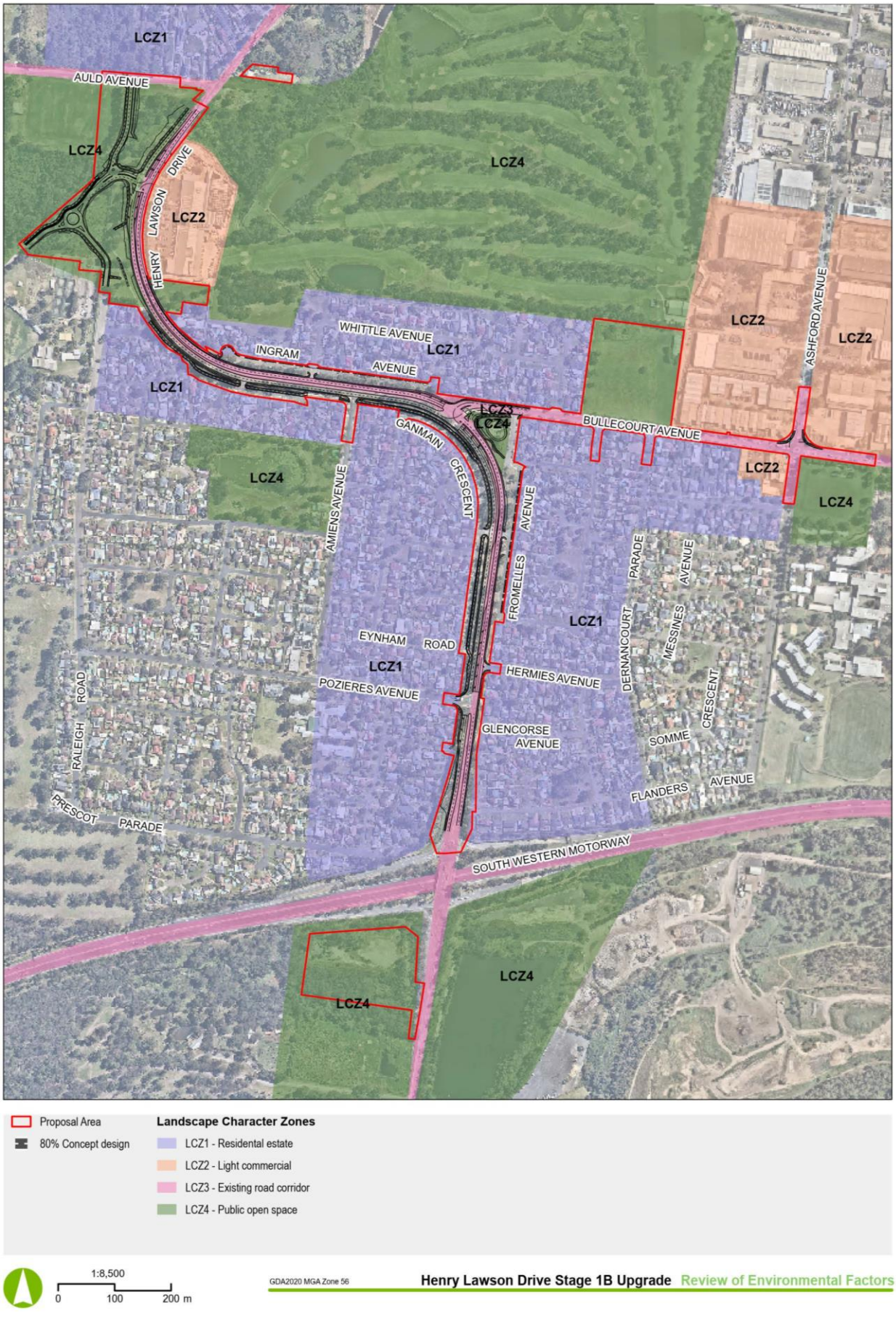


Figure 6-15 Landscape character zones

Table 6-41 Landscape character zones

LCZ	Description
LCZ 1 – Residential estate 	This zone is comprised mainly of the low-density residential suburb of Milperra and extends from Raleigh Road in the north to Pozieres Avenue in the south. Part of the visual fabric of this section of Henry Lawson Drive are wide tree-lined verges which separate the bounding properties of the existing road corridor. These verges are used for passive recreation and connect to other open spaces within the suburb. The eastern end of Bullecourt Avenue has been included in the Henry Lawson Drive upgrade. The road includes a combination of modern semi duplex and detached low-density residential dwellings. There is a small section of the road where the verge is lined with mature street trees separating the road from the fenced vacant lot which is part of the Bankstown Golf Course.
LCZ 2 – Light commercial 	This zone is defined by a mix of commercial premises and extends around 100 metres along the eastern side of the proposal north from Raleigh Road. Commercial signage structures as well as the Flower Power building facade are prominent visual elements in this character area. Vegetation through this zone is completely exotic introduced species. The only mature vegetation of note are the established street trees along a small section of Bullecourt Avenue.
LCZ 3 – Existing road corridor 	The existing road corridor is a state arterial road asset, which includes a two-lane undivided road with a posted speed limit of 60 kilometres per hour and which runs in a primarily north-south direction. Within the existing road corridor, there is open space containing wide areas of turf and scattered stands of established mature trees. Plants within adjoining properties also form part of the landscape character. The bounding properties consist of 1-2 storey residential single dwelling estates and mostly contain a front garden, fencing, driveway and garage next to wide turfed verges.
LCZ 4 – Public open space 	This zone is predominantly comprised of turfed areas associated with the open space corridor of the Georges River and established native trees. The following reserves bound Henry Lawson Drive and Bullecourt Avenue: • Raleigh Reserve (Henry Lawson Drive northbound) • Gordon Parker reserve (Henry Lawson Drive northbound) • Milperra Reserve (Bullecourt Avenue eastbound)

Visual receptors and viewpoints

The locations and directions of selected viewpoints are representative of the range of locations both within and beyond the road corridor and are shown in Figure 6-16. This list does not represent the entire number of receptors likely to be visually impacted by the proposal but does represent the range of viewers potentially impacted by some part of the proposal across each LCZ. The viewpoints selected include:

- Viewpoint 1 – Existing view from pedestrian island on Henry Lawson Drive next to commercial signage pillar. The viewpoint is facing towards the entry signage of the existing light commercial precinct and is opposite Raleigh Reserve.
- Viewpoint 2 – Existing view from the corner of Borella Road and Henry Lawson Drive facing southwest. This view consists of the existing mature street trees and surrounding residential vegetation. On both carriageways within the road corridor there are asphalt shoulders, no kerbs and turf verges. The western/southern edge of the road corridor has an existing shared path that meanders below the street tree canopy.
- Viewpoint 3 – Existing view of the Amiens Avenue / Henry Lawson Drive intersection facing southeast. The major elements within this view are the existing turf verges, kerbs, guard rail on the western edge and existing mature street trees. There is a shared path that runs along the eastern edge of the road corridor.
- Viewpoint 4 – Existing view looking north towards the Bullecourt Avenue / Henry Lawson Drive intersection. The major elements within this view are the existing turf verges, the lack of kerbs and existing mature street trees.
- Viewpoint 5 – Existing view looking south towards the Pozieres Avenue / Henry Lawson Drive intersection. The major elements of this view are the existing turf verges, footpath and shared path, a populated intersection, existing kerbs, existing mature street trees and houses.
- Viewpoint 6 – Proposed view from Keys Parade looking north towards Auld Avenue. The major elements of this view are the existing shared path, Gordon Parker Reserve, the existing creek and existing mature trees.

Each of the existing viewpoints are outlined in Figure 6-17 to Figure 6-22.

Viewpoint	Description
Viewpoint 1	Existing view from Henry Lawson Drive next to commercial signage pillar
Viewpoint 2	Existing view from the corner of Borella Road and Henry Lawson Drive facing southeast
Viewpoint 3	Existing view of the Amiens Avenue / Henry Lawson Drive intersection facing southeast
Viewpoint 4	Existing view looking north towards the Bullecourt Avenue / Henry Lawson Drvie intersection
Viewpoint 5	Existing view looking south towards the Pozieres Avenue / Henry Lawson Drive intersection
Viewpoint 6	Proposed view from Keys Parade looking north towards Auld Avenue

Figure 6-16 Viewpoint locations

Figure 6-17 Viewpoint 1 - Existing view from Henry Lawson Drive next to commercial signage pillar

Figure 6-18 Viewpoint 2 - Existing view from the corner of Borella Road and Henry Lawson Drive facing southeast

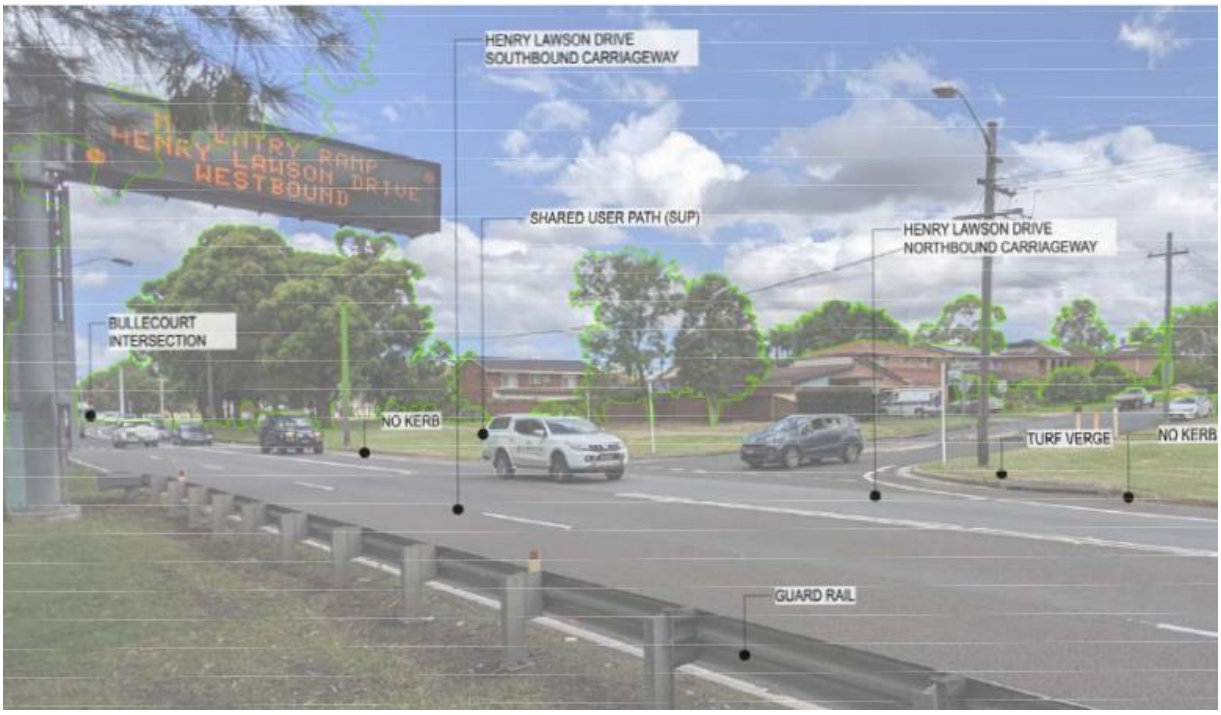


Figure 6-19 Viewpoint 3 - Existing view of the Amiens Avenue / Henry Lawson Drive intersection facing southeast

Figure 6-20 Viewpoint 4 - Existing view looking north towards the Bullecourt Avenue / Henry Lawson Drive intersection

Figure 6-21 Viewpoint 5 - Existing view looking south towards the Pozieres Avenue / Henry Lawson Drive intersection

Figure 6-22 Viewpoint 6 – Proposed view from Keys Parade looking north towards Auld Avenue

6.5.3 Potential impacts

Construction

General construction activities would result in temporary visual impacts on views nearby. These include the movement and operation of various machinery, light and heavy vehicles, and the erection of temporary structures such as fencing and construction ancillary facilities. Lighting, especially during nightworks, would result in temporary visual impacts for nearby sensitive receivers such as households along Henry Lawson Drive and near the Ashford Avenue / Bullecourt Avenue intersection. Visual impacts would be experienced due to clearance of vegetation, excavations and earthworks particularly along Henry Lawson Drive and in recreational areas near the new link road where tree clearing would occur. Additionally, the presence of construction areas including ancillary facilities and plant and equipment would also cause visual impacts, with the largest ancillary facility on Bullecourt Avenue being highly visible. Visual impacts would also be felt by residents near the construction of footpaths and shared paths along Henry Lawson Drive given their proximity to construction activities, including temporary structures and lighting. The greatest impact would be to residential properties that overlook the construction site due to their prolonged exposure.

The potential impacts would be temporary as construction would take about two years to complete. The magnitude of impact would depend on the stage of construction and the location of the work along the alignment. There are no anticipated residual landscape or visual impacts resulting from the construction phase of the proposal. Contractors would be required to rehabilitate all work sites prior to and at the end of the construction period. Landscape and visual impacts may arise from these rehabilitation works and would be most evident during the first year of operation. Visual impacts may vary depending on final construction methods and staging identified in later design stages.

Operation

This section outlines the operational landscape character and visual impacts of the proposal and section 6.5.4 includes landscaping and replanting details.

A landscaping and replanting plan would be implemented, with the initial plan provided as part of the landscape character and visual impact assessment (refer to Appendix G). While this would not completely align with the existing tree corridor and landscape characteristics, efforts would be made through this plan to minimise the operational landscape character and visual impacts of the proposal (as identified in the following sections). As the proposal is located near bushfire prone land, the landscaping and replanting plan would be implemented so that landscape treatments adhere to the guidelines for designated bush fire prone land. Specific details of potential bushfire impacts and mitigation measures can be found in section 6.12.

In addition, it has been noted that all local street signage is to be retained and relocated once the proposal is completed to ensure the original character of the former soldier settlement is retained (refer to Section 6.10.4). It is noted that the Milperra Soldier Settlement sign should be retained and relocated to a similar sight line point along Henry Lawson Drive.

Landscape Character Assessment

A summary of the landscape character impact assessment is presented in Table 6-42.

Table 6-42 Landscape character assessment summary

Character definition	Sensitivity	Magnitude	Overall impact rating
LCZ1 – Residential estate	**High** This zone is bordered by wide turf open space verges and an existing mature street tree canopy cover, both of which contribute to the character and amenity of the area. The zone can accommodate some change, but this would impact its character.	**Low** The proposal would increase the width of existing arterial roads, meaning the magnitude is considered to be limited to a low level of level of change. The magnitude of impact would be low due to the minimal level of change to the landscape setting for the residential estates as this LCZ is located beyond the front-line properties, which are assessed under the existing road corridor (LCZ3).	**Moderate** The expected impact on this zone has been rated moderate. The proposal would have most impact on the properties adjacent to the road corridor, but these properties are excluded and have been assessed under the existing road corridor (LCZ3) since they are an integral part of the road corridor character.

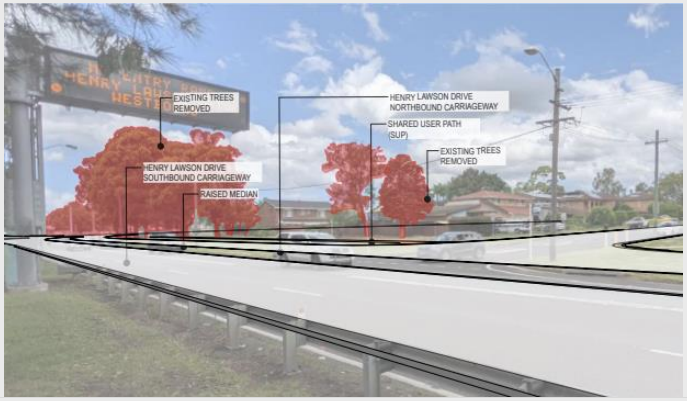
Character definition	Sensitivity	Magnitude	Overall impact rating
LCZ2 – Commercial /light industrial	**Low** The light commercial precinct on Henry Lawson Drive near the Keys Parade intersection comprises a few large scale commercial premises. The precinct on Bullecourt Avenue at the Ashford Avenue intersection is made up of smaller scale light industrial and commercial premises. Both of these landscape characters have few sensitive receivers and a high ability to absorb change.	**Low** The impacts would be confined to the frontages of the light commercial areas and are likely to be low. The physical setting and appearance of the light commercial precincts would not be substantially impacted.	**Low** Overall, a Low impact would be expected on this LCZ, limited to perimeter boundaries.
LCZ3 – Existing road corridor	**Moderate** The upgrade to this LCZ would be consistent with the existing use and character, however the scale of the proposal would result in a moderate sensitivity to change.	**High** The existing character is currently lacking road infrastructure such as medians. The proposal would widen the existing lanes, increasing the bulk and scale of the road. The removal of a large number of existing mature street trees also highly impacts the character. There would be minimal impact to Bullecourt Avenue.	**Moderate-High** The landscape character impact would be moderate-high. This is due to the proposal increasing the scale of the existing arterial roads as well as removing a high number of existing trees, which are currently an important element of the road corridor experience.
LCZ4 – Open space corridor	**Moderate** This LCZ is comprised of a variety of open space areas. The open spaces which adjoin the existing road corridor are excluded from this LCZ assessment. The affected open space areas are limited to the three main open space reserves within proximity to the proposal area; Raleigh Reserve, Gordon Parker Reserve and Milperra Reserve. As such, a moderate sensitivity has been assigned to this LCZ.	**Moderate** The proposal is likely to have a minor character impact on two of the main areas of open space; Raleigh Reserve and Milperra Reserve. It would, however, have a moderate-high impact on Gordon Parker Reserve based on the proximity of the new Auld Avenue link road to the reserve, where the existing built form currently only comprises a shared path. The overall impacts to this character zone have been assessed as having a moderate magnitude when considering the impacts of the proposal on all three reserves.	**Moderate** Overall, a moderate impact rating has been recorded on this LCZ. This is based on the exclusion of the bounding open space areas from this LCZ and the impact being on only one of the three open space reserves.

Visual impact assessment

Six viewpoints were identified within or near to the proposal area and are summarised within Table 6-43.

Table 6-43 Visual Impact Assessment

Viewpoint	Sensitivity	Magnitude	Overall impact rating
1 	**Moderate** The major elements in the view are the light commercial precinct entry signage, Raleigh Reserve and the existing road corridor. Overall, the sensitivity of the view is considered moderate.	**Moderate** There would be an increase in the scale of the road corridor due to the widening from one to two lanes in each direction. The proposal would extend into the existing mown grass and vegetation on the edges of the existing Raleigh Reserve.	**Moderate**
2 	**High** The major elements of the view are the mature trees fringing the bounding properties on the eastern side of the existing road corridor and the wide grass verges with an existing dominant avenue of mature street trees on the western edge of the road corridor. The sensitivity of this view has been assessed as high due to the distinct character of the existing tree canopy and open grass verges impacting the experience of the commuter.	**High** The increase in the width of the existing road corridor from about 13 metres to about 30 metres to accommodate two lanes in each direction would result in high impacts to this view. The existing mature street trees provide privacy through the developed canopy for the bounding properties on the existing road corridor. The magnitude has been assessed as high due to the impact of the view.	**High**

Viewpoint	Sensitivity	Magnitude	Overall impact rating
3 	**Low** The major elements in the view are the existing turf verges, existing mature street trees and shared path on the southern edge as well as the existing guard rail and carriageway on the northern edge. Overall, the sensitivity of the view is considered low due to the existing hardscape elements that dominate the view.	**Moderate** Although the road corridor would be widened from two lanes to four lanes, the road takes up a large proportion of the existing view. The narrowing of the existing turf verge, removal of existing trees and the introduction of the raised medians would be the main impacts to this view.	**Moderate-Low**
4 	**High** The sensitivity of the view is considered high due to the surrounding existing mature street trees and wide turf verges on both the eastern and western edges of the existing road corridor.	**High** The increase in the scale of the road corridor with additional travel lanes and a raised median together with the removal of mature street tree canopies that currently make up a large proportion of the view would result in a high magnitude of change.	**High**

Viewpoint	Sensitivity	Magnitude	Overall impact rating
5 	**High** Along the northbound carriageway, this view contains an existing bus stop, existing signage and a wide turf verge, however the existing mature trees dominate the view and provide a visual buffer to the bounding residential properties.	**High** The high magnitude of change is based on the widening of the existing road to accommodate a raised median, two lanes in each direction and the shared path, leading to the removal of a large number of existing trees that currently screen the visibility of existing residential properties.	**High**
6 	**High** The sensitivity of the view is considered high based on the current undisturbed character of this open space recreational area, with mature canopy trees and existing remnant creekside vegetation.	**High** The new road corridor introduces vehicular traffic to an area currently only used by pedestrians and cyclists. The road structure would impact substantially on the current view and the associated modification of existing levels would result in the removal of existing vegetation. An existing footpath link and the current bridge access across the existing creek would be removed.	**High**

6.5.4 Safeguards and management measures

The urban design process has been carried out in a way that has aimed to retain as much vegetation as possible in the proposal area. Table 6-44 outlines the safeguards and management measures for the landscape character and visual impacts of the proposal and includes detailed design safeguards before construction safeguards to illustrate efforts to retain vegetation in the design process. Construction safeguards which minimise vegetation removal have also been included.

Table 6-44 Landscape character and visual safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
Visual amenity and urban design	Development of the proposal's urban design would continue through to detailed design. Urban design would be integrated into project development processes to ensure the proposal aligns with the urban design objectives. The following policy/guidelines would guide future design development of the proposal: – Transport Urban Design Policy (Beyond the Pavement) – Transport Urban Design Guidelines – the urban design objectives, principles and concept design strategy presented in the urban design report for the proposal would form the basis for future design development and consultation with stakeholders.	Transport	Detailed design
Revegetation	Revegetation as well as biodiversity tree and hollow replacement would be carried out in line with the landscaping principles, urban design concept outlined in the LCVIA and Transport's Biodiversity Guidelines. Revegetation strategies would include but not be limited to: • planting trees at regular intervals to reinstate the existing characteristic avenue treatment parallel to Henry Lawson Drive • planting feature trees, shrubs and ground cover planting to provide visual interest and a sense of place • introducing varied plant species combinations including through type, scale and density of spacing, and with height variations along the length of the road corridor through median planting • restoring ancillary facility areas of the proposal disturbed by major work with appropriate native vegetation • selecting plant species to soften hard elements within the corridor • selecting plant species that are robust and which can survive for the life of the design • replacing existing trees where possible to provide urban cooling	Contractor	Detailed design

Impact	Environmental safeguards	Responsibility	Timing
	• making sure planting complies to sight lines and clear zone requirements with the use of a low height planting mix at intersections.		
	In consultation with Council, opportunities to develop potential 'pocket' and 'linear parks' will be considered during detailed design.	Transport	Detailed design
Road signage and connectivity	Develop the shared path design to contribute to the existing network and linear identity through appropriate connectivity with existing footpaths and roads.	Transport	Detailed design
	Provide appropriate locations for wayfinding and signage along the upgraded road corridor.	Transport	Detailed design
Lighting	Minimise lighting and potential for light spill.	Transport	Detailed design
Earthworks and landscape character	Landscape treatments are to adhere to the guidelines for designated bush fire prone land.	Contractor	Detailed design / pre-construction / construction
Tree management and removal	Minimise the removal of existing roadside remnant vegetation where possible to sustain the existing character of the surrounding suburb. Appropriate vegetation retention areas would include the creek area next to the new link road and the existing trees next to the bioretention basin.	Contractor	Pre-construction / construction
Road signage and connectivity	Existing signage and art is to be protected and preserved in existing locations or reinstated in a suitable location if works require them to be moved.	Contractor	Pre-construction / construction
	Consolidate signage structures to minimise the impact of sensitivity receptors within the upgraded precinct.	Contractor	Pre-construction / construction
Lighting	Minimise night works and provide lighting which minimises light spill	Contractor	Construction
Visual amenity and ancillary facilities	The layout of the ancillary facility sites would be designed to minimise visual amenity impacts. The design would consider: • screening of boundaries facing sensitive receivers or views • careful placement of structures and buildings to maintain viewpoints or provide additional screening of site activities.	Contractor	Pre-construction/ Construction
	The ancillary facilities would be maintained, kept tidy and well-presented including sorting regular removal of excess materials to reduce visual impact.	Contractor	Pre-construction/ Construction
	Ancillary facility sites and temporary construction areas would be progressively restored to at least their pre-construction conditions or in line with Landscaping Plans, when no longer required.	Contractor	Construction

6.6 Biodiversity

The potential biodiversity impacts during construction and operation of the proposal have been assessed as part of the Henry Lawson Drive Upgrade, Stage 1B: Biodiversity Assessment Report (BAR) (EcoPlanning, 2023), provided in Appendix H – Biodiversity Assessment Report. This section references the 'BAR study area', which includes the proposal area and nearby areas of vegetation surveyed as part of the BAR. The BAR study area is outlined in Figure 6-23a-b.

6.6.1 Methodology

The following section details the methodology used to assess the biodiversity impacts during construction and operation of the proposal.

- Background research was conducted to collect and review information on the presence or likelihood of occurrence of:
  - threatened terrestrial and aquatic species and their habitat
  - threatened ecological communities
  - important habitat for migratory species
  - areas of outstanding biodiversity value.
- A site-specific literature and database review was carried out for the BAR study area prior to carrying out the field survey.

Vegetation Assessment

A vegetation survey and assessment was carried out in line with Chapter 4 of the Biodiversity Assessment Method (BAM) (DPIE, 2020). Prior to carrying out the field survey, vegetation mapping carried out by OEH (2016) and the recently released NSW State Vegetation Type mapping (DPE, 2022b) were reviewed. The field survey was carried out on 10 May, 26 May, and 20 July 2022.

During the vegetation survey, the dominant species within each structural layer was recorded. The field surveys were conducted to identify the extent of native vegetation, validate plant community type (PCT) boundaries, and map the condition of vegetation zones in line with Chapter 4 of the BAM.

In determining the PCTs for the BAR study area, various attributes were considered in combination to assign vegetation to the best fit PCT. Attributes included, but were not limited to, consideration of dominant species in each stratum and relative abundance, community composition, previous vegetation mapping, soil landscape and landscape position. Reference was made to the PCT descriptions in the NSW Vegetation Information Sydney Classification Database (DPE, 2022c) and the final scientific determinations for assignment of TECs.

Threatened Species Assessment

A habitat assessment was carried out to assess the likelihood of each threatened and/or migratory species with the potential to occur in the BAR study area. The assessment was based on the results of database searches within a 10km radius of the BAR study area from both BioNet and the Protected Matters Search Tool (PMST), as well as a review of Schedule 4, 4A and 5 of the FM Act. The likelihood of occurrence of threatened species was based on the presence, condition, and type of habitat, as well as previous records. The habitat assessment formed the basis for determining whether targeted surveys were required.

Targeted surveys were carried out in line with Section 5.3 of the BAM and the relevant threatened species survey guidelines. Species not identified as candidate species for further assessment do not require targeted threatened species survey, however an informal survey was conducted while surveying for other threatened species. Targeted surveys were carried out on 3 May, 24 May, and 20 July 2022.

Several dual credit species were considered to have a moderate likelihood of occurring within the BAR study area. However, specific habitat constraints that provide essential breeding habitat were not present within the BAR study area. As such, targeted survey for these species was not required and these species are considered to be ecosystem credit species. These species and their breeding habitat constraints include:

- *Haliaeetus leucogaster* (White-bellied Sea Eagle)
- *Minopterus australis* (Little Bent-winged Bat) and *Miniopterus orianae oceanensis* (Large Bent-winged Bat)
- *Ninox strenua* (Powerful Owl)

- *Pandion cristatus* (Eastern Osprey)
- *Pteropus poliocephalus* (Grey-headed Flying-Fox).

Targeted flora surveys were carried out in line with 'Surveying threatened plants and their habitats: NSW survey guide for the Biodiversity Assessment Method' (DPIE, 2020). They were carried out for five species credit flora species considered to have a moderate likelihood of occurrence prior to the field study:

- Acacia pubescens (Downy Wattle)
- Callistemon linearifolius (Nettled Bottle Brush)
- Dillwynia tenuifolia
- Grevillea juniperina subsp. juniperina (Juniper-leaved Grevillea)
- Haloragis exalata subsp. exalata (Square Raspwort).

Targeted fauna surveys were carried out for one species credit fauna species (*Litoria aurea* (Green and Golden Bell Frog)) considered to have a moderate likelihood of occurrence within the BAR study area.

Due to project timing not aligning with the optimal timing or conditions to detect some species, targeted surveys have not been conducted for the following species credit species with a moderate likelihood of occurrence within the BAR study area:

- Meridolum corneovirens (Cumberland Plain Land Snail)
- Myotis macropus (Southern Myotis).

Based on the Transport guidelines, where a species credit species with a moderate to high likelihood of occurrence has not been adequately surveyed, then the species may be assumed present.

Further details on the potential habitat for each of these species is provided in Appendix H to the REF.

Species polygons

Where species-credit species are recorded (or assumed present), species polygons should be used to accurately assess the impact of the proposal and, if required, assist in the calculation of offsets. As mentioned, the following two species credit species have been assumed to be present within the BAR study area:

- Meridolum corneovirens (Cumberland Plain Land Snail)
- Myotis macropus (Southern Myotis)

Species polygons have been created in line with the BAM and specific requirements listed for each species in their threatened biodiversity data collection profile.

Aquatic surveys

A habitat assessment was conducted for threatened aquatic species, populations and ecological communities listed under the FM Act. The habitat value of each waterway (i.e., habitat sensitivity and classification of waterways for fish passage) was characterised in line with NSW DPI (Fisheries) document *Policy and Guidelines for fish habitat conservation and management (2013 update)*. The waterway habitat assessment included:

- Ecosystem type (e.g., wetlands, floodplains, streams, estuaries, lakes)
- Dimensions of waterway and depth of water
- Flow characteristics and hydrological features of aquatic habitat, including changes to drainage and filtration and flow regime
- Bed substrate (e.g., rocks, coral, gravel, sand, mud)
- Habitat features (e.g., pools, riffles, billabongs, reefs)
- Existing infrastructure and barriers to fish movement (natural or artificial)
- Width and species composition of riparian vegetation including the type of vegetation present (e.g., macrophytes, snags, seaweeds, seagrasses, mangroves, saltmarsh) and condition
- Water quality (based on visual observations).

Matters of National Environmental Significance (MNES)

The following MNES are relevant to the proposal:

- Listed threatened species and communities
- Listed migratory species

The PMST report indicated the following twelve EPBC listed threatened ecological communities have the potential to occur within the BAR study area:

- Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland
- Cooks River/Castlereagh Ironbark Forest of the Sydney Basin Bioregion
- Western Sydney Dry Rainforest and Moist Woodland on Shale
- Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion
- Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest
- Coastal Upland Swamps in the Sydney Basin Bioregion
- Castlereagh Scribbly Gum and Agnes Banks Woodlands of the Sydney Basin Bioregion
- Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community
- River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria
- Subtropical and Temperate Coastal Saltmarsh
- Turpentine-Ironbark Forest of the Sydney Basin Bioregion
- Shale Sandstone Transition Forest of the Sydney Basin Bioregion

As described above, vegetation surveys were carried out to determine the best-fit PCTs within the BAR study area. The site assessment and subsequent analysis established that no TECs listed under the EPBC Act were present within the BAR study area based on the minimum condition criteria not being met.

The PMST database search indicated 94 EPBC listed threatened species and 46 listed migratory species have the potential to occur within the BAR study area. A habitat assessment was subsequently carried out to assess the likelihood of each threatened and/or migratory species occurring in the BAR study area.

The site assessment revealed that two threatened species have a moderate to high potential of occurring within the BAR study area. These included:

- *Hirundapus caudacutus* (White-throated Needletail), Vulnerable and Migratory
- *Pteropus poliocephalus* (Grey-headed Flying-fox), Vulnerable.

A Significant Impact Assessment was conducted for these two species, which can be found in Appendix H of this REF. It was determined that the proposal would not lead to a significant impact on any threatened species listed under the EPBC Act. Therefore, no EPBC Act referral is required.

6.6.2 Existing environment

Landscape features

The landscape context of the BAR study area (which includes the proposal area and nearby areas of vegetation surveyed) is described in Table 6-45. The BAR study area is illustrated in Figure 6-23a-b.

Table 6-45 Proposal landscape features

Landscape feature	BAR study area
IBRA bioregions and subregions	• Cumberland IBRA subregion (Version 7), which forms part of the Sydney Basin IBRA region (Version 7)
NSW Landscapes Region (Mitchell Landscapes)	• Georges River Alluvial Plain and Ashfield Plains

Landscape feature	BAR study area
Soils and geology	• The BAR study area occurs over disturbed terrain, Richmond and Blacktown soil landscapes
Rivers and streams	• Georges River and associated tributaries including the Milperra Drain
Wetlands	• One important wetland occurs along the boundary of the northern ancillary facility and the proposal intersects the coastal wetland proximity area
Areas of geological significance and soil hazard features	• No areas of geological significance (including karst, caves, crevices and cliffs) occur within the BAR study area. The BAR study area does comprise areas with a high probability of acid sulphate soil risk, particularly alluvial sediments associated the Georges River Alluvial Plain Mitchell Landscape
Key Fish Habitat	• No key fish habitat occurs within the BAR study area, however key fish habitat is mapped along the Georges River, around 570 metres downstream of the BAR study area

Figure 6-23a BAR study area

Figure 6-23b BAR study area

Native Vegetation

Five NSW Plant Community Types (PCTs) were recorded in the BAR study area and two vegetation zones were identified. A summary of PCTs and vegetation zones are presented in Table 6-46.

Threatened Ecological Communities

A total of four TECs listed under the BC Act were recorded in the BAR study area, all of which are listed as endangered ecological communities (EEC).

Table 6-46 Plant Community Types and vegetation zones

Plant Community Type (PCT)	Condition	Threatened ecological community under BC Act	Area (ha) in BAR study area
PCT 725 – Broad-leaved Ironbark – Melaleuca decora shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin Bioregion	Low	Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion (EEC)	0.14
PCT 781 – Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion	Good	Not a TEC	0.08
PCT 835 – Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Moderate	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (EEC)	2.20
PCT 1067 – Parramatta Red Gum woodland on moist alluvium of the Cumberland Plain, Sydney Basin Bioregion	Moderate	Castlereagh Swamp Woodland Community (EEC)	0.13
PCT 1800 – Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter Valley	Moderate	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (EEC)	0.99
Planted native vegetation			2.66
Exotic vegetation			8.47

Threatened species

No threatened species of flora were detected within the BAR study area during the survey period. Based on desktop assessments, the Green and Golden Bell Frog had a moderate likelihood of occurrence, meaning targeted surveys were carried out. Targeted surveys showed that there was a low likelihood of occurrence of this species due to suboptimal foraging and breeding habitat in the BAR study area.

Based on the Transport guidelines, where a species with a moderate to high likelihood of occurrence has not been adequately surveyed, then the species may be assumed present. The habitat suitability assessment indicated that the following species have a moderate to high likelihood of occurring within the BAR study area, due to suitable foraging and breeding habitat for these species:

- *Meridolum corneovirens* (Cumberland Plain Land Snail) – potential habitat is present within the BAR study area (i.e., leaf litter, logs). Numerous records of this species within the locality. A survey of suitable habitat for Cumberland Plain Land Snail is recommended prior to construction to determine presence/absence.
- *Myotis macropus* (Southern Myotis) – high mobility and may intermittently use the BAR study area for foraging and breeding. Several records of this species within the locality.

For the Cumberland Plain Land Snail, areas of potential habitat within the BAR study area include unmown areas of PCT 835 (Moderate condition) as it contains a good cover of leaf litter and logs. All other associated PCTs do not contain suitable habitat for this species, as they occur in predominantly mown areas which do not contain a good cover of leaf litter and logs suitable for the persistence of this species. A total of 1.02 hectares of potential habitat for Cumberland Plain Land Snail was identified within the BAR study area.

For the Southern Myotis, all habitat in the BAR study area within 200 metres of a waterbody with stretches 3 metres or wider including rivers, creeks, billabongs, lagoons, dams and other waterbodies were deemed potential habitat. This includes all mapped streams and dams near the BAR study area. A total of 2.11 hectares of potential habitat for the Southern Myotis was identified.

Based on a habitat suitability assessment, fourteen BAM ecosystem credit species (or dual credit species where no breeding habitat is identified) have a moderate to high likelihood of occurrence within the BAR study area. These species are highly mobile and may intermittently use the BAR study area for foraging and/or breeding. These species are:

- *Artamus cyanopterus* (Dusky Woodswallow), Vulnerable BC Act
- *Daphoenositta chrysoptera* (Varied Sittella), Vulnerable BC Act
- *Falsistrellus tasmaniensis* (Eastern False Pipistrelle), Vulnerable BC Act
- *Glossopsitta pusilla* (Little Lorikeet), Vulnerable BC Act
- *Haliaeetus leucogaster* (White-bellied Sea-Eagle), Vulnerable BC Act
- *Hirundapus caudacutus* (White-throated Needletail), Vulnerable and Migratory, EPBC Act
- *Micronomus norfolkensis* (Eastern Coastal Free-tailed Bat), Vulnerable BC Act
- *Miniopterus australis* (Little Bent-winged Bat), Vulnerable BC Act
- *Miniopterus orianae oceanensis* (Large Bent-winged Bat), Vulnerable BC Act
- *Ninox strenua* (Powerful Owl), Vulnerable BC Act
- *Pandion cristatus* (Eastern Osprey), Vulnerable BC Act
- *Pteropus poliocephalus* (Grey-headed Flying-fox), Vulnerable BC Act; Vulnerable EPBC Act
- *Saccolaimus flaviventris* (Yellow-bellied Sheathtail-bat), Vulnerable BC Act
- *Scoteanax rueppellii* (Greater Broad-nosed Bat), Vulnerable BC Act

Aquatic habitat

One second order watercourse (Milperra Drain) is located within the BAR study area. This watercourse originates northeast of the BAR study area within Bankstown Golf Course and Ashford Reserve, and flows west underneath Henry Lawson Drive, then south of Auld Avenue and north of Keys Parade, and eventually entering the Georges River. This watercourse is not listed as Key Fish Habitat under the FM Act. An aquatic habitat assessment was carried out via a visual inspection.

The results of the assessment show that the stream is in a degraded condition and is not mapped as a suitable habitat for fish. The Fisheries Spatial Data Portal and Protected Matters Search was conducted to determine the likelihood of threatened freshwater aquatic species occurring within or next to the BAR study area. No species were determined to have a moderate to high potential to occur within the BAR study area, meaning no detailed aquatic survey was conducted.

6.6.3 Potential impacts

Construction

Removal of vegetation

The vegetation clearance boundary for the proposal is shown in Figure 6-24. This boundary excludes vegetation clearance at part of the ancillary facility south of the M5 Motorway. A summary of the direct impacts of the proposal on native vegetation is provided in Table 6-47. The amount of vegetation removal for the proposal is 11.44 hectares, which is comprised of 2.62 hectares of planted native vegetation, 5.76 hectares of exotic (non-native) vegetation and 3.06 hectares of native vegetation communities. The BAR study area is significantly larger than the existing design impact. This has been utilised to provide flexibility with the final design and ensure all ecological constraints are considered during this design phase. As such, the direct impacts are likely to be overstated, with the final construction footprint seeking to retain as many areas of native vegetation and fauna habitat as possible.

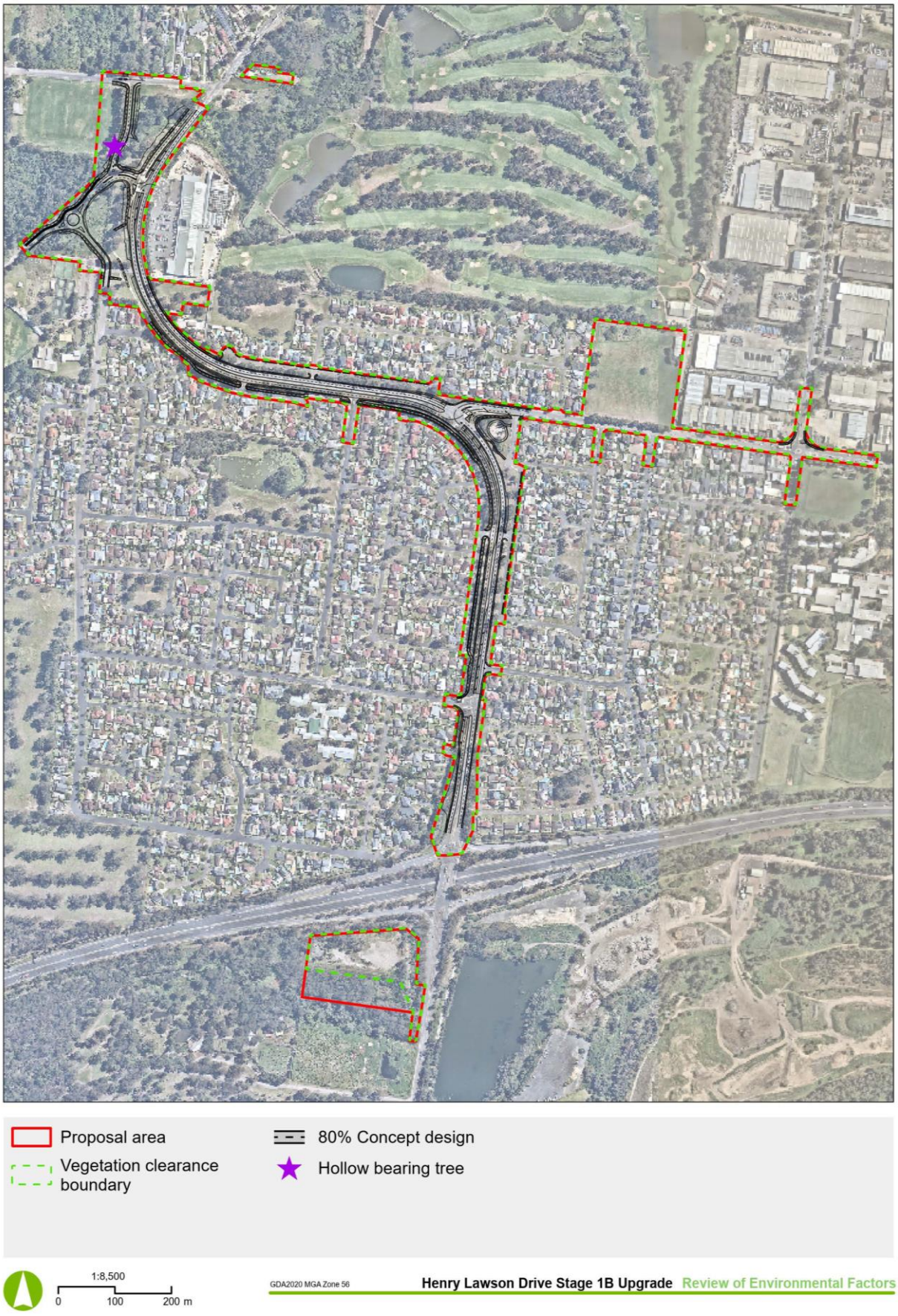


Figure 6-24 Vegetation clearance boundary

Table 6-47 Native vegetation impacts

Plant community type (PCT)	Broad condition class	TEC (under BC Act)	Area to be impacted (ha)
PCT 725 – Broad-leaved Ironbark – Melaleuca decora shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin Bioregion	Low	Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion (EEC)	0.14
PCT 781 - Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion	Good	Not a TEC	0.08
PCT 835–- Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Moderate	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (EEC)	2.16
PCT 1067 - Parramatta Red Gum woodland on moist alluvium of the Cumberland Plain, Sydney Basin Bioregion	Moderate	Castlereagh Swamp Woodland Community (EEC)	0
PCT 1800 - Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley	Moderate	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (EEC)	0.68
N/A	Planted Native Vegetation	N/A	2.62
Total:			**5.68**

Removal of threatened fauna habitat

Direct impacts on threatened fauna species and their habitat are summarised in Table 6-48. Primarily, the proposed impacts would result in the loss of potential foraging habitat for highly mobile threatened bats and birds. Key habitat features affected by the proposal would include the loss of one hollow-bearing tree (shown in Figure 6-24) that forms potential roosting/breeding habitat for hollow-dependent microbats.

Table 6-48 Threatened fauna species direct impacts

Species name	EPBC Act	BC Act	Credit type[1]	Potential occurrence (Moderate, High, Recorded)	Impact (ha)
Artamus cyanopterus (Dusky Woodswallow)	-	Vulnerable	Ecosystem	Moderate	3.06
Daphoenositta chrysoptera (Varied Sittella)	-	Vulnerable	Ecosystem	Moderate	2.98
Falsistrellus tasmaniensis (Eastern False Pipistrelle)	-	Vulnerable	Ecosystem	Moderate	5.68
Glossopsitta pusilla (Little Lorikeet)	-	Vulnerable	Ecosystem	Moderate	5.68
Haliaeetus leucogaster (White-bellied Sea-Eagle)	-	Vulnerable	Ecosystem	Moderate	3.06
Hirundapus caudacutus (White-throated Needletail)	Migratory	Vulnerable	Ecosystem	Moderate	3.06
Ninox strenua (Powerful Owl)	-	Vulnerable	Ecosystem	Moderate	2.98
Meridolum corneovirens (Cumberland Plain Land Snail)	-	Vulnerable	Species	Moderate	1.02
Micronomus norfolkensis (Eastern Coastal Free-tailed Bat)	-	Vulnerable	Ecosystem	Moderate	5.68
Miniopterus australis (Little Bent-winged Bat)	-	Vulnerable	Ecosystem	Moderate	5.68
Miniopterus orianae oceanensis (Large Bent-winged Bat)	-	Vulnerable	Ecosystem	Moderate	5.68
Myotis macropus (Southern Myotis)	-	Vulnerable	Species	Moderate	2.11
Pandion cristatus (Eastern Osprey)	-	Vulnerable	Ecosystem	Moderate	2.92
Pteropus poliocephalus (Grey-headed Flying-fox)	-	Vulnerable	Ecosystem	Moderate	5.68
Saccolaimus flaviventris (Yellow-bellied Sheathtail-bat),	-	Vulnerable	Ecosystem	Moderate	5.68
Scoteanax rueppellii (Greater Broad-nosed Bat)	-	Vulnerable	Ecosystem	Moderate	5.60

Removal of threatened flora

No threatened flora species were recorded within the BAR study area and none are considered likely to occur. As such, no impacts to threatened flora species are expected to result from the proposal.

Aquatic impacts

Aquatic habitat affected by the proposal would include a new creek crossing (box culvert) across Milperra Drain along the local link road between Auld Avenue and Keys Parade and road widening on Henry Lawson Drive south of the existing crossing. The new creek crossing would be near an existing footbridge crossing and the new link road would impact an artificial wetland (PCT 781) and areas of PCT 835 and PCT 1800.

There would be no direct impacts to Key Fish Habitat as a result of the proposal. Indirect impacts to Key Fish Habitat may result via disturbance to Milperra Drain as it flows into the Georges River, which is Key Fish Habitat. Disturbance to sediments during construction may affect water quality downstream. However, given the small width of the stream and the distance from the proposal to the Georges River (600 metres), the impact to water quality within Key Fish Habitat is expected to be negligible.

There would be no direct or indirect impact to threatened species, populations, ecological communities and their habitat listed under the FM Act. However, areas of riparian vegetation (PCT 1800 and PCT 835) would be affected in the form of canopy trees. The shrub and groundcover stratum are dominated by exotic flora.

No coastal wetlands are proposed to be impacted by the proposal. As the BAR study area intersects the proximity area for coastal wetlands, the Construction Environmental Management Plan (CEMP) should address hydrological management of the proposal to make sure nearby wetlands are not affected.

Injury and mortality

The proposal would include road widening, temporary disturbance of ancillary facilities and a new road link between Auld Avenue and Keys Parade. Given the existing long established urban landscape, the risk of injury and mortality during construction of the roads is considered low. Injury threat along Henry Lawson Drive is already present and road widening would not increase this risk.

The new link road between Auld Avenue and Keys Parade would present a new collision risk for fauna during construction and operation. However, this risk is expected to be low, given there are no large areas of nearby habitat that would support a large number of ground dwelling fauna, which are most at risk of injury during movement.

There is always a risk of fauna injury during removal of habitat, which can be reduced through pre-clearance surveys and clearing supervision.

Groundwater dependent ecosystems

The BAR study area contains high potential for terrestrial groundwater dependent ecosystems (GDEs) at the southern ancillary facility. High potential GDEs are also mapped just outside the northern section of the BAR study area. The vegetation associated with terrestrial GDEs within the BAR study area include the PCT 835 Cumberland Riverflat Forest and PCT 1800 Cumberland Swamp Oak Riparian Forest, both of which are associated with fresh water (see Figure 6-25).

It is noted in the soils, surface water and groundwater assessment in Appendix J of this REF that groundwater dependent ecosystems have the potential to be impacted by a number of construction activities, including:

- vegetation removal and soil erosion
- earthworks intercepting groundwater and waterlogged soils
- spillages from stockpiled materials at ancillary facilities
- concrete and asphalt activities
- dewatering and discharges
- works on waterfront lands.

However, the risk of aquifer interference and discharges to groundwater from the proposal is deemed to be low to very low. As such, the water table should not be affected by the proposal and the risk of changes to water availability to groundwater users and GDEs is also deemed to be low to very low. The risk of acid sulphate soils and contamination to groundwater is deemed to be moderate. Therefore, taking a conservative approach, the risk to water quality becoming unsuitable for groundwater users and GDEs is also deemed to be moderate.

Figure 6-25 Groundwater Dependent Ecosystems

Operation

Wildlife connectivity and habitat fragmentation
There are no large areas of habitat that would become fragmented by the proposal. The landscape is already highly fragmented and only likely to be used by highly mobile birds and bats.

The riparian vegetation within the north of the BAR study area currently provides tenuous connectivity between native vegetation to the east and west. However, cleared land and Henry Lawson Drive already present barriers to fauna movements across this corridor, which is likely to be used by highly mobile birds and bats. Removal of vegetation within this location would increase the distance between vegetation patches along the riparian corridor, which could be problematic for short-range endemic species, such as the Cumberland Plain Land Snail. A targeted survey would be carried out during detailed design to determine if this species is present. If present, pre-clearing surveys would also be required so that any individuals can be relocated to areas of native vegetation that are to be retained.

Common peri-urban species such as possums are likely to occur within the BAR study area and would have adapted to navigating through the developed landscape and to the risk of predation by feral and domestic animals and vehicle strike. Removal of vegetation within the BAR study area would remove connectivity for these species.

The vegetation along the roadsides, which is mostly mapped as Planted Native Vegetation, provides stepping-stone habitat for highly mobile birds and bats. Removal of this vegetation would increase the distance between patches of planted roadside vegetation. However, other similar habitat is present throughout the urban area such as roadside plantings and golf course public reserves.

Edge effects on adjacent native vegetation and habitat
The vegetation within the BAR study area is already highly disturbed. There are no large patches of undisturbed vegetation that would contain an undisturbed core. The southern ancillary facility has connectivity to larger areas of native vegetation along the Georges River. However, the ancillary facility would use an existing hardstand fenced compound and removal of nearby native vegetation would not be required. Weed species are prolific in this area, so any clearing along the existing access track would be within heavily disturbed vegetation.

Likewise, the condition of the vegetation around the Milperra Drain is heavily disturbed, with native vegetation restricted to the canopy and exotic species dominant within the shrub and ground stratum. While new edges would be created in this area due to the proposed new link road and road widening of Henry Lawson Drive, edge effects already extend throughout these patches of vegetation, based on the high cover of exotic species.

Injury and mortality
The likelihood of vehicle strike during operation of the proposal would be low given the landscape is already highly disturbed. While injury and mortality would be a new risk to wildlife along the proposed link road between Auld Avenue and Keys Parade, the landscape is not part of a large corridor of intact vegetation where fauna movements would be common.

Invasion and spread of weeds
Exotic species are dominant throughout the entire BAR study area, particularly within the groundcover and mid-storey. There is always a risk that a new species of weed is introduced to an area. However, given the landscape is already heavily infested with exotic species, this risk is low as it would not result in competition with native species, but rather already established weeds.

Invasion and spread of pests
Pest species were not recorded during the field survey, however pest species including the European Fox, the black rat, rabbits and bird species such as the Indian Myna were recorded in the WSP survey (2021). The proposal is unlikely to introduce other pest fauna or increase the spread of existing pest species.

Invasion and spread of pathogens and disease
There was no evidence of known diseases within the BAR study area. Of most risk to the BAR study area is the introduction of infected soil containing Myrtle Rust of Chytrid Fungus. ‘Come clean - go clean’ protocols for plant and equipment, use of clean fill and use of plant material including mulch from plants within the proposal area would reduce this risk.

Changes to hydrology
The existing hydrology is already altered due to development of the proposal area and surrounding land. Final design may result in increased runoff due to a larger area of impervious road surface. Stormwater

design would aim to maintain the existing flood regimes and levels and adequately treat stormwater within the pavement drainage system prior to discharge.

Noise, light, dust and vibration

Noise, light, dust and vibration impacts as a result of the proposal would be minimal when considering the existing background levels along roads and nearby urban areas. Temporary increases in these impacts would occur during construction and operation, but these are unlikely to displace local fauna or have long-term effects given existing local fauna would have already adapted to these disturbances.

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 *Biodiversity Conservation Act, 2016* or *Fisheries Management Act 1994* and therefore a *Species Impact Statement* or Biodiversity Development Assessment Report is not required.

6.6.4 Safeguards and management measures

Table 6-49 Biodiversity safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
Removal of native vegetation	Native vegetation and threatened flora removal would be minimised through detailed design and construction.	Transport	Detailed design
	Pre-clearing surveys would be carried out in line with Guide 1: Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011a).	Transport	Pre-construction
	Vegetation removal would be carried out in line with Guide 4: Clearing of vegetation and removal of bushrock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011a) and native vegetation would be re-established in line with Guide 3: Re-establishment of native vegetation of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011a).	Transport	Construction
	The unexpected species find procedure would be followed under *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011a) if threatened ecological communities, not assessed in the biodiversity assessment, are identified in the proposal site.	Transport	Construction
	The impacts of the proposal to vegetation and threatened species habitat would be offset in line with Transport's Biodiversity Policy (Transport, 2022c), including consideration of no net loss to biodiversity and tree and hollow replacement. A Biodiversity Offset Strategy would be prepared for vegetation zones requiring offsetting.	Transport	Detailed design
	A Tree and Hollow Replacement Plan would be prepared for any residual biodiversity impact that does not require offsets in line with the Biodiversity Policy. Where suitable land is not available for replacement, payment would be made to the Transport Conservation Fund.	Transport	Detailed design
	Vegetation clearance would only occur within the vegetation clearance boundary.	Contractor	Pre-construction / construction

Impact	Environmental safeguards	Responsibility	Timing
Removal of threatened fauna habitat	Threatened fauna habitat removal would be minimised through detailed design and construction.	Transport	Detailed design
	Fauna would be managed in line with Guide 9: Fauna handling of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011a).	Transport	Construction
	Habitat removal would be carried out in line with Guide 4: Clearing of vegetation and removal of bushrock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011a) and habitats would be replaced or re-instated in line with Guide 5: Re-use of woody debris and bushrock and Guide 8: Nest boxes of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011a).	Transport	Construction
	The unexpected species find procedure would be followed under Guide 1: Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011a) if threatened fauna, not assessed in the biodiversity assessment, are identified in the proposal area.	Transport	Construction
	Targeted surveys for Cumberland Plain Land Snail would be carried out during detailed design to determine the presence of any locally occurring populations. If populations are not present during targeted surveys, the BAR should be revised and liabilities should be offset. If populations are present during targeted surveys, pre-clearing surveys should be carried out for the Cumberland Plain Land Snail. Any individuals found should be relocated to areas of retained native vegetation. In addition, all large woody debris should be removed from impact areas and relocated to areas of retained native vegetation.	Transport / Contractor	Detailed design / Construction
Aquatic impacts	Impacts to aquatic habitat would be minimised through detailed design and construction.	Transport	Detailed design
	Aquatic habitat would be protected in line with Guide 10: Aquatic habitats and riparian zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011a) and Section 3.3.2 Standard precautions and mitigation measures of the Policy and guidelines for fish habitat conservation and management Update 2013 (DPI (Fisheries NSW) 2013).	Transport	Construction
	Depending on the final design, a permit may be required from DPI for dredging and reclamation and obstruction to fish habitat.	Transport	Construction
GDEs	Interruptions to water flows associated with groundwater dependent ecosystems would be minimised through detailed design.	Transport	Detailed design

Impact	Environmental safeguards	Responsibility	Timing
Changes to hydrology	Changes to existing surface water flows would be minimised through detailed design. New drainage infrastructure and water quality controls would be installed within the proposal area. This includes upgrading drainage pits and pipes, and the installation of bioretention basins and swales.	Transport	Detailed design
Fragmentation of identified habitat corridors	For landscape scale connectivity impacts, a Wildlife Connectivity Strategy would be prepared as part of final design in line with the requirements of the Transport Biodiversity Policy. Connectivity measures would be implemented in line with the *Draft Wildlife Connectivity Guidelines for Road Projects* (RTA 2011b) or equivalent updated NSW Guidelines. Connectivity measures would be considered for impacts which are not considered a landscape scale connectivity impact in line with *the Draft Wildlife Connectivity Guidelines for Road Projects (RTA 2011b)* or equivalent updated NSW Transport Guidelines.	Transport	Detailed design / pre-construction / construction
	Any connectivity measures implemented would be installed under the supervision of an experienced ecologist.	Transport	Construction
Edge effects on adjacent native vegetation and habitat	Exclusion zones would be set up at the limit of clearing in line with Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011a).	Transport	Construction
Injury and mortality of fauna	Fauna would be managed in line with Guide 9: Fauna handling of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011a).	Transport	Construction
Invasion and spread of weeds	Weed species would be managed in line with Guide 6: Weed management of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011a).	Transport	Construction
Invasion and spread of pests	Pest species would be managed within the proposal area.	Transport	Construction
Invasion and spread of pathogens and disease	Pathogens would be managed in line with Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011a).	Transport	Construction
Noise, light, dust and vibration	Shading and artificial light impacts would be minimised through detailed design.	Transport	Detailed design

6.6.5 Biodiversity offsets

This section details the process of identifying the biodiversity impacts in this proposal that trigger thresholds set out in Transport's Biodiversity Policy (Transport, 2022c). These thresholds are outlined in Table 6-50. Residual impacts that do not exceed offset thresholds must then consider tree and hollow replacement in line with the Biodiversity Policy.

Table 6-50 Thresholds set out by the Biodiversity Policy

Threshold No.	Impact	Threshold
1	Works involving clearing of a CEEC	Where there is any clearing of an CEEC in 'moderate to good' condition
2	Works involving clearing of an EEC	Where clearing of a EEC ≥ 2ha in 'moderate to good' condition
3	Works involving clearing of VEC	Where clearing of VEC ≥ 5ha in 'moderate to good' condition
4	Works involving clearing of any habitat for a known species credit fauna species or clearing of breeding habitat (as defined by the TBDC) for dual-credit fauna species (excluding exotic and planted vegetation that cannot be assigned to a plant community type)	Where clearing ≥ 1ha in 'moderate to good' condition
5	Works involving removal of known threatened flora species and their habitat	Where loss of individuals is ≥10 or where clearing of habitat is ≥ 1ha
6	Type 1 or Type 2 key fish habitats	Where there is a net loss of habitat
7	Any residual biodiversity impact that doesn't require offsets in line with the Biodiversity Policy is to be assessed against the requirements for tree and hollow replacement.	Any clearing of hollows and/or trees ≥5cm DBH

The assessment of vegetation impacts against thresholds is outlined in Table 6-51. This revealed that no vegetation zones trigger the offset thresholds as they either involve clearing less than 2 hectares of an EEC in 'moderate to good' condition, or the vegetation zone is in low condition. The extent of PCT 835 moderate includes 1.44 hectares of remnant/regrowth and 0.72 hectares of roadside planted native vegetation that has been assigned to this vegetation zone based on species composition and landscape position. As planted native vegetation does not require offsets under the Biodiversity Policy, the extent of this PCT that may require offsetting is 1.44 hectares, which is below the two hectare threshold.

As the proposal would involve residual biodiversity impact to vegetation zones, which would not require offsets in line with the Biodiversity Policy, these PCTs have subsequently been assessed against the requirements for tree and hollow replacement.

The assessment of impacts to threatened species habitat revealed that the following two species credit species have triggered the offset thresholds, as the proposal involves clearing of habitat greater than 1 hectare in 'moderate to good' condition (excluding exotic and planted vegetation that cannot be assigned to a plant community type):

- *Meridolum corneovirens* (Cumberland Plain Land Snail).
- *Myotis macropus* (Southern Myotis).

As the threshold has been triggered, offsetting would be required for these species.

Table 6-51 Vegetation assessment against thresholds

Plant community type (PCT)	Assigned Transport condition	TEC	Impact area (ha)[1]	Threshold triggered?
PCT 725 - Broad-leaved Ironbark - Melaleuca decora shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin Bioregion	Low	Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion (EEC)	0.14	**No offset threshold triggered. Tree and hollow replacement required.–**
PCT 781 - Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion	Good	Not a TEC	0.08	**No offset threshold triggered. Tree and hollow replacement required.**
PCT 835–- Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Moderate	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (EEC)	2.16 – comprised of 0.72 hectares of planted vegetation (no offset required) and 1.44 hectares of remnant/regrowth	**No offset threshold triggered. Tree and hollow replacement required.**
PCT 1067 - Parramatta Red Gum woodland on moist alluvium of the Cumberland Plain, Sydney Basin Bioregion	Moderate	Castlereagh Swamp Woodland Community (EEC)	0	**No threshold triggered.**
PCT 1800 - Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley	Moderate	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (EEC)	0.68	**No offset threshold triggered. Tree and hollow replacement required.**
Planted Native Vegetation	N/A	N/A	2.62	**No offset threshold triggered. Tree and hollow replacement required.**

Calculation of tree and hollow replacement requirements requires counting trees and hollows within areas that do not require offsetting. A tree count would be required within each relevant vegetation zone to determine tree replacement requirements. Only one hollow bearing tree was present within the BAR study area, which would require replacement with three artificial hollows

Preliminary ecosystem credit calculations have been carried out for impacts that trigger the thresholds in the vegetation zones above, with the Cumberland Plains Land Snail and Southern Myotis requiring 18 and 32 species credits, respectively.

6.7 Socio-economic, property and land use

The potential socio-economic, property and land use impacts during construction and operation of the proposal have been assessed as part of the Henry Lawson Drive Upgrade Stage 1B Socio-economic impact assessment (Aurecon, 2023b), provided in Appendix I.

6.7.1 Methodology

The socio-economic impact assessment (SEIA) was prepared for a 'moderate' level assessment as per Transport's EIA-N05 Environmental Impact Assessment Practice Note – Socio-economic Assessment (Transport, 2020b). The moderate level of assessment is used as it reflects the proposal scale and magnitude of potential impacts to the socio-economic environment.

The SEIA used the following methodology:

- Establishment of the socio-economic study area
- Review of statutory planning and legislative requirements, including a review of existing State and local government strategies relevant to the social and economic environment of the socio-economic study area
- A summary of community consultation for the proposal including key community themes relevant to the socio-economic impact assessment. The description of stakeholder themes and concerns focused on impacts to access and connectivity for private vehicles, freight, and public and active transport, as well as amenity impacts associated with noise and vibration and visual impacts.
- Description of the existing environment of the socio-economic study area to establish baselines. The existing socio-economic environment is described in terms of:
  - an analysis of key population and demographic indicators, including data from the 2021 ABS Census of Population and Housing
  - an analysis of existing data and information on local business and industry, employment and income, and dwelling characteristics
  - a desktop audit of community facilities, public services and places of special interest drawing on Council's database to identify likely locations of community activity, and the distribution of services and facilities that are likely to be accessed by communities within the proposal area
  - a desktop audit of industrial zones and retail centres drawing on government and council databases to identify likely locations of businesses and traders
  - no additional baseline assessment has been carried out, as the existing assessment carried out for the Henry Lawson Drive Stage 1A REF informed this SEIA.
- Identification and assessment of the potential socio-economic impacts of the proposal's construction and operation on property, local amenity, social infrastructure, and access. The impact assessment considers sensitivity and magnitude to determine potential significance of impacts prescribed in Transport EIA-N05.
- Identification and assessment of management and mitigation measures to avoid, minimise, manage, or mitigate the proposal's impacts and enhance or maximise the proposal's benefits identified through the socio-economic impact assessment.

Three study areas were defined to factor in anticipated local social impacts and those likely to occur on a broader scale due to the proposal. These study areas are detailed in Table 6-52.

Table 6-52 Study areas used in the social impacts assessment

Area	Definition
Direct study area	This study area is an area that is within 200 metres of the proposal. The direct study area is the catchment where potential direct impacts would occur because of the proposal.
Socio-economic study area	The socio-economic study area covers indirect impacts which would be based on a 400-metre buffer from the proposal. The socio-economic study area includes receivers and dwellings that are not within the direct impact area but who would interact with the proposal area, either by driving, using the bus stops or the shared paths. Indirect impacts are likely to include amenity impacts and access and connectivity impacts. This area has been selected as a representation of the area surrounding the proposal and it is acknowledged that some indirect impacts may not extend that far, while others may extend further afield.
Broader study area	To provide context about the community, liveability and characteristics of the area surrounding the proposal, the broader study area is based on the following ABS areas: • Chipping–Norton Moorebank - Statistical Area Level 2 • Panania–North - Milperra - Statistical Area Level 2 • Condell Park - Statistical Area Level 2. Comparison was also made with the wider Canterbury-Bankstown LGA and Greater Sydney. These areas were selected as they are appropriate for comparison for a moderate level assessment.

The study areas are outlined in Figure 6-26.

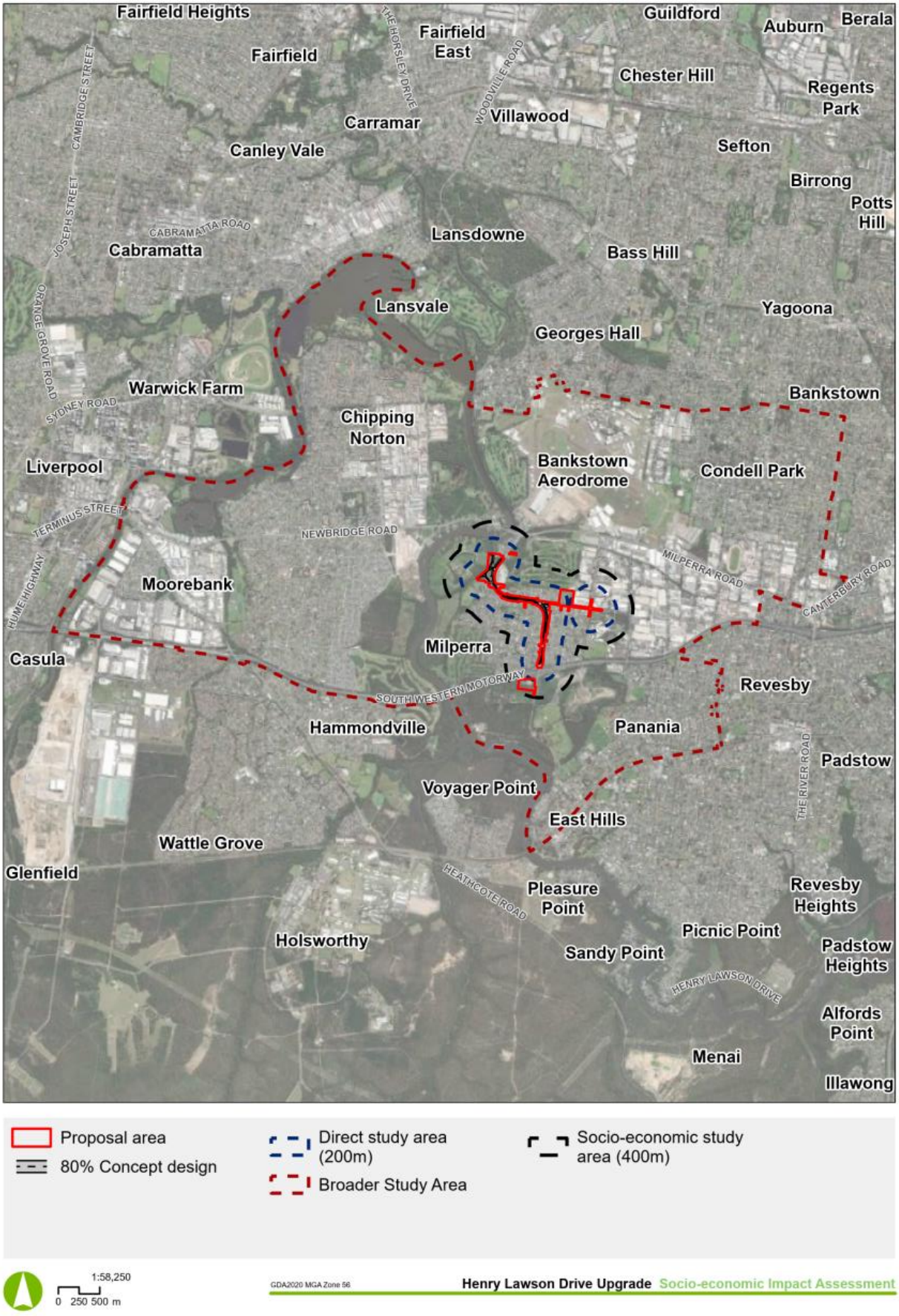


Figure 6-26 Broader and Direct study areas

This assessment has applied the impact grading matrix to assess the level of significance for potential negative impacts only. The impact grading matrix is shown in Table 6-53.

Table 6-53 Impact grading matrix

		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

6.7.2 Existing environment

The socio-economic characteristics of the broader study area are summarised in this section. The following information has been obtained from Census data.

Population

The Census usual resident population of the broader study area in 2021 was 44,926 people living in 13,660 dwellings with an average household size of 3.1. The population of the Canterbury Bankstown LGA was 371,006 that year, with close to 5.3 million residents living in the Greater Sydney area overall. The Canterbury Bankstown LGA population forecast for 2022 is 401,017 and is forecast to grow to 463,311 by 2036.

Age profile

In 2021, the median age in the broader study area was 36, which was slightly younger than Greater Sydney's median age of 37 years. There were 724 people (1.6 per cent) over the age of 85 living in the broader study area. About 28 per cent of residents of the broader study area counted in 2021 were children and young people (under 19 years). This is slightly higher compared to the 23 per cent registered in the Canterbury Bankstown LGA and the 22 per cent in Greater Sydney.

The broader study area had a higher than average share of children aged 0-4 years (14 per cent) and has a high share of parents and homebuilders (35-49 years) (16 per cent), suggesting there are many young families living in the area. It also indicates there could be a potential increased level of demand for age-based services and facilities, such as childcare.

Aboriginal and Torres Strait Islander residents

Around 1.2 per cent of the total population in the direct study area and 2.7 per cent in the socio-economic study area identified as being of Aboriginal and Torres Strait Islander descent at the 2021 Census, compared to the Greater Sydney average of 1.7 per cent and the LGA average of 0.8 per cent.

Industry of employment

In 2021, Health Care and Social Assistance, Construction, and Education and Training, were the top industries of employment in the broader study area. An average of 12.5 per cent of the broader study area residents (aged 15 years and over) were employed by the Health Care and Social Assistance sector, a similar proportion when compared to the Canterbury Bankstown LGA and Greater Sydney average of 13.04 per cent and 13.38 per cent respectively. This is likely explained by the proximity to the Liverpool Hospital (around 2 kilometres northwest of the proposal) and the Bankstown-Lidcombe Hospital (around 3.4 kilometres east of the proposal).

An average of 9.61 per cent of the broader study area residents were employed by the Education and Training sector, compared to the Greater Sydney rate of 8.49 per cent. This is likely explained by the proposal's proximity to the Western Sydney University campus to the east of the proposal. The Construction sector employs 8.85 per cent of the broader study area residents, compared to the Greater Sydney rate of 8.1 per cent.

Household income

In 2021, the median weekly household income in the broader study area was $1,937, lower than Greater Sydney's at $2,077. At the 2021 Census, 14.5 per cent of the broader study area households reported a weekly income of less than $800 per week compared to 17.9 per cent across Greater Sydney. Around 30 per cent of households in the broader study area reported having a weekly income of more than $3,000 per week, compared to 30 per cent in Greater Sydney.

Car ownership

In 2021, vehicle ownership in the broader study area ranged between 1.8 to 2 vehicles per household, with 71 per cent of households having two or more motor vehicles. In comparison, 45 per cent of households in the Canterbury Bankstown LGA and 46 per cent of Greater Sydney households had access to two or more motor vehicles. Only 4.8 per cent of households in the broader study area had no motor vehicles registered. The high vehicle ownership in the broader study area may be reflective of the levels of advantage or disadvantage in the local community, the reliance on private motor vehicles to travel to work, and the lack of public or active transport choices for residents.

Social infrastructure

The direct study area and socio-economic study area have a mix of urbanised and natural open parklands comprising a combination of low-density residential dwellings, commercial and industrial areas and open recreational spaces near the Georges River and M5 Motorway. Social infrastructure within or near to the proposal area including the Bankstown Golf Course, Milperra Public School, East Hills High School, East Hills childcare centre, Western Sydney University, Milperra Lions Soccer Club and Milperra Histopath Pathology Drive-thru Clinic. It is likely that the local community use Henry Lawson Drive and connecting streets to access these social infrastructure facilities.

Areas of community interest

Within communities, there are areas that hold value and are appreciated by the community. This includes local spaces, gathering areas, roadside memorials and other places that are valued by the community. The following three primary areas of community value are located within the direct study area:

- Georges River
- Newland Avenue and Newland Reserve (Named after WWI Victory Cross recipient James Newland)
- Ingram Avenue (Named after George Morb Ingram who was a Victoria Cross recipient from WWI).

Access and connectivity

The following travel patterns were identified from the review of ABS data:

- There is a higher proportion of residents in the Canterbury Bankstown LGA (8.6 per cent) and Greater Sydney (8.4 per cent) who commute to work by public transport (train, bus, ferry, tram/light rail) when compared to the broader study area (3.8 per cent).
- The preferred method of travel to work in the broader study area, the Canterbury Bankstown LGA and Greater Sydney was *travel to work by car (as driver)* and *(as passenger).* The high vehicle ownership in the broader study area may be reflective of the levels of advantage or disadvantage in the local community, the reliance on private motor vehicles to travel to work, and the lack of public or active transport choices for residents.
- Travel to work by train was the third most used method of travel to work in the broader study area, the Canterbury Bankstown LGA and Greater Sydney.

Other key transport features of relevance include:

- Main roads within the proposal area, including Henry Lawson Drive, Milperra Road and the M5 Motorway.
- Bus services as the main form of public transport through the broader study area. There are currently bus stops located within the direct study area on Amiens Avenue at Henry Lawson Drive, at Ganmain Crescent, on Pozieres Avenue before Henry Lawson Drive, on Henry Lawson Drive opposite Pozieres Avenue and on Pozieres Avenue opposite Milperra Public School. Bus services, such as route 922 and 962, travel along Pozieres Avenue and Amiens Avenue. School bus services for local educational facilities including Milperra Public School use these local services in combination with dedicated school buses. Other bus services, such as 922, M90, 962 and S5, travel along Bullecourt Avenue and service important facilities in the area such as Western Sydney University.
- A continuous shared path on the western/southern side of Henry Lawson Drive from Auld Avenue to Ruthven Avenue/Eynham Road intersected by general roads, and a series of shorter shared paths on the eastern side scattered between Bullecourt Avenue and the M5 Motorway. Connected shared paths continue south of the M5 Motorway towards Kelso Park North.
- The provision of an important route for freight and industrial type business operations designated as a B-Double access route that connects the surrounding large industrial areas of Milperra, Revesby, Chipping Norton and Moorebank.

Community values

The City of Canterbury Bankstown Council's Community Strategic Plan (CSP) was used to inform the community values for the SEIA as it was developed recently and informed by extensive community consultation. The CSP defines the vision and priorities of the community and is designed to improve life for its residents.

Residents have voiced several features of what they love about their community, such as having good access to a range of parks and open spaces, diverse children's playgrounds, a variety of local food and shopping, an abundance of local events and good train services. Areas for improvement that communities would like to see that are relevant to the proposal include:

- better designed and well–managed development, including affordable housing, enough off–street car parking and not too much high density or overcrowding
- easier movement around the city, with less congestion, more parking, less bumpy roads; and
- a family friendly, pet friendly and child friendly city.

Land use and zoning

Henry Lawson Drive is zoned as SP2 – Infrastructure, as a key connection for traffic movement between the Hume Highway, Milperra Road/Newbridge Road, and the M5 Motorway. Most of the land surrounding the proposal is mapped as R2 – Low Density Residential. The area on the south-western end of Henry Lawson Drive and south of Bullecourt Avenue is largely zoned as RE2 – Private Recreation and R2 – Low Density Residential. There are a range of industrial services within the socio-economic study area, comprised of medium and large-scale warehousing and industrial parks and associated businesses, including the Milperra Industrial Park, which is on the eastern side of the socio-economic study area, north of Bullecourt Avenue and east of Ashford Avenue.

Property

Property within the proposal area is owned by:

- Transport for NSW
- Canterbury Bankstown City Council
- the Crown (crown land)
- private owners such as residents and businesses.

There are also properties across the Canterbury Bankstown LGA that form part of the NSW Government's Floodplain Management Program to implement voluntary purchase schemes. The purpose of this program is to reduce risks to properties in highly hazardous flood conditions from riverine or overland flooding (Office of Environment and Heritage, 2013). There is one property within the proposal area that is subject to the program, located at 439 Henry Lawson Drive which has been identified as an ancillary facility for the proposal.

6.7.3 Potential impacts

Construction

The proposal is expected to have some adverse impacts during the construction phase, these are shown in Table 6-54.

Table 6-54 Construction social impacts

Aspect	Impact (with mitigation)	Sensitivity	Magnitude	Overall impact
Property	Impacts to property would include: • driveway adjustments that could have moderate amenity/visual impacts to properties along Bullecourt Avenue and Henry Lawson Drive • adjustments to properties on Ingram Avenue and Fromelles Avenue where footpaths would be constructed • adjustments to properties on the northern side of the Bullecourt Avenue / Ashford Avenue intersection • partial acquisition of an entire lot of land that forms part of the Milperra Sports Centre for use as an ancillary facility and for the extension of Raleigh Road • full acquisition of lots along the existing Henry Lawson Drive Road corridor that are currently owned by Council • no acquisition of residential properties (property acquisition details can be found in section 3.6).	Moderate	Moderate	Moderate
Land use	Land use impacts would be limited to changes for areas required for ancillary facilities and construction activities.	Moderate	Low	Moderate-low
Access and connectivity	Access and connectivity impacts would include: • temporary local road / Henry Lawson Drive intersection (Raleigh Road, Ingram Avenue, Amiens Avenue, Ganmain Crescent, Fromelles Avenue and Hermies Road) changes to facilitate the construction of the proposal. This would result in temporary full closures of intersections but would be staged so that not all intersections would be closed off at the one time to allow people access to Henry Lawson Drive. A Traffic Management Plan (TMP) would be developed prior to construction which would incorporate local road and intersection changes • construction traffic, slower speeds around construction areas and the installation of temporary traffic arrangements which may result in traffic delays • temporary relocation or temporary closure of bus stops along Henry Lawson Drive which may impact public transport users, particularly the elderly and less mobile • removal of up to eight parking spaces on Auld Avenue near the Auld Avenue link road to allow the construction of the link road to tie-in with Auld Avenue	High	Moderate	Moderate-high

Aspect	Impact (with mitigation)	Sensitivity	Magnitude	Overall impact
	• driveway adjustments which would cause temporary disruptions during construction. Changes in access from freely accessible prior to construction to potentially altered and delayed access may cause frustration for some stakeholders. Access for emergency services would be maintained.			
Social infrastructure	Impacts to social infrastructure would include: • the temporary closure or adjustment of footpaths and shared paths around the widening works which could result in changes to connectivity along Henry Lawson Drive to the Georges River and the surrounding recreational areas • access and amenity impacts (including noise and visual impacts from construction) at the Auld Avenue / Henry Lawson Drive intersection and ancillary facility impacts to patronage of Gordon Parker Reserve • vehicular and pedestrian access to large areas of playing fields and parklands near the proposal being impacted particularly during busy weekend sport periods, although alternative access arrangements would be provided to maintain access • potential impacts to the community enjoyment and attractiveness of community facilities as access to social infrastructure in the broader study area accessed via Henry Lawson Drive would be impacted by construction traffic and potential delays around construction areas • increased construction related traffic which may impact access and travel times to educational facilities in the direct study area and socio-economic study area.	Moderate	Moderate	Moderate
Business and commercial	Business and commercial impacts would include: • amenity impacts in the form of noise and visual impacts for businesses closest to the proposal, specifically at the Flower Power complex, Milperra Sports Centre and businesses at the Bullecourt Avenue / Ashford Avenue intersection • impacts to freight drivers and heavy vehicles with time-crucial deliveries from traffic delays and detours around construction sites • increased traffic activity through construction work force and machinery • impacts to businesses on the northern side of the Bullecourt Avenue / Ashford Avenue intersection in the form of temporary access disruptions due to intersection works.	Moderate	Moderate	Moderate
Amenity and community	Amenity and community impacts would include: • impacts to the amenity of sensitive receivers near the proposal in the form of noise, visual and air quality impacts, particularly when noise or vibration intensive equipment is used near receivers	Moderate	High	Moderate-high

Aspect	Impact (with mitigation)	Sensitivity	Magnitude	Overall impact
	• increased traffic activity through construction work force and machinery • potential sleep disturbance and higher impacts during noisy works • vegetation removal which would reduce the visual amenity of the direct study area • potential impacts to the community's use of public recreational greenspace, impacting facilities enjoyment and wellbeing • impacts to the Milperra memorial sign which would need to be permanently relocated to accommodate the road widening in this area. The relocation of the roadside memorial would be carried out in consultation with the council.			
Cumulative impacts	Cumulative construction impacts would include: • impacts in the form of construction fatigue, amenity impacts and traffic impacts from proposed developments near the proposal, including the Riverlands Development, the Anglicare Seniors Living development on Bullecourt Avenue, the potential Western Sydney University development to allow for residential housing, and other projects that form part of the Henry Lawson Drive Upgrade program of works • potential consultation and construction fatigue for local communities and stakeholders due to the proximity and timing of these projects.	Moderate	Moderate	Moderate

Operation

Socio-economic impacts during the operation phase of the proposal are shown in Table 6-55.

Table 6-55 Operational social impacts

Aspect	Impact (with mitigation)	Sensitivity	Magnitude	Overall impact
Property	Operational property impacts would include: • impacts from the partial acquisition of private property (strip acquisition) which would be required to accommodate the extension of Raleigh Road, the development of Keys Parade, and to upgrade the northern side of the Bullecourt Avenue / Ashford Avenue intersection • impacts from the acquisition of land which is currently publicly accessible along Henry Lawson Drive and the future Auld Avenue to Keys Parade link road • driveway adjustments that could have moderate amenity/visual impacts to properties along Bullecourt Avenue and Henry Lawson Drive.	Low	Moderate	Low-moderate
Land use	Operational land use impacts would include: • changes in land use in the road corridor, such as areas that were previously vacant or vegetated land alongside Henry Lawson Drive forming part of the road footprint during the operational phase • impacts associated with permanent land use changes for the bioretention basin and associated maintenance infrastructure • temporary impacts from the change in land use at the section of the Milperra Sports Centre proposed to be acquired for road widening, which would be restored to previous use in consultation with the property owner • the conversion of a shared path into a road with a shared path for the new link road between Auld Avenue and Keys Parade (avoiding impacts to Gordon Parker Reserve).	Low	Moderate	Low-moderate
Access and connectivity	Operational access and connectivity impacts would include: • Changing local road access arrangements which could increase the risk of residential isolation particularly for the residential developments to the south-western side of Henry Lawson Drive. However, most of the intersections along the Henry Lawson Drive length would become left in and left out for safety reasons. Residents would be required to take new routes to access properties and businesses. Details of these new routes are included in Section 3.2.3 of this REF and Appendix I	Moderate	Moderate	Moderate

Aspect	Impact (with mitigation)	Sensitivity	Magnitude	Overall impact
	• the implementation of left in left out access at side streets which has the potential to increase travel times for residents and road users but would maintain safe access to Auld Avenue • proposed right turn restrictions which have the potential to create additional traffic on local roads, such as Dernancourt Parade and Pozieres Avenue, as local traffic navigates the network to access Henry Lawson Drive • negligible impacts to public bus services, with the bus stop currently located south of Pozieres Avenue to be moved north of the intersection with Henry Lawson Drive • improved safety for motorists at key locations including: – Henry Lawson Drive intersections with Auld Avenue, Ruthven Avenue, Whittle Avenue, Amiens Avenue, Ganmain Crescent, Fromelles Avenue and Hermies Avenue – Henry Lawson Drive / Bullecourt Avenue intersection: provision of additional right turn bays which would increase turn storage capacity and reduce the risk of road blockage and rear end collisions, as well as the conversion of the left turn exit lane from Bullecourt Avenue into a slip lane which would improve safety – Henry Lawson Drive / Pozieres Avenue intersection: provision of right and left turn bays which would increase turn storage capacity and reduce the risk of road blockage and rear end collisions – along Henry Lawson Drive through the separation of traffic by the raised concrete median. • the removal of up to eight parking spaces on Auld Avenue to accommodate the new link road, which would minorly impact parking at Gordon Parker Reserve • impacts to five residential properties with Henry Lawson Drive driveway access becoming left in left out.			
Social infrastructure	Operational social infrastructure impacts would include: • the change in access to Auld Avenue via the Keys Parade intersection when travelling south on Henry Lawson Drive which would result in increased travel times, impacting access to social infrastructure facilities • increased travel times and alternate access requirements which may be inconvenient for people visiting Gordon Parker Reserve and Vale of Ah Reserve and which may impact patronage for residents and visitors • the realignment of the shared path along Henry Lawson Drive near its closed intersection with Raleigh Reserve, which would increase open space and result in further opportunities to facilitate physical and community wellbeing.	Moderate	Moderate	Moderate
Business and commercial	Impacted businesses during the operation phase would include: • businesses on the northern side of the Bullecourt / Ashford Avenue intersection which would experience some slight increases in noise (reduced amenity) due to the road corridor being closer to their premises	Moderate	Low	Low-moderate

Aspect	Impact (with mitigation)	Sensitivity	Magnitude	Overall impact
	• businesses on the eastern side of Henry Lawson Drive, including the Flower Power Complex and the Bankstown Golf Course, and industrial businesses on Ashford Avenue in Milperra which may experience slightly increased flooding impacts during the operation of the proposal which could lead to damages, safety impacts and stress for business owners and employees.			
Amenity and community	Operational amenity and community impacts would include: • the increased infrastructure footprint within the direct study area, which may adversely impact the natural and vegetated character of the area • the noise wall on the western side of Mactier Avenue being shifted closer to existing buildings due to the proposed widening works, which may impact residents who perceive this shift as encroachment and as reducing green areas • properties around the Henry Lawson Drive / Bullecourt Avenue intersection potentially experiencing some slight increases in noise (reduced amenity) due to the road corridor being closer to their premises (refer to section 6.3) • visual impacts from a substantial increase in road-related infrastructure, including pavements and drainage facilities.	Moderate	Moderate	Moderate
Cumulative impacts	There are not expected to be any cumulative socio-economic impacts during the operation of the proposal. Design development of the proposal has included expected demand and growth from surrounding developments and land uses. The proposal is needed to support these other projects and proposals once they are constructed and in operation.	Negligible	Negligible	Negligible

6.7.4 Safeguards and management measures

Table 6-56 Socio economic safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
Community impacts during construction including noise, visual, amenity impacts	A Community Liaison Plan (CLP) would be prepared and implemented as part of the construction environmental management plan (CEMP) to help provide timely and accurate information to the community during construction. The CLP would include (as a minimum): • mechanisms to provide details and timing of proposed activities to affected residents, including changed traffic and access conditions • contact name and number for complaints. The CLP would be prepared in line with Transport's *stakeholder engagement toolkit* and the *Transport for NSW Stakeholder and Community Engagement Policy 2019.* Continued consultation with the community, recreational groups, businesses, and other stakeholders until the completion of the proposal would be carried out. Discussions would include design changes and construction activities, the nature and timing of construction works, and mitigation measures.	Transport / Contractor	Detailed design / pre-construction
Property impacts due to temporary access changes and property acquisition	Continued consultation with affected property owners and land occupiers until the completion of the proposal would be carried out. Discussions including the nature and timing of construction works would be required to identify relevant mitigation measures for noise, traffic, access, and visual impacts. Property acquisition would align with property acquisition requirements including private and crown land acquisition, in line with the Land Acquisition (Just Terms Compensation) Act 1991 and Land Acquisition Reform 2016.	Contractor	Pre-construction / construction
Noise wall relocation	Consultation would be carried out during detailed design with property owners potentially affected by the relocation of the noise wall near the Henry Lawson Drive / M5 Motorway intersection.	Transport	Detailed design
Access disruptions and access impacts	Continued consultation with emergency services would be carried out to understand access requirements so that access can be maintained during construction. Communication with the community regarding alternate access arrangement and notification for emergency services due to changes traffic conditions would also be carried out.	Transport / contractor	Detailed design / construction
Changes in access for all road users	The local community would be notified of temporary changes to local road intersections prior to works at those intersections commencing. Consultation would continue during construction should arrangements change.	Contractor	Pre-construction / construction
Traffic impacts for all road users, including	A Traffic Management Plan (TMP) would be developed prior to construction. Active transport should be addressed as part of this TMP.	Transport	Pre-construction / construction

Impact	Environmental safeguards	Responsibility	Timing
pedestrians and cyclists	Alternative routes for active transport users would be clearly identified by signage and the use of traffic controllers where required. This includes areas along Henry Lawson Drive and close to Gordon Parker Reserve, which is frequented by school children and families, and near Western Sydney University.		
Construction traffic impacts on local businesses' operations and patronage	Continued consultation with businesses within the direct study area about timing and scheduling of construction activities would be carried out.	Contractor	Pre-construction / construction
	Wayfinding and the location of signage during construction would be based on the construction staging and where room is available.	Transport / contractor	Detailed design / construction
Social infrastructure impacts including access and amenity impacts	Consultation with Council would be carried out to make sure that construction activities mitigate potential impacts to Council run events that may be occurring in the proposal area at the same time.	Contractor	Pre-construction / construction
	Consultation with operators of the golf courses, educational facilities, public transport providers and Council in reference to construction activities and mitigation measures during busy periods and events at these facilities would be carried out.	Contractor	Pre-construction / construction
Relocation of bus stops during construction	Public transport providers and users would be notified in advance of any temporary or permanent changes to bus stop locations through signage at the existing bus stops. Adequate way finding signage would be installed.	Transport / contractor	Detailed design / construction
Cumulative impacts	Consultation with Council, relevant developers and other stakeholders would be conducted to minimise cumulative impacts. Opportunities would be explored to coordinate construction activities with other construction projects in the area to reduce risk of cumulative impacts.	Transport / contractor	Detailed design / construction

6.8 Surface water

An assessment of the proposal's impacts to soils, surface water and groundwater was carried out by Aurecon (2023c) and can be found in Appendix J – Soils, Surface Water and Groundwater Working Paper. This section summarises potential impacts on the surface water environment and safeguards to mitigate these impacts as outlined in the working paper.

6.8.1 Methodology

The surface water assessment included:

- A desktop review of available information and data collation
- Field verification consisting of a general regional walkover and targeted waterway geomorphological survey to define:
  - The existing environment
  - Potential construction and operational impacts
  - Construction and operational mitigation measures
- An assessment against relevant requirements and waterway objectives, evaluated on a qualitative basis
- A write-up of impact assessment findings and identification of any appropriate management measures to be implemented during construction and operation.

6.8.2 Existing environment

The proposal area sits within a low-lying portion of the region, within the George's River floodplain. It ranges between five to 18 metres Australian Height Datum (AHD), with the highest points situated at the southern end of Henry Lawson Drive. The section of Henry Lawson Drive running easterly into Bullecourt Avenue has an average elevation of six metres AHD, sloping west towards the Georges River (0 metres AHD). Elevation increases in a southerly direction towards the M5 Motorway, where it begins to decline again down to five metres AHD nearby a surface water body on Bransgrove Road. The upper and lower limits of the proposal area sit upon a landscape that is highly weathered, with alluvial sediments forming level to very gently undulating plains, gently undulating low rises and alluvial terraces.

The proposal area is situated within the Georges River catchment, which spans 930 square kilometres and covers a significant section of the Greater Sydney region (DPIE, 2018). Georges River extends about 60 kilometres south-west of Sydney, with the waters in this catchment ultimately flowing east into Botany Bay. The Georges River catchment is one of the most urbanised and developed catchments in Australia, which has resulted in degraded water quality throughout most of the area. Land use varies across the catchment but includes protected areas such as drinking water catchments and conservation areas in the upper catchment.

The proposal area follows an already established roadway along a low-lying and flat floodplain of the Georges River. The proposal is intersected by the Milperra Drain which flows from east to west along Milperra Road before running under Henry Lawson Drive and then cutting south-west into the Georges River. The Milperra Drain at Henry Lawson Drive is natural and tidally affected. Upstream it has recently undergone bank reconstruction with limestone banks by Council (next to Milperra Road). Scattered throughout the nearby Bankstown Golf Course are around seven dams which from a desktop assessment appear to be connected to drains which are connected to Milperra Drain. Between Milperra Drain and Henry Lawson Drive there appears to be a string of ponds which are mapped as coastal wetlands.

The proposal area sits within a largely urbanised section of the Georges River Catchment, the Mid-Estuary Creek sub catchment, which has led to degraded river health (State of the Georges River, 2020). The main cause of this degradation is from significant volumes of stormwater that are delivered through runoff from urban areas in comparison with forested land, with sewage overflows and legacy pollutants also contributing (Georges River Keeper, 2020). Urban creeks are the main method of transport for stormwater runoff into the river, with impacts including eroded banks, altered channels, elevated pollutants, reduced biodiversity, and increased dominance of more tolerant aquatic species. Ongoing challenges in this region of the catchment include habitat loss, increased stormwater flows, sewage, litter, and runoff from urban areas.

Acid sulphate soils

Acid sulphate soils are natural sediments that contain iron sulphides, formed from the process of sulphate reduction, that often naturally occur in lakes, rivers, wetlands, and oceans (Australian Government, 2018). Acid sulphate soils are found most in coastal and estuarine wetlands, however, can also occur inland in waterways, wetlands, and drainage channels. These soils develop in waterlogged, saline, and anaerobic conditions and are benign when left undisturbed in a waterlogged environment. When exposed to air, the iron sulphides in the soils react with atmospheric oxygen and water to produce sulphuric acid. Exposure to air occurs in response to a reduction in water levels within the hydromorphic zone of soils (e.g., during droughts and dredging operations).

Inland acid sulphate soil risk is determined by the presence of waterways, wetlands, drainage channels and dryland salinity. The proposal area is considered 'high risk' for inland acid sulphate soils, given the presence of extensive floodplain soils and proximity to major waterway channels and wetlands (eSpade, 2022). A review of Geoscience Australia Portal revealed the risk of acid sulphate soils within the proposal area, with the northern and southern sections of Henry Lawson Drive identified as being at high risk of acid sulphate soils (high probability more than three metres below ground surface). A small portion of the proposal area, south of the high-risk area, is classified as low risk (low probability 1-3 metres below ground surface). Figure 6-27 outlines the acid sulphate soil risk of the proposal area.

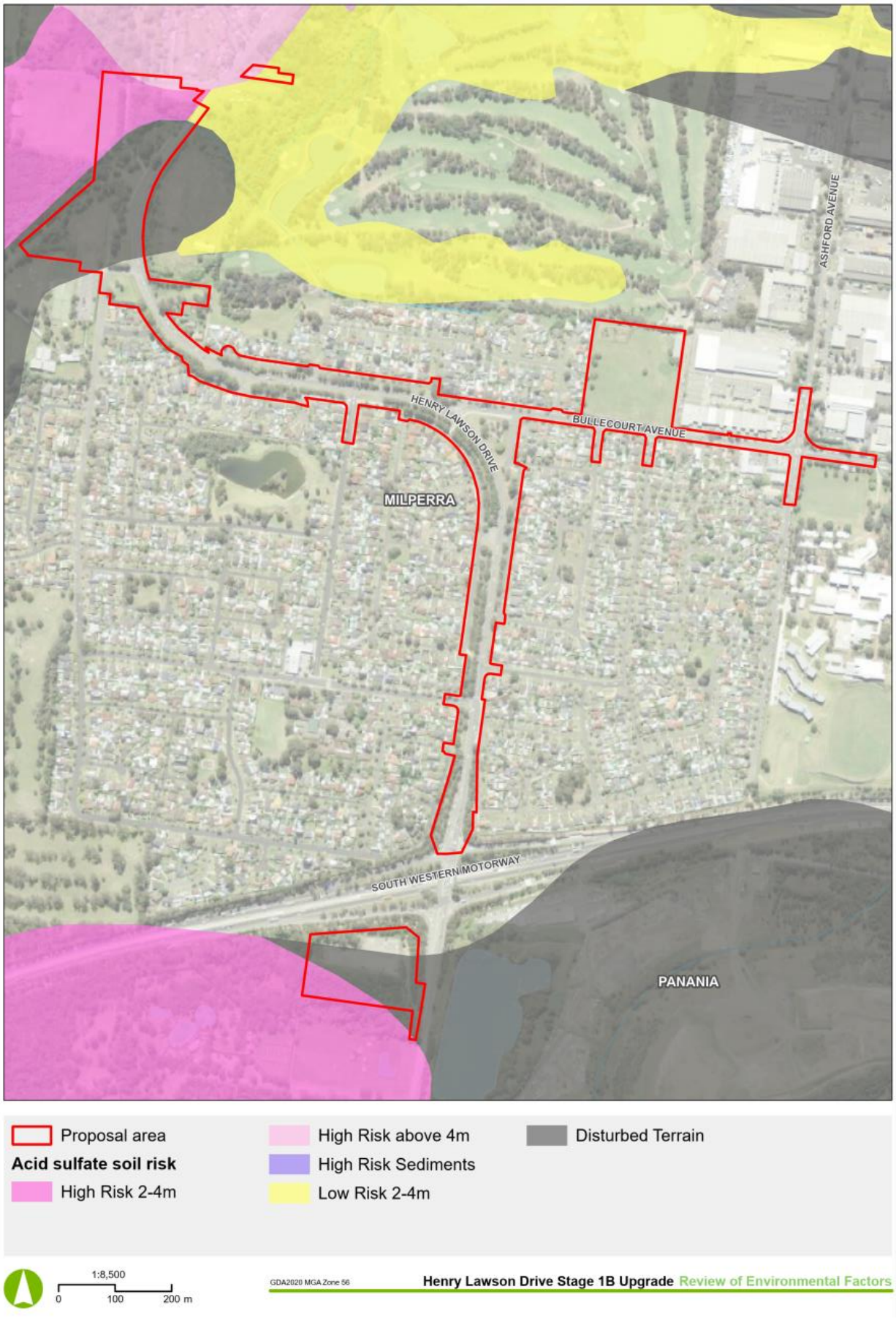


Figure 6-27 Acid sulphate soils near the proposal area

Salinity

Salinity risk for the proposal is presented in Figure 6-28.

For most of the proposal area, salt sites occur primarily on the edges of drainage lines and the potential for soil salinity is high. Frequent salt sites occur throughout this landscape within urban structures, with some larger sites also occurring along colluvial slopes and drainage lines. The combination of localised salt cycling and deeper groundwater rise produces high salt levels. High salt export is driven by groundwater discharge and runoff into streams. Frequent widely distributed salt sites produce high loads during rainfall events, while salty groundwater discharge maintains these high loads in periods of dry conditions. The water in this region is brackish with water quality impact recorded as high due to incoming tides on the Georges River. Significant features of this landscape include saline and sodic subsoil material and mainly colluvial change of slope salt sites.

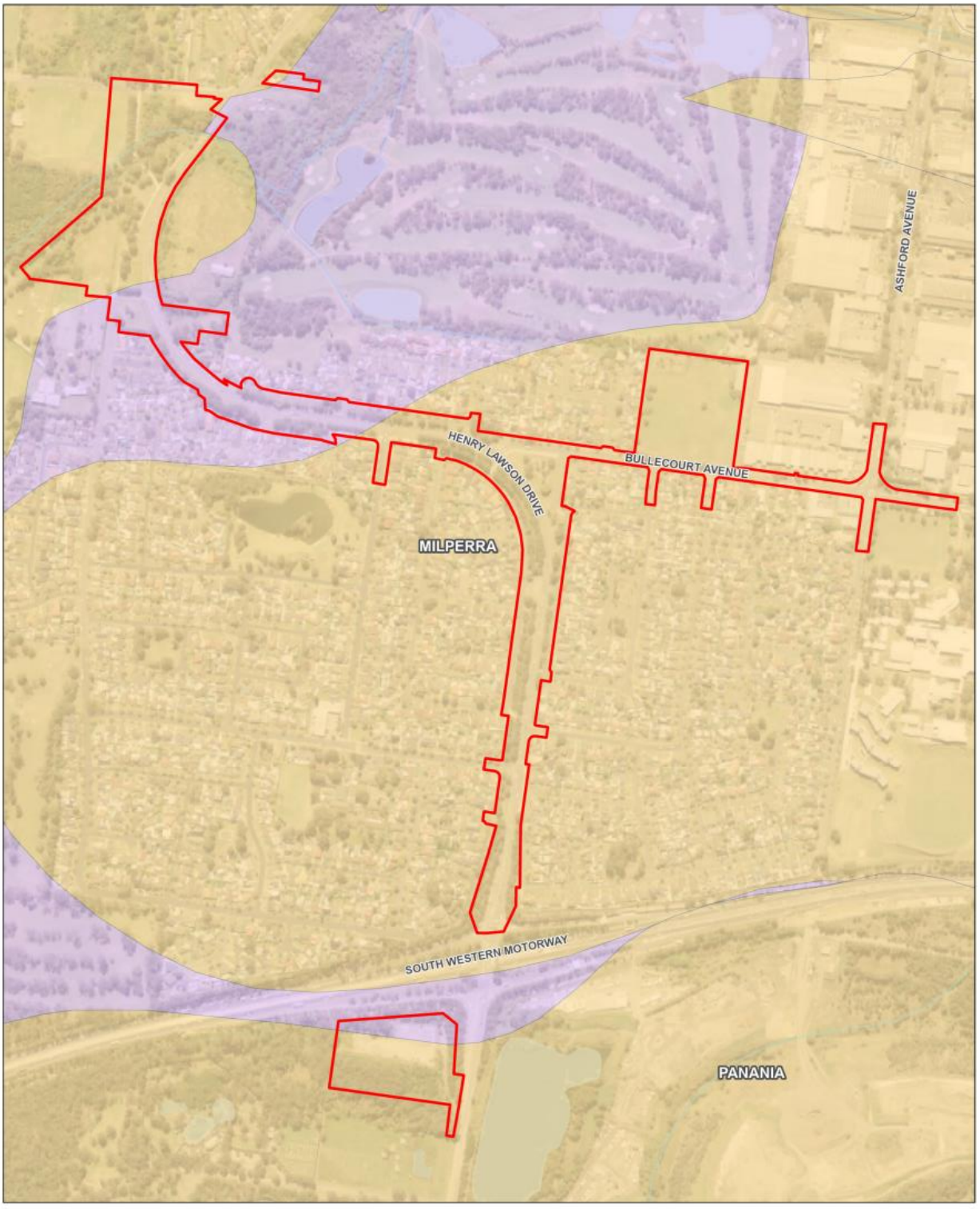


Figure 6-28 Proposal area salinity risk

6.8.3 Potential impacts

Construction

A surface water impact assessment for the construction phase of this proposal is outlined in this section. If not managed correctly, construction activities of the proposal could potentially lead to adverse impacts to the surface water environment. Potential construction impacts are summarised in Table 6-57.

Table 6-57 Surface water construction impacts

Impact	Description of potential impact
Vegetation removal and earthworks – soil erosion	Clearing the proposal area of vegetation and topsoil could increase the risk of soil erosion in all soil types. Excavations could further increase the risk of erosion as this would increase the surface area of soils and subsoils exposed to the elements. During wet weather events sediment-laden stormwater runoff could drain to both the Milperra Drain and the Georges River. The runoff may have elevated total dissolved solids (TDS), total suspended solids (TSS), nutrients (phosphorous and nitrogen) and a reduction in dissolved oxygen which could impact areas that are deemed Key Fish Habitats and identified Wetlands. Potential impacts could stem from this increased mobilisation of sediment which would increase turbidity. Mitigation measures such as construction erosion and sediment controls would be installed to minimise soil erosion and movement into waterways. These controls would be managed in accordance with the proposal's Soil and Water Management Plan and final Erosion and Sedimentation Control Plans.
Acid sulphate soils	Disturbance of potential acid sulphate soils may cause acid generation. There is a high potential for acid sulphate soils in the northern area of the proposal between 2-4 metres below ground level (bgl) during culvert construction across Milperra Drain and general site levelling earthworks. The presence of acid sulphate soils would impact surface water quality through corrosion due to the presence of acidic substances in the surrounding soil. Cracking of concrete structures can also be accelerated. Surface water runoff containing increases in acid sulphate soils could impact the Georges River and Milperra Drain water quality through decreased pH and decreased dissolved oxygen concentration, which would affect aquatic ecosystem health. An acid sulphate soils plan would be developed for the proposal which would manage the potential for intercepting acid sulphate soils and avoid impacts to nearby soils and surrounding waterways.
Ancillary facilities and stockpiling	Materials stored within the ancillary facilities transported to waterways via sediment-laden stormwater runoff has the potential to cause a reduction in water quality within Milperra Drain and the Georges River. The deposition of sediments from stockpiles and stored materials within the ancillary facility in nearby waterways may have geomorphological impacts on Milperra Drain. If not managed properly, construction materials could contaminate waterways through surface water runoff, leading to altered aquatic conditions and adverse effects on aquatic ecosystems. Stockpile sites would be actively managed, including appropriate bunding and construction erosion and sediment controls to minimise water quality impacts. Additionally, materials which can be easily transported by surface water or flood waters would not be stored at ancillary facilities within flood prone zones, which would avoid impacts of contaminants and other construction materials on nearby waterways.
Concrete/asphalt activities	Concrete transport and pouring operations have the potential to lead to soil and water pollution (increase in pH, TSS, TDS and minor levels of aluminium, iron and magnesium oxides) as a result of cement laden runoff not being properly contained or being accidentally released to surface waters. Poor cement handling, storage and disposal practices would also contribute to these impacts. Vehicle movements in the area for concrete transport could potentially create disturbances to sediment, increasing impacts to nearby water quality either immediately through vehicle movements or subsequently through wind and water runoff.

Impact	Description of potential impact
	Appropriate bunding and construction erosion and sediment controls would be implemented to avoid spills and leaks leaving the proposal area which would mitigate the potential for harmful materials entering waterways. Access points to and from worksites would also be managed to minimise sediment movement via surface water into nearby waterways.
Discharges	During excavation works for culvert construction and site levelling, if the groundwater table is encountered, and dewatering is required, the water would have to be disposed of by either discharging to the environment or through offsite disposal. Water would only be discharged to the environment if appropriate treatment and testing of the water is carried out prior to discharge. If water is discharged to the environment, this has the potential to degrade surface water, depending on the quality of the groundwater. This could cause increased turbidity and other impacts in the Georges River and Milperra Drain. Erosion and sediment controls would capture and treat dirty water prior to release to avoid this water entering nearby waterways and contaminating ecosystems.
Leak, spills and waste	Potentially harmful chemicals (e.g., hydrocarbons, oil and grease, heavy metals) could accidentally be released to the surface water environment during construction spills, refuelling and inappropriate storage or handling. Leakage from construction worker facilities or wastewater collection points could runoff into soils and receiving waterways. This has the potential to contaminate exposed soils or mobilise contaminated soils and liquids into local watercourses which could result in water quality impacts. Spillage of waste or construction materials during transportation could lead to macro pollutants including plastics, construction material, wastage being conveyed in surface runoff to nearby drainage pathways and downstream waterways. Measures relating to the potential impacts associated with accidental leaks and spills during construction would be incorporated into a site-specific emergency spill plan. This would avoid impacts to waterways and the surface water environment from leaks or spills of potentially harmful chemicals.
Works on waterfront lands	The proposal ties in where Henry Lawson Drive crosses Milperra Drain. Any construction activities including clearing or earthworks have the potential to directly change the geomorphological condition of Milperra Drain. There is a proposed outlet on the western side at this point and a culvert would be constructed under Keys Parade to Auld Avenue. There is also a proposed stormwater outlet into Milperra Drain on the western side of the existing bridge. Any work within the waterfront land of Milperra Drain increases the risk of sediment and other construction materials being mobilised into waterways, if uncontrolled. This could potentially lead to water quality impacts within the stream and downstream. Construction within the banks of the waterways could cause geomorphological changes to the waterway if excavation is required at these locations within the bank. Guidelines have been outlined in Section 6.8.4 to minimise the risk of sediment and other chemicals being mobilized into waterways and causing harm to aquatic environments.

Operation

Operational impacts of the proposal on surface water include increased stormwater runoff as a result of vegetation removal, spills as a result of vehicle accidents and stormwater discharges through outlets. Details of these potential operational impacts are summarised in Table 6-58.

Table 6-58 Surface water operational impacts

Impact	Description of impact
Stormwater runoff	The proposal includes a water quality strategy to reduce the potential for increased runoff leaving the site and increasing sediment and nutrient loads into receiving waters. The system would include a bioretention basin at the Henry Lawson Drive / Bullecourt Avenue intersection, two Gross Pollutant Traps (near Ingram Avenue and Keys Parade, a vegetated treatment swale on the eastern side of the Auld Avenue link road and scour protection at drainage outlets. The water quality strategy is to limit the discharge of pollutants to meet the water quality objectives and maintain the environmental values for the Georges River Estuary and tributaries. The proposal, with the controls in place, would reduce the pollutant load levels to below the existing levels and achieve stringent Neutral or Beneficial Effect criteria. During wet weather events, increased stormwater volume of a potentially degraded quality could drain to Milperra Drain and the Georges River, including areas that are deemed Key Fish Habitat and identified wetlands. This would decrease water quality in these aquatic ecosystems. The water quality stormwater drainage system that would be implemented as part of the proposal would minimise these impacts. Further details on the proposal's drainage and water quality design are provided in section 3.2.3. The drainage design is shown in Figure 3-1a-e in Section 3.1.
Leaks, spills, general litter and vehicle accidents	Potential pollutants from the use of the proposal could include heavy metals, hydrocarbons, oils and grease, and other contaminants, gross pollutants and general litter'. The proposal would increase traffic and motor vehicle volume, which could increase the risk of motor vehicle accidents/collisions that may leak petrol and enter drainage lines and receiving waterways. This could potentially lead to contamination of exposed soils or mobilisation of contaminated soils and liquids into local watercourses which could result in water quality impacts. Littering of waste by motorists and pedestrians could potentially lead to gross pollutants including plastics being transported by surface runoff to nearby drainage pathways and downstream waterways. There are a number of terrestrial GDEs downstream of the proposal on the banks of School House Creek. These may also be impacted by surface water contamination and seepage to the groundwater system. The water quality stormwater drainage system that would be implemented as part of the proposal including swales, bioretention basin and Gross Pollutant Traps would minimise these impacts. For details, refer to section 3.2.3.
Stormwater discharges through outlets	The proposal's drainage design would provide three main outlets to Milperra Drain at the Ruthven Avenue, Amiens Avenue and Bullecourt Avenue intersections with Henry Lawson Drive. Minor increases in flows are expected to each outlet due to increased impervious area within the catchment. Scour and erosion could potentially occur at outlets. The increased stormwater runoff volume entering the drainage network could scour and erode receiving waterways, altering their geomorphology. However, as per the drainage design outlined in section 3.2.3, new outlets would be designed appropriately with scour protection, meaning scour and erosion impacts are unlikely to occur.

6.8.4 Safeguards and management measures

Table 6-59 Surface water safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
Soil erosion and water pollution	A Soil and Water Management Plan (SWMP) would be prepared and implemented as part of the CEMP. The SWMP would identify all reasonably foreseeable risks relating to soil erosion and water pollution and describe how these risks would be addressed during construction. The Soil and Water Management Plan (SWMP) would be reviewed by a soil conservationist on the TfNSW list of Registered Contractors for Erosion, Sedimentation and Soil Conservation Consultancy Services. The SWMP would then be revised to address the outcomes of the review.	Transport / Contractor	Detailed design / pre-construction
	Where possible, permanent drainage structures would be installed as early as possible to facilitate effective separation of clean offsite and dirty onsite water.	Contractor	Construction
	The preliminary Erosion and Sedimentation Management Plan (ESMP) and Erosion and Sedimentation Control Plans (ESCP) produced for the proposal would be updated during the detailed design phase to refine the erosion and sedimentation controls for the proposal. Final ESCP will be developed by the construction contractor and would include the need to implement progressive ESCPs and the continual updating of these plans during construction.	Transport / Contractor	Detailed design / construction
Contamination of surface water	Regular visual water quality checks (including for turbid plumes and hydrocarbon spills or slicks) would be carried out when working in or near waterways. Construction water quality monitoring would be carried out upstream and downstream of the proposal to ensure that controls and site practices are effective at maintaining current water quality conditions. Monitoring would be carried out in line with the Guideline for Construction Water Quality Monitoring (RTA, undated).	Contractor	Construction
Water pollution due to stockpiles	Stockpile site locations would be confirmed during detailed design and where applicable managed in line with Environmental Procedure Management of Wastes on Roads and Maritime Services Land (RMS, 2014) and the Stockpile Site Management Guideline (RMS, 2015b). This would consider measures to manage cross contamination within a stockpile area. Further consideration of how to manage stockpiles, material laydown and chemical storage with respect to floodwaters would be carried out by the construction contractor.	Transport / Contractor	Detailed design / pre-construction
Water pollution from accidental spills	A site-specific emergency spill plan would be developed and include spill management measures in line with the Transport for NSW Code of Practice for Water Management (RTA, 1999) and relevant EPA guidelines. The plan would address measures to be implemented in the event of a spill, including initial response and containment, and notification of	Contractor	Detailed design / pre-construction

Impact	Environmental safeguards	Responsibility	Timing
	emergency services and relevant authorities (including TfNSW and EPA officers).		
	An emergency spill kit would be kept on site at all times. Spill kits would be located at all ancillary facilities and main construction work areas. All staff would be made aware of the location of spill kits and trained in their use. The refuelling and maintenance of plant and equipment would be carried out in a designated sealed bunded area at ancillary facilities, where possible. Vehicle wash downs and concrete washouts would be carried out within designated sealed bunded areas at construction ancillary facilities or carried out off-site.	Contractor	Construction
Stormwater discharges leading to pollution	A Construction Water Quality Discharge Assessment would be completed during detailed design in line with the EPA's Assessing and managing water pollution from road works and the Draft Guideline for Assessing the Impacts of Treated Water Discharge from Water Quality Treatment Controls (TfNSW, 2020c).	Transport	Detailed design
Works on waterfront land	Works within Milperra Drain to construct the culvert would be carried out with consideration to the design and construction considerations in the Guidelines for instream works on waterfront land, Department of Primary Industries, Office of Water, July 2012, Guidelines for watercourse crossings on waterfront land, Department of Primary Industries, Office of Water, July 2012 and in line with relevant Transport specifications and guidelines.	Transport / Contractor	Detailed design / pre-construction

6.9 Groundwater

An assessment of the proposal's impacts to soils, surface water and groundwater was carried out by Aurecon (2023c) and can be found in Appendix J – Soils, Surface Water and Groundwater Working Paper. This section summarises potential impacts on the groundwater environment and safeguards to mitigate these impacts as outlined in the working paper.

6.9.1 Methodology

Key considerations of the groundwater assessment included:

- Groundwater resources (e.g., aquifer conditions, resource potential, vulnerability, recharge levels)
- Groundwater users (e.g., irrigation, stock and domestic, commercial/industrial, potable water supply)
- Groundwater quality (physical parameters and chemistry)
- Groundwater dependent ecosystems (e.g., watercourses, wetlands, springs)

The following steps were carried out as part of the groundwater assessment:

- Desktop review of available information and data collation
- Field verification involving a general regional walkover and targeted waterway geomorphological survey to define:
  - The existing environment
  - Any potential construction and operational impacts
  - Relevant mitigation measures
- Assessment against relevant requirements and waterway objectives, evaluated on a qualitative basis.

A dewatering assessment was also carried out for the proposal.

6.9.2 Existing environment

Hydrogeological landscapes

Hydrogeological landscapes were distinguished using the eSPADE portal (NSW DPI). Most of the proposal area, specifically the central section of Henry Lawson Drive, falls within the Bankstown Hydrogeological Landscape (HGL). This landscape is characterised by low hills and rises on Triassic shale and sandstone. It is a region of moderate to high rainfall (greater than 800 millimetres) and is distinguished from other areas within Sydney by its high prevalence of sodic and saline soils, particularly within drainage channels. This is believed to be caused by historical tidal influence from the Parramatta and Georges Rivers. This has resulted in high levels of salinisation throughout the area, with several frequent small patches of severely impacted land. Limitations and hazards related to this landscape include high salinity, highly erodible sub-soil, and streambank erosion.

The northern section of the proposal area, as well as the south past M5 Motorway, fall within the Moorebank HGL. This landscape is characteristic of low-lying Quaternary, Neogene and Triassic alluvial floodplains of the Georges River and features flat extensive floodplains and alluvial plains. The disturbed and/or reclaimed lands close to the river are commonly waterlogged, containing ponded water and back swamps, which creates the potential for acid sulphate soils. This HGL is distinguished from other areas within the Sydney Metropolitan area by its very flat and low-lying alluvial plain, with ponding on the borders of the Georges and Parramatta Rivers. This HGL is distinguishable from the Bankstown HGL specifically as it is heavily influenced by acid sulphate soils.

Hydrogeological landscapes are shown in Figure 6-29.

Figure 6-29 Hydrogeological landscapes

Aquifers

Aquifers present in the proposal area consist of both unconfined unconsolidated alluvial sediments and semi-confined fractured rock. Groundwater flow within the Bankstown HGL is driven by the primary porosity of the alluvial sediments and along the secondary porosity (structures) in the fractured bedrock. Water moves laterally through shale layers in this HGL, although vertical movement is possible when vertical fracturing occurs. Hydraulic conductivity and aquifer transmissivity are low to moderate with a gentle to moderate hydraulic gradient (less than 10 – 30 per cent). The groundwater table in the Bankstown HGL is intermediate (2-6 metres) with flow lengths of less than 10 kilometres (short to intermediate).

Groundwater flow within the Moorebank HGL is driven by the primary porosity of the unconsolidated alluvial sediments. Hydraulic conductivity is moderate to high and aquifer transmissivity is moderate with a gentle to moderate hydraulic gradient (less than 10 – 30 per cent). Groundwater table is shallow to intermediate (0-8 metres) with flow lengths of less than 5 kilometres (short).

Groundwater users

A search of the National Groundwater Information System conducted on 20 May 2022 returned 31 registered bores within the groundwater study area. Not all registered bores have a full suite of available information such as water level or water quality. Registered bores that are within the proposal area are outlined in Figure 6-30.

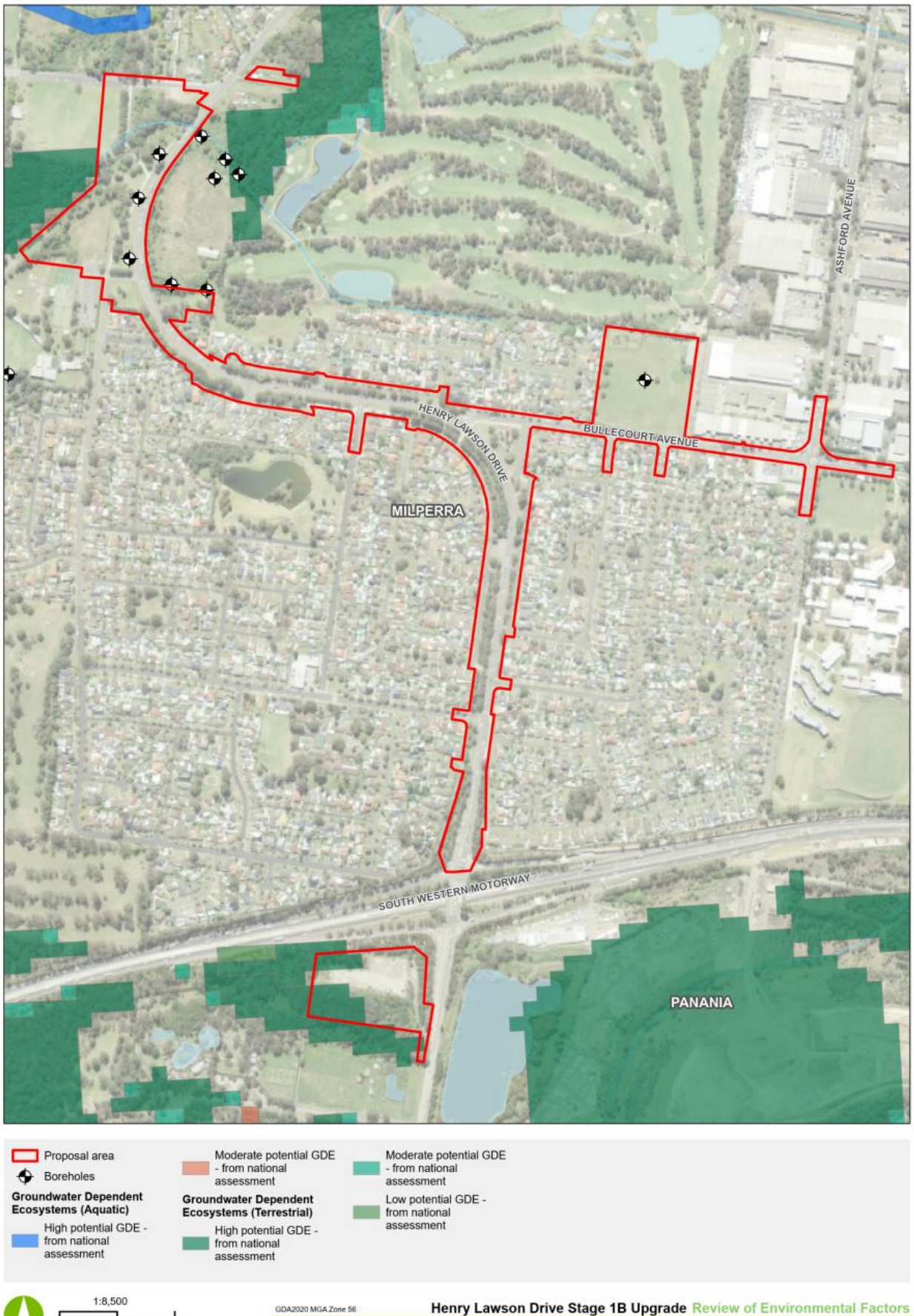


Figure 6-30 Registered bores

Groundwater quality

Groundwater within the Bankstown HGL is brackish to saline, with salt cycling being a significant process in relation to water quality. Salt discharge into streams from the saline alluvium is significant. Water quality within the Moorebank HGL is fresher in comparison, ranging from fresh to marginal.

Groundwater levels

Groundwater levels throughout the proposal area are expected to be shallow as it is located within the alluvium and given the proximity of the Georges River. Depth to the water table within the Bankstown HGL ranges from 2-6 metres below ground level (bgl), varying seasonally (lower in summer, higher in winter). Groundwater recharge rates within this landscape are classified as moderate.

Water table depths within the Moorebank HGL range from 0-8 metres bgl, depending on the season (lower in summer, higher in winter). Groundwater recharge is reported to be moderate to high, with a gentle hydraulic gradient (less than 10 per cent).

A number of boreholes were drilled as part of geotechnical investigations for the proposal. Groundwater depths are presented in Table 6-60.

Table 6-60 Groundwater depths

Borehole ID	Location	Standing water level (metres bgl)
BH01	South of entrance of footbridge west of Henry Lawson Drive and south of Auld Avenue	1.1
BH02	South of middle of footbridge west of Henry Lawson Drive and south of Auld Avenue	1.6
BH05	North side of Henry Lawson Drive at intersection of Amiens Avenue	7.6
BH07	East side of Keys Parade (approximately 70 metres west of Henry Lawson Drive)	1.5
BH08	North side of Raleigh Road (approximately 40 metres west of Henry Lawson Drive)	Not encountered within 3.8 metres

6.9.3 Potential impacts

Construction

An impact assessment for the construction phase of this proposal is outlined in this section. If not managed correctly, construction activities of the proposal could potentially lead to adverse impacts to the groundwater environment. Potential construction impacts are summarised in Table 6-61.

Table 6-61 Groundwater construction impacts

Impact	Description of impact
Acid sulphate soils	Disturbance of potential acid sulphate soils may cause acid generation. Acid sulphate soils are natural sediments that contain iron sulphides, which can release acid when exposed to air through processes such as construction. There is a high potential for acid sulphate soils in the northern area of the proposal between 2-4 metres bgl that could be intercepted during culvert construction across Milperra Drain and general site levelling earthworks. The presence of acid sulphate soils can accelerate corrosion and cracking of concrete structures due to the presence of acidic substances in the surrounding soil. . Appropriate management of acid sulphate soil particularly through capturing and treating it in line with the Acid Sulphate Soils Management Plan would minimise impacts to groundwater aquifers.

Impact	Description of impact
Discharges	The dewatering assessment carried out for the proposal analysed the likely inflows to the excavation work. This estimated a maximum excavation depth of 3 metres bgl across the proposal area, except in certain locations along Henry Lawson Drive which were noted to be subject to smaller, deeper excavations. Estimated inflows and dewatering volumes were then calculated. It should be noted that dewatering volumes are conservative and likely represent a worst-case scenario. Estimated inflows and dewatering volumes are included in Table 6-62. The locations included correspond to areas of data availability and where different depths of the excavations are expected. Considering depths and duration of excavations, the dewatering assessment noted that the volume of water likely to be encountered would not trigger the need for a water access licence to be obtained. The water encountered during excavations would be required to be discharged. The preferred method of discharge is offsite disposal via a licenced liquid waste contractor. Should off-site disposal be selected by the contractor as the primary method of water management, then measures such as documenting wastewater storage and daily inspections of the stored water should be implemented.
Leaks, spills and waste	Potentially harmful chemicals (e.g., hydrocarbons, oil and grease, heavy metals) could accidentally be released to the surface water environment during construction spills, refuelling and inappropriate storage or handling. Leakage from construction worker facilities or wastewater collection points could runoff into soils and receiving waterways. They could leach into groundwater sources and contaminate the alluvial aquifer. Measures to minimise the potential impacts associated with accidental leaks and spills during construction would be incorporated into a site-specific emergency spill plan.
Dewatering	The WM Act 2000 states that an Aquifer Interference Approval (AIP) is needed for aquifer interference activities (which would include construction dewatering). Approval is required only for significant active dewatering (>3 ML/day) or where GDEs are potentially impacted. Passive dewatering activities of groundwater ingress into excavations and bored piles by public authorities do not require any approvals or permits under the WM Act 2000. As groundwater is shallow throughout the proposal, especially closer to Georges River, there is potential for groundwater levels to rise due to higher than average rainfall conditions caused by short-term and long-term climate cycles. This could lead to potential saturation of planned excavations, meaning excavation sites would require dewatering. The dewatering assessment concluded that water encountered during excavations would be under the threshold to trigger the need for a water access licence. Dewatering volumes calculated as part of the dewatering assessment are conservative and likely represent a worst-case scenario. A site dewatering plan would be implemented to minimise impacts to the construction site and the groundwater aquifer.
Disturbance of land salinity	Salts within the Parramatta/Georges River HGL are known to be highly mobile and pose a severe potential impact to buildings and structures within the proposal area. There is a high risk of excavated soils being saline, which may cause impacts where spoil material is exposed to surface waters and rain. However, it is noted that in the proposal area and surrounds, groundwater salinity is already high. Runoff from exposed soils could produce a highly saline waste stream that may have minor impacts should it migrate into the groundwater through recharge. Due to the minor amount of soil to be excavated, these impacts are considered very low.
Culvert construction	No works would result in groundwater flow obstruction or interference beyond the proposed culvert under the Auld Avenue and Keys Parade link road. The impacts would be highly localised as they affect a small specific extent and flow interference would be on the scale of 10-1 metres. As such, the potential for aquifer interference is considered low and potential impacts downstream or on other groundwater users would be negligible.
Groundwater users	There are nine registered bores within one kilometre of the proposal area, with the majority being monitoring bores. The risk of aquifer interference and discharges to groundwater is deemed to be very low to low. As such the water table should not be affected by the proposal and the risk of changes to water availability to groundwater users is therefore also deemed to be very low to low.

Table 6-62 Estimated inflows

Location	Calculated inflow at the expected excavation (cubic metres per day)
Road alignment excavations	
Henry Lawson Drive between Fromelles Avenue and Borella Road	0.36
Henry Lawson Drive between Borella Road and Milperra Road	0.15
Keys Parade and the Auld Avenue local link road	4
Raleigh Road extension to Keys Parade	0.05
Isolated deeper excavations	
Gross pollutant trap along Henry Lawson Drive between Fromelles Avenue and Borella Road	0.42
Gross pollutant trap along Henry Lawson Drive between Borella Road and Milperra Road	7.55
Bioretention basin near Bullecourt Avenue	0.22
Deeper drainage infrastructure along Henry Lawson Drive between Borella Road and Milperra Road	1.18

Operation

Operational impacts of the proposal on groundwater include impacts as a result of vehicle accidents and aquifer recharge in the proposal area. These potential operational impacts are summarised in Table 6-63.

Table 6-63 Groundwater operational impacts

Impact	Description of impact
Leaks, spills, general litter and vehicle accidents	Heavy metals, hydrocarbons, oils and grease, and other contaminants may leach into soils and enter waterways and groundwater from motor vehicles using the upgrade. Gross pollutants and general litter may arise from motor vehicles. The proposal would increase traffic and motor vehicle volume, therefore increasing the risk of motor vehicle accidents/collisions that may leak petrol and enter drainage lines and receiving waterways. This could potentially lead to contamination of exposed soils or mobilisation of contaminated soils and liquids into local watercourses which could result in water quality impacts. There are a number of terrestrial GDEs downstream of the proposal on the banks of School House Creek which may be impacted by surface water contamination and seepage to the groundwater system. The hydrological soil type within the proposal area suggests that seepage would be minimal. Given the depth to groundwater and low permeability soils, impacts to groundwater quality are likely to be minor as a result of a spill.
Aquifer recharge	The proposal would increase areas with impermeable surfaces, thereby inhibiting overall recharge to underlying aquifers following rain events. Surface water runoff, stormwater and other associated drainage channels are not expected to interact with groundwater or aquifers across the proposal's alignment during operation. Due to the increase in the impermeable pavement for Henry Lawson Drive, there is likely to be a minor reduction in the overall recharge rate to underlying unconfined aquifers. This reduction is unlikely to produce an effect that would constitute aquifer interference, meaning the potential impacts are considered to be very low.

6.9.4 Safeguards and management measures

Table 6-64 Groundwater safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
Overall groundwater impacts	Further investigations would be carried out at the detailed design stage to gain an understanding of site-specific potential interactions with groundwater during construction and operations.	Transport	Detailed design
Groundwater dewatering during excavation	In the event that groundwater/aquifer dewatering must occur to lower the groundwater table and reduce or prevent groundwater ingress into excavations, potential impacts on GDEs would be quantitatively assessed prior to dewatering along with the implementation of appropriate management measures and documentation in a site dewatering management plan. Quantitative assessment would include assessment of the magnitude and duration of drawdown and whether impacts are likely to adversely affect the habitat conditions and ecological communities within the GDEs. Relevant approvals and permits would be obtained prior to groundwater/ aquifer dewatering.	Contractor	Pre-construction
Encountering acid sulphate soils	An Acid Sulphate Soil Management Plan (ASSMP) would be prepared and implemented to manage acid sulphate soils exposed by excavations of soils between 2-4 metres, changes to groundwater levels and stockpiling. The ASSMP would be informed by the results of the Detailed Site Investigation that would include the identification of presence and extent of acid sulphate soils, particularly around the culvert works over Milperra Drain.	Contractor	Detailed design
Disposal of groundwater	Should off-site disposal be selected by the contractor as the primary method of water management then the following measures must be implemented: • Site Environmental Coordinator or representative must contact the waste disposal contractor and receiving facility to determine the correct analytical suite and documentation required before water is transported. • All liquid waste must be characterised with the documentation made available to both the waste disposal contractor and receiving facility • All produced water must be collected and stored in a sealed, bunded or similar storage vessel • Daily inspections of the stored water must be made and include the following items: – Date/ time and location of dewatering – Estimated inflow rate – pH – Turbidity – Signs of visible oil or fuel (hydrocarbon) sheen on the water – Any unusual odour colour slime or foamy scum.	Contractor	Construction

6.10 Non-Aboriginal heritage

The potential impacts on non-Aboriginal heritage during construction and operation of the proposal have been assessed as part of the *Non-Aboriginal Heritage Statement of Heritage Impact – Henry Lawson Drive Stage 1b* (Aurecon, 2023d), provided in Appendix K – Non-Aboriginal Heritage Statement of Heritage Impact. The existing heritage sensitivities, potential impacts of the proposal and safeguards to mitigate them are summarised in this chapter.

6.10.1 Methodology

Overview

A Statement of Heritage Impact (SOHI) has been prepared to assess the non-Aboriginal heritage impacts of the proposal. The SOHI has included preparation of a historic overview, field survey, heritage significance assessment, archaeological assessment and heritage impact assessment, including visual/setting impacts to known heritage items from the proposal.

The report draws upon a previous SOHI prepared to inform the strategic phase of the Henry Lawson Drive (M5 Motorway to Hume Highway) Strategic Phase Statement of Heritage Impact, prepared by GML Heritage for RMS (2018).

The following tasks were carried out as part of the assessment:

A desktop review and database searches of relevant heritage materials was carried out. This included:

- A review of heritage reports and studies previously prepared for relevant items and areas within the proposal area
- Identification of the heritage items within the area with the potential to be affected by the proposal, either through direct impacts and/or impacts on the visual setting
- Identification of heritage items that are likely to be physically impacted, or those that have a direct frontage to the proposal area.
- Review of applicable statutory heritage lists within the proposal area, including:
  - The State Heritage Register (SHR)
  - Local heritage items (as included in Schedule 5 of relevant LEPs)
  - State Agency Section 170 registers
  - The National Heritage List (NHL)
  - The Commonwealth Heritage List (CHL)
  - The NSW National Trust Register (non-statutory list)

Field investigation

A field investigation was then carried out within the proposal area on 20 July 2022 to inspect heritage listed items and potential archaeological sites. This allowed for an understanding of the heritage items that would be potentially affected by the proposal. An assessment of the heritage impact of the proposal on the heritage significance of each of the affected items was then carried out and mitigation measures were devised in response to this.

Archaeological assessment

An archaeological assessment was also carried out for the proposal in accordance with *Statements of Heritage Impact* (2002), the Burra Charter and the ICOMOS publication *Guidance on Heritage Impact Assessments for Cultural World Heritage Properties*. Historical archaeological potential was identified based on the following:

- Consideration of the physical evidence observed at the sites
- Identified areas of previous disturbance
- Historical information about the development and occupation of the sites
- Previous archaeological assessments and excavations.

The historical background and significance assessment of individual sites within the proposal area has been based on previous historical archaeological assessments and historical information gathered from a range of

primary and secondary sources. During the field survey, the general location and current condition of known and potential historical archaeological sites was inspected.

6.10.2 Existing environment

The proposal area extends across the suburb of Milperra. The suburb is bounded by the Georges River to the west, Panania to the south, Bankstown Aerodrome to the north and Revesby to the east.

Exploration around the Bankstown area began in 1789 when Governor Arthur Phillip lead a party which travelled south from Rose Hill to a place near Salt Pan Creek. Land grants were later issued around the area in response to the need for fertile land for early European settlers. Bankstown was initially the name applied to a broad district now covering Bankstown, Liverpool and Moorebank.

By the 1830s, much of the land granted to settlers remained largely uncleared and uncultivated. However, the area was largely cleared by the mid-1850s as the demand for timber rose dramatically with the construction of railways and dwellings as well as for manufactured goods such as wagons and pick-axe handles for the gold fields. Despite the apparent early success of the Bankstown area, many factors acted against further growth. The area was segregated from Sydney and much of the viable agricultural land on the Georges River was less accessible than the land in nearby Liverpool. Furthermore, the Georges River was prone to flooding meaning the homes, farms and livelihoods of the settlers were often washed downstream.

Bankstown did eventually attract some simple processing industries, mainly linked to the preparation of primary products for market. This included charcoal burning, soap manufacture, quarrying and Liebentritt's Pottery which began the manufacture of a range of increasingly sophisticated clay products in the area.

By the turn of the Century, the Bankstown area remained largely stable. It was following the First World War that the population started to boom. By 1915 there were 4,750 residents in 1090 homes, with occupations varying from orchardists, poultry farmers, dairy farmers, brickmakers and sawmill owners. A key historic element of the area from around this time was the former Milperra Solder Settlement. This was established as part of the Australian Soldier Settlers' Schemes which were brought about to reward returning soldiers with rural land and to expand growth in rural areas. The subdivision of the Settlement contained five streets: Bullecourt, Fleurbaix, Amiens and Pozieres Avenues, which were named after French battlefields, and Ashford Avenue, which was named after the incumbent Minister for Lands. Around fifty allotments were established for the purposes of poultry farming. An early plan of the settlement shows that small farms were just over 4 acres while two large farms contained more than 30 acres, and one very large farm extended across 93 acres. Further details about the former Milperra Solder Settlement are contained below.

Heritage listed items

Heritage items within the proposal area are listed in Table 6-65.

Table 6-65 Heritage listed items

Register listing	Item name	Address	Significance
Bankstown LEP 2015 #I29	Milperra Soldier Settlement (former)	Ashford Avenue Milperra NSW 2214	Local

A key historic element of the proposal area is the former Milperra Soldier Settlement. The Australian soldier settlers' schemes that were instituted during World War I were a response to the repatriation of returning soldiers. The land encompassed by the Soldiers' Settlement at Milperra was almost entirely located within the confines of the 650-acre grant of land made to George Johnston Junior in August 1819 although it also included parts of Thorne's estate and the Connell grant and part of the Georges Hall Estate. The land was acquired in April 1917 as a Group Settlement Purchase. The subdivision of the Settlement contained five streets: Bullecourt, Fleurbaix, Amiens and Pozieres Avenues, which were named after French battlefields, and Ashford Avenue, which was named after the incumbent Minister for Lands. Around fifty allotments were established for the purposes of poultry farming. The soldiers' settlement scheme ultimately failed through lack of training, capital, investigation of the land that was to be farmed and too many blocks of land that were too small to be realistically farmed. Less than eleven of the original Milperra Solider settlers remained by 1923, and their forfeited farms were allocated to other returned soldiers. By 1929, only about two thirds of the settlers were still working their land and by World War II at least half had moved on. However, the experience gained by the scheme led to the establishment of a successful settlement scheme program after World War II. Today, the Milperra sign near Amiens Avenue signifies the start of the former soldier settlement area.

There is one unlisted potential heritage item identified within the proposal area, the Milperra Soldier Tree, which was planted by J. Morrison in 1917. There is a small commemorative plaque in front of the tree, which was unveiled in 1988 by Bankstown City Council and the Milperra Bicentennial Committee. The tree and plaque are directly opposite 41 Ingram Avenue, Milperra. A heritage assessment of the Milperra Soldier Tree and commemorative plaque has concluded that these items have high value at a local level for their historic, associative, social and aesthetic significance. The Milperra Soldier Tree and commemorative plaque are shown in Figure 6-31 and Figure 6-32, respectively and in Figures 3-18 to 3-22 in Appendix K.

Heritage items are shown in Figure 6-33.

Figure 6-31 Soldier tree and commemorative plaque, opposite 41 Ingram Avenue

Figure 6-32 View of commemorative plaque in front of the Soldier tree

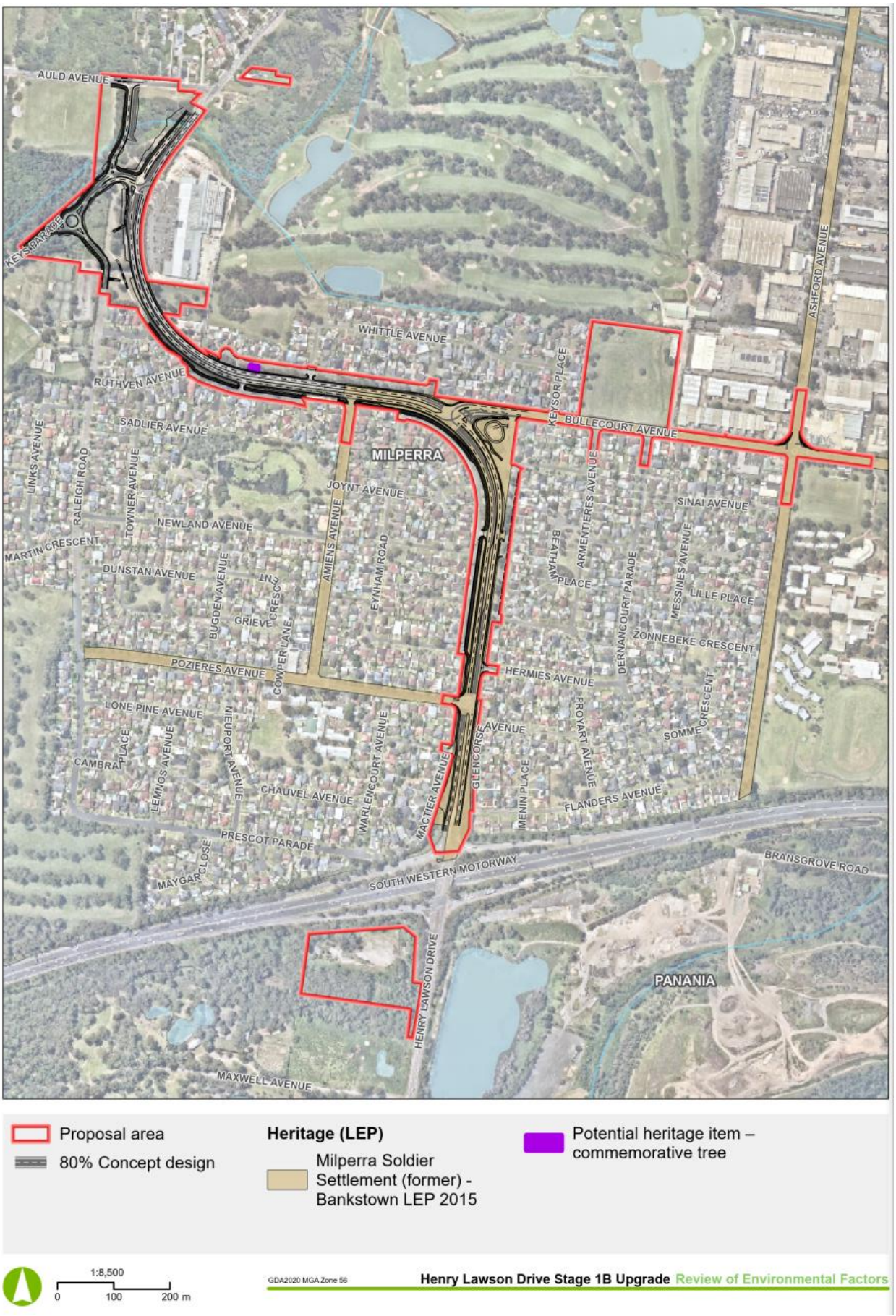


Figure 6-33 Heritage items near the proposal

Historical archaeological potential

The assessment does not provide a detailed review of all potential archaeological resources across the entire corridor. It uses the information gathered from existing sources to determine where the key archaeological resources may exist within the localised areas of the proposed excavation, particularly in the proposal area.

The proposal area falls within a road corridor which has undergone large changes since its construction in the 1930s, and later widening projects in the late 1960s and 1970s. According to the preliminary SOHI prepared by GML (2018) for the Henry Lawson Drive Upgrade Program, the past construction of existing roads has posed a moderate to high level of archaeological disturbance to the area and that modifications to the landscape including cutting culverts in the terrain and levelling the ground for the road surface has led to low to nil potential for historic archaeology in the proposal area.

6.10.3 Potential impacts

Construction

Table 6-66 summarises the listed heritage items located throughout the HLD Stage 1B proposal area and gives a ranking of the heritage impact identified.

Table 6-66 Summary of construction heritage impacts

Heritage item	Activity	Summary of impacts
Milperra Soldier Settlement (former) (#I29)	Widening Henry Lawson Drive from two to four lanes, including associated road, services and drainage upgrades, and vegetation removal	**Minor adverse (Direct physical and visual)** While the proposal area would encroach into the heritage curtilage and see a change to the intended scale of the former Settlement alignment, it would extend into areas that have been subject to more contemporary development and would have minimal impact on the heritage significance of the item.
Milperra Soldier Tree and commemorative plaque	Widening Henry Lawson Drive from two to four lanes, including associated road, services and drainage upgrades, and vegetation removal	**Major adverse (Direct physical and visual)** The current assessment shows that this tree would need to be removed due to impacts to its Structure Root Zone from the widening works. The removal of this tree and changes to its immediate setting would result in irreversible impacts to the local significance of this tree.
Henry Lawson Drive Road Bridge	The northern tie-in works would connect the proposal with the existing road bridge and new road bridge.	**Neutral** These works would have no heritage impact given the tie in scope would not occur on the bridge deck or structure.

Archaeological assessment

The potential archaeological impacts of the proposal are summarised in Table 6-67.

Table 6-67 Archaeological impacts of the proposal

Proposal feature	Findings
• Widening works to Henry Lawson Drive and associated intersection upgrades, particularly between Raleigh Road and the M5 Motorway. • Relocating utilities (including electrical, gas, water and	These works are not expected to have any built historic heritage impacts however they have the potential to disturb historical archaeological deposits within the proposal area. There is a minor risk for archaeological items to be uncovered during ground excavations and disturbance works. This includes the potential historical archaeology associated with the former agricultural activities in the area, as well as land clearing and

Proposal feature	Findings
telecommunications) and adjustment of drainage.	development associated with the former Soldier Settlement. Potential for any associated remains of the former uses of the area are unlikely to be intact and would be ephemeral in nature. However, there has been substantial ground and soil disturbance within the proposal area which means there is low potential for any archaeological remains.
• Intersection upgrades at Bullecourt Avenue and Bullecourt Avenue / Ashford Avenue intersection. • Upgrades at Amiens Avenue and Pozieres Avenue.	These works are not expected to have any built historic heritage impacts however they have the potential to disturb historical archaeological deposits within the proposal area. It is noted that the reserve to the south of the Bullecourt Avenue / Henry Lawson Drive intersection is an area which has been largely undeveloped since the construction of Henry Lawson Drive and may be an area which could contain potential for subsurface remains of former farming activities in the general area. Any existing road verges would also have a similar level of potential for subsurface historical archaeological remains given these areas have also seen less development over time than the road corridor itself. However, as there has been substantial ground and soil disturbance within the proposal area, which means there is low potential for any archaeological remains.
• Construction of the shared path on the western/southern side of Henry Lawson Drive.	The works associated with the upgrade to an existing shared path are not expected to have any impact on potential subsurface historical archaeology as works are unlikely to include any extensive level of excavation to prepare and lay the shared path.

Operation

Henry Lawson Drive has been widened and upgraded a number of times since its inception as a rural road within the Milperra Soldier Settlement in the 1920s and 1930s, and since its construction and upgrade as a main arterial road in the mid-to-late 20th century. Therefore, the former Milperra Soldier Settlement road alignment has seen many levels of disruption from its original intention as a rural road linking up adjoining settlements and farm land. The proposal would see this disruption continue with new widening of the main arterial and upgrades to all its intersections within the Milperra Soldier Settlement curtilage.

Whilst the proposal would add to the cumulative impact to the former Milperra Soldier Settlement road alignment, it enables the alignment itself to remain legible and is easily identifiable from aerials as the same historic alignment from the 1930s.

6.10.4 Safeguards and management measures

Table 6-68 Non-Aboriginal heritage safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
Non-Aboriginal heritage	A Non-Aboriginal Heritage Management Plan (NAHMP) would be prepared and implemented as part of the CEMP. It would provide specific drafting guidance on measures and controls to be implemented to avoid and mitigate impacts to non-Aboriginal heritage. The NAHMP would be prepared in consultation with the Office of Environment and Heritage.	Contractor	Pre-construction
	The *Transport for NSW Unexpected Heritage Items Procedure – EMF-HE-PR-0076* (Transport, 2022f) would be followed in the event that any unexpected heritage items, archaeological remains or potential relics of non-Aboriginal origin are encountered.	Contractor	Construction

Impact	Environmental safeguards	Responsibility	Timing
	Work would only re-commence once the requirements of that Procedure have been satisfied.		
	If potential future changes occur to the concept design resulting in works extending further into the LEP listed Milperra Soldier Settlement (former), further assessment would be required to address potential heritage impacts.	Contractor	Detailed design / pre-construction
	Further investigation into interpretation opportunities should be explored in the detailed design stage of the proposal by a qualified heritage interpretation specialist. This should take form of a Heritage Interpretation Plan (HIP). Recommendations for ideal locations for interpretation include along the shared path aligning with Ganmain Crescent, near the location of the Milperra Solider Tree, and in the small reserve to the south of the Bullecourt Avenue and Henry Lawson Drive intersection.	Contractor	Detailed design
Milperra Soldier Tree	Design change should be considered to look at how to minimise impacts to the Milperra Soldier Tree structural root zone to allow retention of the tree.	Contractor	Detailed design
	If the Milperra Soldier Tree and Commemorative Plaque cannot be avoided during works, it is recommended the former location of the tree is marked by the existing plaque, which should, at a minimum, be reinstated and refurbished. Heritage interpretation associated within this tree must be investigated within the HIP to be prepared for the proposal. It is also recommended that a re-planting strategy along this side of Henry Lawson Drive occur which would include the planting of a new tree as close to the original location of the former tree, or within the vicinity of its original location, to symbolise the tree's former location and mitigate the loss of the mature tree.	Contractor	Pre-construction / construction
Street signage	All local street signage is to be retained and relocated once the proposal is completed to ensure that the character of the former soldier settlement is retained, and to mark the former alignments of significant streets	Contractor	Pre-construction / construction
	The Milperra suburb road sign must be retained and relocated to a similar vantage point along Henry Lawson Drive once the proposal is completed.	Contractor	Pre-construction / construction
Milperra Drain Bridge	Should works be undertaken on the existing Milperra Drain Bridge superstructure or pre-cast concrete parapets, further heritage assessment would be required.	Contractor	Detailed design
Archaeological impacts	A qualified NSW historical archaeologist should be engaged during detailed design to provide a historical archaeological assessment for subsurface archaeological potential in the Milperra Soldier Settlement footprint and any archaeological potential associated with any other eras of development in the Milperra area.	Contractor	Detailed design / pre-construction

6.11 Aboriginal cultural heritage

An Aboriginal cultural heritage assessment report (CHAR) was prepared in September 2020 for the overall Henry Lawson Drive upgrade between the Hume Highway and the M5 Motorway. Due to design development, the Stage 1B proposal area assessed as part of the REF included areas that were not captured in this CHAR, meaning further assessment of the Aboriginal heritage of these areas was required. Due to the highly disturbed nature of these areas, a Stage 1 Procedure for Aboriginal Cultural Heritage Consultation and Investigation (PACHCI) was prepared by Transport. The CHAR and Stage 1 PACHCI can be found in Appendix L and Appendix M respectively.

6.11.1 Methodology

The CHAR identified three surface artefact scatters with areas of Potential Archaeological Deposits (PAD), two isolated surface artefacts and seven areas of PAD where surface artefacts were not found. The assessment recommended a program of archaeological test excavation be carried out in areas that were assessed as having potential for Aboriginal archaeological objects. The aim of the test excavation program was to collect information about underground Aboriginal objects through excavation of a sample of the areas of identified Aboriginal archaeological sites.

Field methodology was developed and carried out in line with the Roads and Maritime PACHCI and OEH *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (the OEH Code of Practice). The test excavation program was specifically designed to target questions of artefact survivability through assessing the intactness of the deposit. Following archaeological investigations, Aboriginal stakeholder consultations were carried out, which included the provision of test excavation methodology and results.

As has been mentioned, a Stage 1 PACHCI was carried out in 2022 to assess new areas in the proposal area that were not covered in the CHAR. The Stage 1 PACHCI involved preliminary assessments of the Aboriginal cultural heritage of the proposal. This assessment identified the proposal as being unlikely to have an impact on Aboriginal cultural heritage.

6.11.2 Existing environment

Existing landscape

The proposal area and its surrounds includes a low-lying hill in the south, floodplains which are next to the eastern bank of the Georges River and Prospect Creek, and the western slopes and spur lines of a northwest running ridge in the north. The ridgeline forms the watershed between the Prospect Creek catchment area in the west and Salt Pan Creek, located around five kilometres east of the proposal area. Prospect Creek and Salt Pan Creek are major tributaries of the Georges River which flows north and east along the boundary between the Cumberland Plain to the north and the Woronora Plateau to the south. The Georges River contains salt water from the Liverpool Weir to Botany Bay, around 15 kilometres east of the proposal area.

The low-lying parts of the proposal area would have been in the vicinity of a range of resources used by Aboriginal people; however, these areas are located within a flood prone zone. Flood prone areas are dynamic landscapes where sediment can be removed, reworked or redeposited. This can negatively impact the preservation of underground archaeological objects. Elevated landforms near to or within the floodplain are generally found to have greater archaeological potential than the flats.

Previous archaeological investigations in the region have shown that areas close to permanent water sources are more likely to contain high-density Aboriginal sites. These areas would have provided a stable environment throughout the year for the use of a range of resources.

Land use history

Before 1788, a mixture of native vegetation communities would have existed across the Cumberland Plain with distribution determined by soil, terrain, climate and management by Aboriginal people. The proposal area and surrounds features eight vegetation classes: Cumberland Shale Plains Woodland/Grassy Woodland; Castlereagh Swamp Woodland/Dry Sclerophyll Forest; Coastal Lagoon Fringing Scrub/Freshwater Wetlands; Cumberland Riverflat Forest, Cumberland Swamp Oak Riparian Forest, Estuarine Swamp Oak Forest/Forested Wetlands; Estuarine Reedland/Freshwater Wetlands; and Estuarine Mangrove Forest/Saline Wetlands. The wide variety of native vegetation and sources of permanent water would have made the region an attractive locale for past Aboriginal people. The variety of habitats would also have encouraged a diverse population of fauna.

The low-lying portions of the proposal area would have been in the vicinity of a range of resources used by Aboriginal people, however these areas are located within a flood prone zone. The Georges River has had 19 flooding events between 1873 and 1980 alone, and one in 20-year floods occurred in 1986 and 1988. Flood prone areas are dynamic landscapes where sediment can be removed, reworked or redeposited. These processes can negatively impact the preservation of subsurface archaeological deposits and elevated landforms bordering or within the floodplain are generally found to have greater archaeological potential than the flats.

British settlement into the region began in 1797 with land grants along the Georges River and Prospect Creek which Governor Hunter called 'Bank's Town' after Sir Joseph Banks. Grants made to George Bass and Matthew Flinders covered the area immediately north of the junction of the Georges River and Prospect Creek. Agricultural use of the area was generally limited because of flooding and difficulties in transportation to Parramatta or Sydney.

Results of investigations

Figure 6-34 shows the sites within the entire Henry Lawson Drive Upgrade Program between the Hume Highway and the M5 Motorway which were identified as having potential for Aboriginal archaeological objects in the CHAR.

As can be seen, all sites identified as having potential for Aboriginal archaeological objects are located outside of the Henry Lawson Drive Stage 1B proposal area. As such, no Aboriginal cultural heritage sites were identified.

Further assessment carried out in the Stage 1 PACHCI showed that the proposal would be unlikely to have an impact on Aboriginal cultural heritage. The assessment is based on the following:

- the proposal is unlikely to harm known Aboriginal objects or places
- the AHIMS search did not indicate moderate to high concentrations of Aboriginal objects or places in the proposal area
- the proposal area does not contain landscape features that indicate the presence of Aboriginal objects, based on the OEH Code of Practice and the Roads and Maritime Services' procedure
- the cultural heritage potential of the proposal area appears to be reduced due to past disturbance
- there are no sandstone rock outcrops likely to contain Aboriginal art.

Figure redacted due to information of a sensitive nature.

Figure 6-34 CHAR results (not for public display)

6.11.3 Potential impacts

Construction

Given all sites identified as having potential for Aboriginal archaeological objects were determined as being outside the scope of this proposal, there would be no impact to known Aboriginal heritage items during the construction process. However, if unknown or potential Aboriginal heritage items are uncovered during construction, the *Transport for NSW Unexpected Heritage Items Procedure – EMF-HE-PR-0076* (Transport, 2022f) should be followed.

Operation

No impacts to Aboriginal heritage would occur during the operation of the proposal.

6.11.4 Safeguards and management measures

Table 6-69 Aboriginal heritage safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Aboriginal heritage	An Aboriginal Heritage Management Plan (AHMP) would be prepared in line with the Procedure for Aboriginal cultural heritage consultation and investigation (Transport, 2012) and Transport for NSW Unexpected Heritage Items Procedure – EMF-HE-PR-0076 (Transport, 2022f) and implemented as part of the CEMP. It would provide specific drafting guidance on measures and controls to be implemented for managing impacts on Aboriginal heritage. The AHMP would be prepared in consultation with all relevant Aboriginal groups.	Contractor	Detailed design / Pre-construction	Section 4.9 of QA *G36 Environment Protection*
Aboriginal heritage	The *Transport for NSW Unexpected Heritage Items Procedure – EMF-HE-PR-0076* (Transport, 2022f) would be followed in the event that an unknown or potential Aboriginal object/s, including skeletal remains, is found during construction. This applies where Transport does not have approval to disturb the object/s or where a specific safeguard for managing the disturbance (apart from the Procedure) is not in place. Work would only re-commence once the requirements of that Procedure have been satisfied.	Contractor	Detailed design / Pre-construction	Section 4.9 of QA *G36 Environment Protection*

6.12 Other impacts

Other impacts that would result from the proposal are summarised in this section.

6.12.1 Existing environment and potential impacts

Table 6-70 Other potential impacts

Environmental factor	Existing environment	Potential impacts
Soils and contamination	The northern portion of the proposal area is underlain by the Richmond soil landscape. The southern and eastern section are underlain by the Blacktown soil landscape. The Richmond soil landscape consists of alluvial soils, as characterised by poorly structured orange to red clay loams, clays and sands. The Blacktown soil landscape consists of residual soils and is characterised as red and brown Podzolic Soils, grading to Yellow Podzolic Soils on lower slopes and drainage lines. Acid sulphate soil risk ranges from low to high in the northern section of the proposal area. There is no mapped acid sulphate soil risk in the southern and eastern portion of the proposal area. There are a number of contaminated sites listed on the NSW EPA's public register within one kilometre of the proposal area. This includes the former landfill located at 479 Henry Lawson Drive (now the Flower Power Garden Centre) directly east of the proposal area and the Riverlands Milperra property at 54 Auld Avenue about 250 metres west of the proposal area. These two sites present a moderate risk due to their proximity to the proposal due to the hazardous ground gas potentially previously produced, former and current contaminants and chemicals possibly used onsite. Contaminants of potential concern (COPC) for the proposal include:	The following soil impacts have the potential to occur during construction: • Clearing the proposal area of vegetation and topsoil would increase the risk of soil erosion in all soil types. Excavations further increase the risk of erosion as it increases the surface area of soils and subsoils exposed to the elements. It is likely that top soils may be eroded by surface runoff during wet weather events. • Disturbance of potential acid sulphate soils may cause acid generation. The presence of acid sulphate soils can accelerate corrosion due to the presence of acidic substances in the surrounding soil. Cracking of concrete structures can also be accelerated. • Runoff from exposed soils could produce a highly saline waste stream that may have minor impacts should it migrate into the groundwater through recharge. Due to the minor amount of soil to be excavated (148m^3), these impacts are considered very low. During construction, the proposal may disturb contaminated material, including during excavation and when groundwater is intercepted. The following former or current land uses and associated contamination sources have the potential to impact the proposal area during construction: • **Onsite filling**: there may be intermittent COPCs present within uncontrolled fill presumed to have been used historically in and next to the proposal area, including at the ancillary facility south of the M5. While only small volumes of spoil would be generated in the proposal area, which can be managed with standard management practices, onsite filling presents a moderate to high risk. • **Historical agriculture**: there is a risk of potential impacts from the historical agricultural usage of the wider area. Due to the flooding and runoff patterns of the proposal and downstream areas, these surface contaminants may have been

Environmental factor	Existing environment	Potential impacts
	• Heavy metals (Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Zinc) • Polychlorinated Biphenyls (PCB) • Total Recoverable Hydrocarbons (TRH) • Polycyclic Aromatic Hydrocarbons (PAH) • Per and Poly-Fluoroalkyl Substances (PFAS) • Volatile organic compounds (VOCs) • Asbestos in soils • Inert landfill wastes • Landfill gasses (i.e., methane and carbon dioxide). Analysis of the eSPADE salinity hazard mapping revealed the potential for saline soils within the proposal area. For most of the proposed zone, salt sites occur primarily on the edges of drainage lines and the potential for soil salinity is high.	drawn into groundwater and the deeper soil profiles. Historical agriculture presents a low to moderate risk. • **Offsite residential and commercial land uses**: fill material from outside the proposal area would not be disturbed during construction activities, meaning these land uses present a low risk. • **Former landfill operations**: there is a risk that potential impacts from the former landfill to the northeast of the proposal area have mobilised into soils and groundwater surrounding the former landfill, particularly during the development of the Flower Power complex. Impacts from the former landfill could include unknown wastes, potential soil and groundwater contaminants and hazardous ground gases (HGG). A long term management plan is in place for the Flower Power complex, however these landfill contaminants could become exposed and mobilise into the environment if any excavation of piling in the area surrounding Keys Parade or the southern section of Henry Lawson Drive is carried out. The former landfill operations pose a moderate risk of contamination to the proposal area during construction. • **Golf course operations and maintenance**: general upkeep and maintenance of the two golf courses in the area poses a risk of contamination through surface runoff and leaching into the groundwater table below the golf courses. COPCs include pesticides, herbicides and elevated nutrients from fertiliser use. However, the risk of contamination is low. • **Current petrol station operations and infrastructure**: there is a risk of underground storage tanks (USTs) storing petrol and other fuels to have potentially leaked and impacted the surrounding soils and groundwater near the BP at the Bullecourt Avenue and Ashford Avenue intersection. These could pose a risk to construction workers and the wider environment should any spills or leaks be encountered. Further impacts to soils and groundwater from UST leakage are unknown and may be encountered during piling and excavation works. However, the potential for impacts would be minimised through shallow excavation depth for the site's future usage as road and footpath infrastructure. For this reason, petrol station operations would pose a moderate to high risk of contamination. • **Kelso Waste Facility (located south of the M5 Motorway)**: there is a risk associated with potential impacts from the waste facility mobilising into soils and groundwater at the southern area of the former landfill. However, the closest area of the proposal to the Kelso Waste Facility is the ancillary facility south of the M5, where the intention is to only use the existing gravel area. The risk of contamination from this facility has been noted has low to moderate. Since the

Environmental factor	Existing environment	Potential impacts
		current engineering design indicates no clearing or excavation, the risk rating is reduced. • **Excavations intercepting groundwater and waterlogged soils**: excavation of soils within the Georges River hydrogeological landscape in the north-western section of the proposal area could expose acid sulphate soils between two and four metres below the surface. Once excavated and if left unmanaged, acid sulphate soils could cause harm to nearby waterways and flora and fauna in the area. Relatively small volumes of spoil would be produced from shallow excavations. Standard practices to manage acid sulphate soils produced as a result of the proposal would be implemented. As such, excavation risks are anticipated to be low to moderate. Potential risks to the local environment would be managed through implementation of a Construction and Environmental Management Plan (CEMP) during construction as well as other safeguards and management measures outlined in Section 6.12.2.
Air quality	The proposal area has been assessed using the Tool for Roadside Air Quality (TRAQ). Modelling was performed for four scenarios: • Projected 2031 traffic flows with and without the proposal • Projected 2041 traffic flows with and without the proposal A review of the data shows that both with and without the proposal, the section of the HLD north of Milperra Road is predicted to have the highest peak hour traffic in 2031 and 2041 as well as being impacted by the proposal. Therefore, the predicted traffic on this section has been adopted as a worst case traffic estimates, to present a conservative modelling scenario. CO, NO_2, PM_{10} and $PM_{2.5}$ were modelled at 10m from the kerbside.	The TRAQ assesses potential air quality impacts of the proposal from vehicular emissions on surrounding sensitive receptors. Scenarios with and without the proposal were assessed for 2031 and 2041. For the 2031 traffic emissions scenarios: • Maximum CO concentrations were within current air quality criteria • Annual and maximum NO_2 concentrations were within current air quality criteria • Maximum 24-hour PM_{10} concentrations were within criteria, however the annual PM_{10} reached the limit of the criteria without the proposal (25µg/m^3), including cumulative impact (predicted incremental impact plus assumed background concentration). With the proposal, the annual PM_{10} slightly exceeded the criteria at 25.2µg/m^3 (including cumulative impact) • Maximum 24-hour $PM_{2.5}$ concentrations were within criteria, however the annual $PM_{2.5}$ exceeded the limit of the criteria without the proposal (8µg/m^3) including cumulative impact of other proposals, reaching 12.2µg/m^3. With the proposal, the annual $PM_{2.5}$ exceeded the criteria at 12.4µg/m^3 (including cumulative impact) For the 2041 traffic emissions scenarios: • Maximum CO concentrations were within current air quality criteria • Annual and maximum NO_2 concentrations were within current air quality criteria

Environmental factor	Existing environment	Potential impacts
		• Maximum 24-hour PM_{10} concentrations were within criteria. With the proposal, the annual PM_{10} slightly exceeded the criteria at 25.3µg/m^3 (including cumulative impact) • Maximum 24-hour $PM_{2.5}$ concentrations were within criteria, however the annual $PM_{2.5}$ exceeded the limit of the criteria without the proposal (8µg/m^3) including cumulative impact of other proposals, reaching 12.1µg/m^3. With the proposal, the annual $PM_{2.5}$ exceeded the criteria at 12.5µg/m^3 (including cumulative impact) The increases in the predicted cumulative annual average concentrations at 10m from the kerbside as a result of the proposal are minimal. TRAQ is a highly conservative screening model, which may overestimate actual impacts, and the modelling was performed using conservative assumptions in relation to the assumed PM2.5/PM10 ratio, meteorological data, season options, and the fleet mix.
Bushfire	A search of the NSW Bush Fire Prone Land dataset (NSW Rural Fire Service, 2020) was conducted on 12/12/22. To the north of the proposal alignment, the areas of vegetation along Bankstown Golf club is mapped as Vegetation Category 1 land. Vegetation Category 1 is considered to be the highest risk for bush fire and is given a 100 metre buffer. Vegetation along the south of Auld Avenue near the intersection of Henry Lawson Drive is mapped as Vegetation Category 2. Vegetation Category 2 is considered to be a lower bush fire risk than Category 1 and Category 3, but higher than the excluded areas. This vegetation category is given a 30 metre buffer	The Planning for Bush Fire Protection (PBP) 2006 identifies development standards for designing and building on bushfire prone land in New South Wales. A road upgrade is not a class of development that requires a bushfire assessment under the PBP. Measures to mitigate and manage bushfire would be developed and included as part of a site-specific bushfire management plan within the CEMP for the proposal. Temporary ancillary facilities and construction infrastructure would generally be less sensitive to bushfire than permanent facilities, given the temporary nature of the construction compounds and the absence of critical infrastructure within the compounds. Construction personnel would be inducted into the requirement to operate safely to minimise risk of fire. During construction, there would be impacts on roads in and next to the construction footprint including reduced speed limits and modified arrangements. This may delay response times and/or access for emergency services including fire crews, in the event of a bushfire. It is recommended that a bushfire management plan is prepared. Road reserves are extremely important in bushfire management. They provide access for firefighting operations, can provide a containment line or firebreak, and are a route of escape in the event of an evacuation. The proposal would not obstruct the road reserves during construction. It would therefore continue to be able to perform as an evacuation route. The proposal is not expected to be a significant bushfire hazard during operation as ongoing vegetation management activities by Transport would be carried out along the road corridor. Access for emergency services would be improved by the operation of the proposal.

Environmental factor	Existing environment	Potential impacts
Waste	Transport is committed to ensuring the responsible management of unavoidable waste and promotes the reuse of such waste in line with the resource management hierarchy principles outlined in the *Waste Avoidance and Resource Recovery Act 2001*. These resource management hierarchy principles, in order of priority, are: • Avoidance of unnecessary resource consumption in operations, maintenance, construction and management • Resource recovery (including reuse, reprocessing, recycling and energy recovery) • Disposal. By adopting the above principles, Transport aims to efficiently reduce resource use, reduce costs, and reduce environmental harm in line with the principles of ESD.	The proposal has the potential to generate waste from the following activities: • vegetation clearance including native, exotic and noxious species • topsoil removal for embankments and removal of soil for road widening • existing structure removal and utility adjustments. Waste streams likely to be generated during construction of the proposal include: • Excess spoil-material generated by the proposal would be reused on site in areas of fill with the exception of any unsuitable material. The only spoil which would be removed from site is material which is deemed unsuitable for reuse on site • Green waste as a result of vegetation clearing. Noxious weed material would be separated from native green waste. Green waste would either be mulched and reused on site or sent to a composting facility • roadside materials (e.g., fencing, guideposts and guard rails) • packaging and general waste from staff (e.g., lunch packaging, portable toilets) • chemicals and oils including waste from motor vehicles • wastewater from wash-down and bunded areas • redundant erosion and sediment controls. Unsuitable fill material and all other wastes would be classified in line with the NSW EPA Waste Classification Guidelines (2014) and disposed of at an appropriately licenced facility. Final waste classification is required once the volumes of waste requiring offsite disposal during construction are confirmed. There would be only minimal generation of waste from the construction of the proposal.

6.12.2 Safeguards and management measures

Table 6-71 Other impacts Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
Soils	• A Contaminated Land Management Plan would be prepared in line with the Guideline for the Management of Contamination (Transport for NSW, 2013) and implemented as part of the CEMP. The plan would include, but not be limited to: – capture and management of any surface runoff contaminated by exposure to the contaminated land – further investigations required to determine the extent, concentration and type of contamination, as identified in the detailed site investigation (Phase 2) – management of the remediation and subsequent validation of the contaminated land, including any certification required – measures to ensure the safety of site personnel and local communities during construction. • If contaminated areas are encountered during construction, appropriate control measures would be implemented to manage the immediate risks of contamination. All other works that may impact on the contaminated area would cease until the nature and extent of the contamination has been confirmed and any necessary site-specific controls or further actions identified in consultation with the Transport for NSW Senior Manager Environment and Sustainability and/or EPA. • A site-specific emergency spill plan would be developed and include spill-management measures in line with the Transport Code of Practice for Water Management (RTA, 1999) and relevant EPA guidelines. The plan would 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 EPA officers).	Contractor	Detailed design / pre-construction
Contamination	• A detailed site investigation (DSI) should be carried out during detailed design in the areas showing a moderate risk of COPCs to assess if concentrations are above the tier 1 screening values, as described in the National Environmental Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) Schedules B1 and B2 (NEPM, 2013). These include: – the onsite area in the northwest section with historical agricultural uses – the current BP petrol station	Transport / Contractor	Detailed design / construction

Impact	Environmental safeguards	Responsibility	Timing
	– the former landfills and current Flower Power complex and Kelso Waste Facility – the general filling of ground – the current Bankstown and Riverland Golf Courses – the southern ancillary facility. • The scope of the DSI should be detailed in a sampling analysis and quality plan (SAQP) which should include collection of soil, groundwater and landfill gas samples near associated moderate risk areas. Since the southern ancillary facility would be used as a storage facility with no intrusive works, a licenced asbestos assessor should conduct a walkover to assess the impact of asbestos containing material onsite and to assess the need for an asbestos management plan and a management plan to contain soil material brought onsite and minimise cross-contamination with asbestos. It should also be in accordance with the NEPM 2013 and analytical results compared to the applicable Tier 1 screening values in Schedule B2 of the NEPM 2013. • If deeper excavation is required based on the detailed design, further site investigation would be required for the area next to the BP petrol station within the proposal area. The site investigation would need to assess soil, groundwater and vapour risks to the proposal area. • Analytical results from any spoil requiring off-site disposal should be compared to the concentrations in the NSW EPA Waste Classification Guidelines Parts 1 to 4 and Addendum 1. If natural soil is disturbed, it may meet the definition of ENM for reuse and the analytical data should be compared to the concentrations and requirements in the ENM Resource Recovery Order and Exemption under the Protection of Environmental Operations (Waste) Act 2000. • If soils between two and four metres are disturbed with the proposal area, an ASSMP should be included in the CEMP. The ASSMP should be informed by the results of the DSI that would include the identification of presence and extent of ASS/PASS, particularly around the northern section of the proposal area.		
Air quality	An Air Quality Management Plan (AQMP) would be prepared and implemented as part of the CEMP. The AQMP would include, but not be limited to: • potential sources of air pollution • air quality management objectives consistent with any relevant published EPA and/or Office of Environment and Heritage (OEH) guidelines	Contractor	Detailed design / pre-construction

Impact	Environmental safeguards	Responsibility	Timing
	• mitigation and suppression measures to be implemented • methods to manage work during strong winds or other adverse weather conditions • a progressive rehabilitation strategy for exposed surfaces.		
Waste	A Waste Management Plan (WMP) would be prepared and implemented as part of the CEMP. The WMP would include but not be limited to: • measures to avoid and minimise waste associated with the proposal • classification of wastes and management options (re-use, recycle, stockpile, disposal) • statutory approvals required for managing on- and off-site waste, or application of any relevant resource recovery exemptions • procedures for storage, transport and disposal • monitoring, record keeping and reporting. The WMP would align with the *Environmental Procedure - Management of Wastes on Transport for NSW Land* (Transport, 2014b) and relevant Transport Waste fact sheets.	Contractor	Pre-construction
	A Material Re-use and Management Plan (MRMP) would be prepared to: • identify strategies to avoid, reduce, reuse and recycle all materials • identify the type, classify and estimate volumes of all materials to be generated and used. Identify storage, treatment, transport and disposal options and pathways	Transport	Detailed design
Bushfire risk	The CEMP would include a bushfire management plan prepared in line with the Planning for Bush Fire Protection 2019 (Rural Fire Service 2019). Measures to be implemented to manage bushfire risk include: • monitoring of weather and local bushfire ratings • consultation requirements for community notifications in the event of a bushfire • maintaining equipment in good working order • ensuring plant and equipment are fitted with appropriate spark arrestors, where practicable • ensuring site workers are informed of the site rules including designated smoking areas and putting rubbish in designated bins. • obtaining hot work permits and implementing total fire bans as required • implementing adequate storage and handling requirements for potentially flammable substances in line with the relevant guidelines.	Contractor	Pre-construction / Construction

Impact	Environmental safeguards	Responsibility	Timing
Consultation with emergency services	Consultation with emergency services, including the Rural Fire Service and Fire and Rescue NSW to: • ensure emergency access is maintained during construction • co-ordinate any bush fire emergency actions as outlined in the proposal's Bushfire Management Plan.	Contractor	Construction

6.13 Cumulative impacts

The incremental effect of multiple sources of impact (past, present and future) are referred to as cumulative impacts (Contant and Wiggins, 1991, Council on Environmental Quality, 1978). Cumulative impact assessment considers a proposal within the context of other past, present and likely future sources of impact. This is necessary to identify any impacts associated with the proposal that may have an additive effect or interaction with impacts from other activities within the locality to the extent that the overall (cumulative) impact becomes significant when it would not otherwise have been significant.

6.13.1 Study area

The cumulative impact assessment has considered the impacts of the proposal to Henry Lawson Drive between Auld Avenue and the M5 Motorway. Other developments and projects that are located near the proposal have been included when considering cumulative impacts (refer Section 6.13.3). Developments and projects have been considered where either the construction or operation phases of the projects would overlap with the proposal and result in cumulative impacts.

6.13.2 Broader program of work

The proposal is part of a broader program of work to widen the road surface on sections of Henry Lawson Drive between Hume Highway, Villawood, and the M5 Motorway, Milperra. The Henry Lawson Drive Upgrade Project has been divided into four stages, with this proposal forming the second stage. An REF and an EIS were prepared and submitted for the first stage, Henry Lawson Drive Upgrade Stage 1A, in 2021. Stage 1B provides connection between Stage 1A and the M5 Motorway. The cumulative impacts considered in this section build on those outlined in the REF for Stage 1A.

6.13.3 Other projects and developments

The other projects and developments which have been identified as relevant when considering the cumulative impacts are:

- Henry Lawson Drive Stage 1A project (including the Tower Road intersection upgrade) (REF and EIS approved, in delivery)
- Milperra Road and Murray Jones Drive intersection upgrade (as part of the Bankstown Airport redevelopment by Bankstown Airport Ltd) (in planning)
- SIMTA Intermodal Facility (in construction)
- Riverlands subdivision (DA approved, in delivery)
- Anglicare Seniors Living Development, Bullecourt Avenue, Milperra (DA approved, construction timing to be confirmed)
- Widening of Milperra Drain within Bankstown Golf Course (completed 2021)
- Bankstown Airport redevelopment (in construction)
- Henry Lawson Drive Upgrade - Georges Hall (completed in late 2022)
- Gordon Parker Reserve amenities upgrade (completed in late 2022)
- Glenfield Waste Services Materials Recycling Facility (in planning).

The proposal forms part of the broader Henry Lawson Drive upgrade.

6.13.4 Potential impacts

Biodiversity

Residential and infrastructure development in the locality in historic and recent times has led to extensive vegetation clearing in the locality and at the catchment scale. Remaining remnant vegetation/habitat has also been affected by a variety of disturbance mechanisms, including clearing of undergrowth, altered fire regimes, feral animals and weed invasion. This habitat loss and disturbance has resulted in the local extinction of a number of species which are less tolerant of habitat loss and disturbance (e.g., woodland birds and small mammals) and an increased risk of extinction to a number of vegetation communities.

Isolated remnant populations of disturbance-sensitive threatened species in such a landscape may be susceptible to local extinction due to seemingly small reductions in habitat area or quality, if the habitat is near the lower limit in size or quality necessary to support a viable population and a critical threshold is reached.

In assessing the cumulative impact of a proposal, it is important to consider whether the additive effects of multiple projects and proposals may cause such a critical threshold to be reached for any threatened biodiversity affected.

The following projects and proposals are underway or planned in the locality, which impact on biodiversity values that are likely to be impacted by the current proposal, resulting in a cumulative impact. Information has been sourced where it is publicly available:

- Bankstown Airport Redevelopment South West Precinct (in construction)
  - clearing of 3.5ha of native vegetation
  - habitat for Grey-headed Flying Fox, Green and Golden Bell Frog, seven Microchiropteran Bats, Swamp Harrier, Little Eagle, Square-tailed Kite, Eastern Osprey, Varied Sittella, Dusky Woodswallow, Scarlet Robin and Flame Robin.
- SIMTA Intermodal Facility (in construction):
  - clearing of 1.23ha of native vegetation.
- Milperra Drain Widening (in construction):
  - 0.83ha of River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-east Corner bioregions
  - 0.15ha of Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions.
- Glenfield Waste Services Materials Recycling Facility (in planning):
  - 9.5ha of critically endangered Cumberland Plain Shale Woodland and Shale Gravel Transition Forest
  - five threatened bat species recorded.
- Riverlands subdivision – Milperra (in planning):
  - 0.54ha River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-east Corner bioregions
  - 0.48ha Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions
  - Southern Myotis
  - Green and Golden Bell Frog.
- Anglicare Seniors Living Development:
  - removal of 0.13ha of TEC and 0.01ha of planted native vegetation (as identified in Section 5.3 of Appendix H).
- Henry Lawson Drive – EIS for Stage 1A (in delivery):
  - 0.02ha of Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions

  - 0.02ha River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-east Corner bioregions
  - 0.21ha Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions
  - threatened species including Large Bent-winged Bat, Little Bent-winged Bat, Swift Parrot and Southern Myotis.
- Henry Lawson Drive – REF for 1A (in delivery):
  - 1.69ha of PCT 725, PCT 781, PCT 835, PCT 1236, PCT 1234 and PCT 1800. Some of this vegetation overlaps with Stage 1B.
- Henry Lawson Drive – Addendum REF for 1A (in delivery):
  - 0.27ha of vegetation, including 0.13ha of PCT835 and 0.14ha of weeds and exotics.

The proposal's removal of 6.1ha of native vegetation and habitats would represent an incremental increase to impacts on biodiversity associated with past, present and future projects and proposals within the locality. This incremental increase is considered unlikely to exacerbate impacts on biodiversity such that the critical threshold would be reached.

Indirect impacts on biodiversity from noise, dust, light and contaminant pollution are likely to result from activities associated with both the proposal and would likely result in incremental cumulative effects. Environmental safeguards and mitigation measures would minimise the potential for cumulative effects.

Aboriginal cultural heritage

Cumulative impacts to Aboriginal cultural heritage can result in substantial or total loss of any remaining cultural heritage in an area. This is through the loss of artefacts, sites or knowledge.

The cumulative contribution of the proposal on Aboriginal cultural heritage is negligible as there are no known Aboriginal heritage sites within the proposed disturbance footprint.

Another seven sites may be subject to total and direct harm from potential future upgrade of sections of the Henry Lawson Drive corridor. Most of these sites are considered to have low significance while two sites have moderate significance. Archaeological mitigation would be required for future upgrade projects where cultural heritage exists, should future transport planning and development occur. The timing of this is uncertain.

Non-Aboriginal heritage

The proposal has been assessed as having a minor impact on the former Milperra Soldier Settlement. While the proposal area would encroach into the heritage curtilage and see a change to the intended scale of the former Settlement, it would extend into areas that have been subject to more contemporary development and would have minimal impact on the heritage significance of the item. The proposal has been assessed as having a major adverse effect on the Milperra Soldier Tree, which would require removal under current design specifications. As detailed in section 6.10.4, opportunities to minimise impacts to the Milperra Soldier Tree structural root zone to allow for retention of the tree would be considered during detailed design. In combination with the heritage impacts associated with nearby projects, including the Bankstown Airport Redevelopment, the cumulative contribution of the proposal is considered minor.

Contamination and soil quality

The contamination and soil quality impacts relating to the proposal have been considered with an understanding of the existing site constraints through the desktop review which highlighted potential issues from nearby sites. It is considered that there is an overall beneficial impact when considering the proposal in addition to the surrounding major projects as all projects would manage and/or rehabilitate any known contamination issue.

For example, the Flower Power complex had historical indications of elevated CoPC including methane and landfill gas concentrates. As it has been constructed, it is reasonable to assume the site has been remediated.

The cumulative impact from the overall proposal includes similar impacts to the proposal, noting that the proposal involves impacts from a greater scale of construction activities. The proposal does have the added risk of asbestos in fill material and a large scale of soil disturbing activities. It is estimated that only a small

amount of spoil material would be generated as a result of the proposal, which could be managed with standard construction practices (to be confirmed during detailed design).

Hydrology and flooding

The hydrology assessment cumulatively assessed local terrain changes from this proposal, the Henry Lawson Drive Stage 1A upgrade and the Milperra Drain reconstruction. These terrain changes formed part of the pre-proposal conditions. The Bankstown Airport redevelopment did not form part of pre-proposal conditions. These impacts include:

- According to the Henry Lawson Drive Stage 1A REF, the upgrade would have the potential to increase peak flood levels at a number of locations due to the raised level of Henry Lawson Drive and the obstruction this would have on flow that presently overtops the road during coincident Georges River and Milperra catchment flooding.
- According to the Milperra Drain Widening Review of Environmental Factors (Cardno, 2018), the widening of Milperra Drain would result in a reduction in the depth of flooding at a number of properties along Ashford Avenue and Milperra Road. No increases in flood levels attributable to the widening works are identified. With safeguards, the proposal would have only a minor impact on flood behaviour in Milperra Drain. The proposal would not adversely affect the benefits of the Milperra Drain widening (i.e., reductions in flood levels).

The combination of the proposal, the Henry Lawson Drive Stage 1A upgrade and the Milperra Drain widening would only have a minor drainage and flooding impact. Ongoing consultation with Canterbury Bankstown Council would occur during detailed design to assess potential impacts of the proposal and to consider emerging hydrology and flooding issues.

It is expected that the proposal would not adversely affect the reductions in flood levels in Milperra Drain that are attributable to the widening works within the Bankstown Golf Course.

Land use and development

The proposal would involve a minimal change to the land use of the area. While most of the proposal would be constructed within the existing road corridor, there would be some strip acquisition and change of land use along the Henry Lawson Drive corridor. Impacts would be related to the mostly partial property acquisition.

Other major projects in the area would have a greater impact on surrounding land use. The Bankstown Airport redevelopment would result in the land use change from airport operational land to commercial development. The Riverlands development would result in a land use change in a large parcel of land along the Georges River from recreational to residential development. The Anglicare Seniors Living Development at 27 Bullecourt Avenue, Milperra would change the land use at that site from recreational to a residential retirement village development.

As such, cumulatively, the proposal would only contribute a minor impact to land use change in the area.

Groundwater

Potential cumulative impacts may include reduced recharge as a result of increased area of impervious surfaces. Increased groundwater and soil salinity may also result through stormwater to groundwater interactions.

The key potential cumulative impacts include:

- Interception of acid sulphate soils: infiltration through acid sulphate soils would potentially leach acids into the groundwater resource which is shared by the Henry Lawson Drive Stage 1A EIS proposal. However, these are to be managed by following Guidelines for the Management of Acid Sulphate Materials 2005 (RMS, 2005) and the CEMP of this proposal.
- Accidental spills or leaks of chemicals, oils and greases that, if not managed appropriately, could contaminate the groundwater.
- Impacts on groundwater from the culvert works across Milperra Drain and the impacts from a greater scale of construction activities. Although aquifer drawdown is not proposed, if groundwater dewatering must occur for the proposal, potential impacts on GDEs must be quantitatively assessed and documented in a site dewatering management plan prior to dewatering along with appropriate management measures.

When considering the proposal in addition to surrounding major projects, this proposal is not of a nature that would draw upon the groundwater aquifer as a water supply. Impacts on groundwater would therefore be via

interactions during excavations. The contribution of the proposal to cumulative impacts is expected to be minor and short term during the construction period. The soils, surface water and groundwater assessment (Appendix J to this REF) notes that surrounding developments, including the Flower Power complex, the Riverlands development, the Anglicare Seniors Living Development and the Gordon Parker Reserve amenities upgrade, are not anticipated to result in any cumulative groundwater impacts.

Surface water

During construction, potential negative impacts to water quality of the sensitive receiving environments could arise if construction of future developments were to occur concurrently with the proposal.

Given the current status of surrounding projects, it is expected that the main civil earthworks and surface infrastructure for the Henry Lawson Drive Stage 1A upgrade and for the Riverlands development would be completed before the proposal commences construction in 2024. If occurring concurrently, in a worst case scenario, the potential impacts would likely include increases in water quality parameters such as TSS, TDS and turbidity due to the disturbance or removal of groundcover and bulk earthworks. However, the safeguards and mitigation measures for the proposal would be sufficient to avoid and manage the proposal's cumulative contribution to water quality impacts.

During operation, the proposal could contribute to the cumulative water quality impacts on the Georges River with other surrounding projects and proposals. Each project and proposal would be expected to manage water quality within the sub-catchments of their development and in line with the objectives of the Coastal Management SEPP and the Greater Metropolitan Regional Environmental Plan No 2 – Georges River Catchment. The proposal aims to have a neutral cumulative contribution to water quality parameters that include gross pollutants, total nitrogen, total phosphorus and TSS.

The safeguards and mitigation measures identified for the proposal would be sufficient to achieve a neutral cumulative contribution. This would include further investigations for stormwater quality controls in the broader sub-catchments in consultation with Canterbury Bankstown Council.

Traffic and transport

The traffic modelling for the proposal used a broader road network as the study area to capture expected future traffic generation from proposed future land use changes. Forecasted traffic volumes adopted for the proposal therefore include the Bankstown Airport Redevelopment, Flower Power complex and the proposed Riverlands subdivision, as well as the future traffic flow with the Henry Lawson Drive Stage 1A upgrade in operation. Traffic modelling results are detailed in Section 6.2.

Noise and vibration

The noise and vibration impacts of the proposal have been summarised in Section 6.3. The main impacts on sensitive receivers would be during construction, in particular night-time periods. The proposal is expected to commence construction in 2024. By this time, the projects and proposals that have common sensitive receivers to this proposal are expected to be complete, including Bankstown Airport Redevelopment. Therefore, cumulative construction impacts of the proposal in combination with these other projects and proposals are not expected to occur.

The Riverlands subdivision is located some distance away from the noise catchment areas and sensitive receivers impacted by the proposal. As a result, cumulative impacts are considered unlikely from the combination of these proposals.

During operation, predicted noise impacts have been based on future forecasted traffic volumes that include the Bankstown Airport Redevelopment, Flower Power complex, the proposed Riverlands subdivision and the Henry Lawson Drive Stage 1A upgrade. On this basis, the proposed noise mitigation for several sensitive receivers (refer Section 6.3.5) addresses the cumulative contribution of traffic noise from these other projects and proposals.

Socio-economic

Cumulative impacts could occur during construction if other projects are constructed concurrently or in close timing with the proposal. It is expected that the proposal would commence construction soon after the completion of surrounding projects, including the Bankstown Airport Redevelopment and the Stage 1A upgrade.

This would mean the community would experience construction activity in the local area for an extended period of time. Cumulative impacts from construction would be in the form of reduced amenity and traffic disruptions. Potential consultation and construction fatigue for local communities and stakeholders could

also be experienced. The magnitude of the cumulative impacts due to concurrent construction projects are moderate, resulting in the level of significance being moderate.

During operation, the proposal is not expected to make a substantial negative contribution to cumulative impacts in combination with that of other projects and proposals. Design development of the proposal has included expected demand and growth from surrounding developments and land uses. The proposal is needed to support these other projects and proposals once they are constructed and in operation. The sensitivity of the community to cumulative socio-economic impacts is negligible. The magnitude of the cumulative impacts (amenity, access, land use changes, social infrastructure and businesses) during operation is negligible, resulting in the level of significance being negligible.

Air quality

There is potential for cumulative impacts relating to dust generation during construction of the proposal along with the construction of the surrounding development. With incorporation of safeguards, the proposal would have only a minor impact in terms of cumulative dust generation.

The proposal would have the larger cumulative contribution to air emissions from transport, once operational. In the long-term this is expected to reduce if the implementation of Transport's Future Transport Strategy, Future Energy Action Plan 2020-2025 and NSW Government Climate Change Policy is successful. It is also noted that the proposal would be catering for future demand that would be driven by surrounding development, not by the road in itself.

Risk/hazard

There is limited bushfire risk from the other major developments and therefore there would not be a cumulative impact. The increased capacity from the proposal, however, could assist traffic evacuation during times of bushfire or flood emergencies.

The surrounding developments also would not have impacts on the airport operations.

With the incorporation of safeguards, the proposal would only have a minor impact in terms of cumulative impacts relating to risk/hazards.

Waste management

The proposal involves an amount of waste generation which requires consideration and management. There would be waste generated from the other projects, however, they have similar safeguards in place. For example, Bankstown Airport Redevelopment have stated that any demolition waste would, where practicable, be recycled at Bankstown Airport. The Bankstown Airport contractor would also prepare a detailed waste management plan. In terms of operational waste, Bankstown Airport have an Operational Environmental Management Plan that would include waste management procedures for the site. A Waste Management Plan was also prepared for the Riverlands subdivision, as part of their development application.

With the incorporation of safeguards, the proposal would only have a minor impact in terms of cumulative impacts relating to waste.

6.13.5 Safeguards and management measures

Table 6-72 Cumulative safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
Cumulative impacts	Ongoing consultation would be carried out between proponents and construction contractors of surrounding projects to identify the potential for cumulative impacts to occur should construction occur concurrently with the proposal. Co-ordination of traffic management controls would be considered to minimise cumulative traffic impacts, particularly during peak holiday periods. Co-ordination of out of hours work would be considered to minimise cumulative noise impacts to sensitive receivers and to ensure respite periods are achieved for sensitive receivers.	Transport / contractor	Detailed design / pre-construction / construction

7 Environmental management

7.1 Environmental management plans (or system)

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) would be prepared to describe the safeguards and management measures identified. The CEMP would provide a framework for establishing how these measures would be implemented and who would be responsible for their implementation.

The CEMP would be prepared prior to construction of the proposal and must be reviewed and certified by the Transport for NSW Environment and Sustainability Officer prior to the commencement of any on-site works. The CEMP would be a working document, subject to ongoing change and updated as necessary to respond to specific requirements. The CEMP would be developed in line 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 G40 - Clearing and Grubbing*, *QA –Specification G10 - Traffic Management*.

The Contractor's CEMP as required under QA Specification G36 would identify the monitoring requirements during construction of the proposal which would include but not be limited to: monitoring of water quality upstream and downstream of construction works, noise monitoring, vibration monitoring, and other required monitoring to respond to community complaints. The following Transport environmental inspection and incident reporting procedures would be followed during construction:

- Transport for NSW's Environmental Inspection Procedure
- Transport for NSW's Environmental Incident Procedure.

In the long term, the asset would be put into the Transport asset and maintenance system and would be subject to periodic maintenance inspections, including inspections of operational water quality controls and carrying out any required maintenance.

7.2 Summary of safeguards and management measures

Environmental safeguards and management measures outlined in this REF would 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 would minimise any potential adverse impacts arising from the proposed works 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
GEN1	Minimise environmental impacts during construction	A CEMP would be prepared and submitted for review and endorsement of the Transport for NSW Senior Manager Environment and Sustainability prior to commencement of the activity. As a minimum, the CEMP would address the following: • any requirements associated with statutory approvals • details of how the proposal would implement the identified safeguards outlined in the REF • issue-specific environmental management plans, including management actions to avoid inadvertently causing additional impacts to those described in the BAR, an appropriate erosion and sedimentation control plan, and weed control activities • roles and responsibilities • communication requirements • induction and training requirements • procedures for monitoring and evaluating environmental performance, and for corrective action • reporting requirements and record-keeping • procedures for emergency and incident management • procedures for audit and review. The endorsed CEMP would be implemented during the carrying out of the activity.	Contractor / Transport	Pre-construction / detailed design
GEN2	Notification	All businesses, residential properties and other key stakeholders (e.g., schools, local councils) affected by the activity would be notified at least five working days prior to commencement of the activity.	Contractor / Transport	Pre-construction
GEN3	Environmental awareness	All personnel working on site would receive training to ensure awareness of the environment protection requirements to be implemented during the proposal. This would include up-front site induction and regular "toolbox" style briefings. Site-specific training would be provided to personnel engaged in activities or areas of higher risk. These include: • Threatened species habitat • Unexpected finds procedure	Contractor	Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
		• Adjoining residential areas requiring noise awareness, behavioural practices and mitigation measures.		
GEN4	Utilities	Prior to the commencement of works, the location of existing utilities and relocation details would be confirmed following consultation with affected utility owners. Further assessment would be carried out if the scope or location of proposed utility relocation works falls outside of the assessed proposal scope and footprint.	Contractor	Pre-construction
Arboriculture				
A1	Tree removal	During detailed design, opportunities to reduce the number of trees impacted by the proposal will continue to be explored. Where possible, consideration will be given to refining the proposal's alignment and shared path design options to avoid or minimise impact on root zones.	Transport	Detailed design
A2	TPZ Encroachment	Where minor encroachment with the TPZ occurs, the following measures would be implemented: • the area lost to this encroachment would be compensated for elsewhere near the TPZ • tree protection would be installed. For any works within the TPZ of protected trees, the proposal arborist must be present. Where major encroachment with the TPZ occurs, the following measures would be implemented: • the proposal arborist must demonstrate that the tree(s) would remain viable • root investigations by non-destructive methods may be required for any trees proposed to be retained • the area lost to this encroachment would be compensated for elsewhere near the TPZ • the proposal arborist would be required to supervise any work within the TPZ • tree protection would be installed.	Contractor	Pre-construction / construction
A3	Tree removal, pruning and excavation impacts	All tree removal and pruning work is to be carried out by an arborist with a minimum AQF Level 3 qualification in Arboriculture, in line with Australian Standard AS4373-2007, Pruning of Amenity Trees (AS4373), the Work Health and Safety Act 2011, and Work Health and Safety Regulations 2017. The proposal arborist must supervise and certify that all excavations and root pruning are in line with AS4373 and AS4970. All excavations (including root investigations) within the TPZ must be carried out using tree-sensitive methods and be supervised by the proposal arborist.	Contractor	Pre-construction
A4	Construction clearance impacts on trees	Minor vegetation trimming may be required to accommodate construction clearances. Vegetation trimming would follow the following guidelines: • pruning must not exceed 10 per cent of the overall canopy volume • no limbs greater than 100 millimetres in diameter are to be removed • the final pruning cut shall be at the branch collar or growth point in line with AS4373.	Contractor	Pre-construction

No.	Impact	Environmental safeguards	Responsibility	Timing
A5	Tree protection fencing	Where tree protection is required, tree protection fencing must follow the following guidelines: • temporary mesh panel fencing (minimum height of 1.8 metres) • installed prior to site set up and remain intact until the completion of the proposal • protective fencing must not be removed or altered without the approval of the proposal arborist • prominently signposted with 300 millimetre by 450 millimetre boards stating, “NO ACCESS – TREE PROTECTION ZONE.” • certified and inspected by the proposal arborist. If tree protection fencing is not practical due to site constraints, tree protection delineation must be installed as an alternative. Specifications for tree protection barriers are as follows: • star pickets spaced at 2 metre intervals • connected by a continuous high-visibility barrier/hazard mesh or flagging rope • maintained at a minimum height of 1 metre. Another alternative where tree protection fencing is not practical would be trunk protection. Specifications for trunk protection are as follows: • a thick layer of carpet underfelt, geotextile fabric, or similar wrapped around the trunk to a minimum height of 2 metres • 1.8 metre lengths of softwood timbers aligned vertically and spaced evenly around the trunk (with a small gap of around 50 millimetres between the timbers) • the timbers must be secured using galvanised hoop strap (aluminium strapping).	Contractor	Pre-construction
A6	Restricted activities in the TPZ	Activities not allowed in the TPZ (unless otherwise approved under the development consent) include: • machine excavation and trenching • ripping or cultivation of the soil • storage of building materials, waste, and waste receptacles • disposal of waste materials and chemicals including paint, solvents, cement slurry, fuel, oil, and other toxic liquids • movement and storage of plant, equipment, and vehicles • soil level changes, including the placement of fill material • mechanical removal of vegetation • affixing of signage or hoardings to trees • other physical damage to the trunk or root system	Contractor	Pre-construction / Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
		• any other activity that is likely to cause damage to the tree.		
A7	Root and ground impacts	If temporary access for vehicle, plant or machinery is required within the TPZ, ground protection should be installed. Where possible, areas of the existing pavement should be used as ground protection. The area within the TPZ should be mulched during construction (where practical) with good-quality composted wood chip/leaf mulch and should be maintained at a depth of 150 millimetres to 200 millimetres. Mulching around the base of the tree would provide nutrients and organic matter to the soil as it breaks down, improving and maintaining the overall health of the trees.	Contractor	Pre-construction / construction
A8	Demolition	The demolition of all existing structures inside or directly next to the TPZ of trees to be retained must be carried out in consultation with the proposal arborist. Any machinery is to work from inside the footprint of the existing structures or outside the TPZ, to minimise soil disturbance and compaction. If it is not feasible to locate demolition machinery outside the TPZ of trees to be retained, ground protection would be required. The demolition should be carried out inwards into the footprint of the existing structures, sometimes referred to as the 'top-down, pull back' method.	Contractor	Construction
A9	Underground services	Where possible, the re-location of services underground should be carried out outside of the TPZ of trees. If underground services need to be installed within the TPZ, they must be installed using tree-sensitive excavation methods under the supervision of the proposal arborist. Boring methods such as horizontal directional drilling may be used for underground service installation, provided the installation is at a minimum depth of 800 millimetres below grade. Excavations for entry/exit pits must be located outside the TPZ. Any conflicting roots greater than 50 millimetres in diameter identified during the relocation of underground services shall be pruned using clean, sharp secateurs or a pruning saw to ensure a clean cut, free from tears. All root pruning (greater than 50 millimetres) must be documented and carried out by the proposal arborist.	Contractor	Construction
A10	Ongoing impacts	Site inspections would be carried out by the proposal arborist around every 12 weeks during the construction phase. A final site inspection would also be carried out by the proposal arborist after all major construction has ceased, following the removal of tree protection.	Contractor	Construction
Traffic and transport				
T1	Traffic and transport	A Traffic Management Plan (TMP) would be prepared and implemented as part of the CEMP. The TMP would be prepared in line with the Transport *Traffic Control at Work Sites Manual* (RTA, 2010) and *QA Specification G10 Control of Traffic* (Transport for NSW, 2008). The TMP would include: • confirmation of haulage routes • swept path analysis of haulage vehicles using the Bullecourt Avenue / Ashford Avenue intersection • measures to maintain access to local roads and properties • site-specific traffic control measures (including signage) to manage and regulate traffic movement • measures to maintain pedestrian and cyclist access • requirements and methods to consult and inform the local community of impacts on the local road network, including disruptions to parking	Contractor	Pre-construction / construction

No.	Impact	Environmental safeguards	Responsibility	Timing
		• access to construction sites including entry and exit locations and measures to prevent construction vehicles queuing on public roads. • a response plan for any construction traffic incident • 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 • monitoring, review, and amendment mechanisms.		
T2	Construction site access	Construction site access would be designed and implemented with consideration of: • road design guidelines and turning paths for heavy vehicles • appropriate sight distances to allow traffic to safely enter and exit • visibility of compliant warning and wayfinding signs • use of accredited traffic controllers, where appropriate and/or other controls to separate, slow down or temporarily stop traffic for safe entry/exit • minimising use of local roads, where practical • provision of deceleration lanes at accesses next to highly trafficked roads.	Contractor	Pre-construction / construction
T3	Traffic impacts	Further traffic modelling would be carried out during detailed design following confirmation of the construction methodology and traffic staging to confirm the potential for traffic impacts and identify whether any additional mitigation measures or traffic control measures would be required.	Contractor	Detailed design
T4	Impact on bus stops or routes	Temporary and permanent bus stop relocation would be discussed with the relevant bus operator and the community would be notified.	Transport / contractor	Detailed design / pre-construction
T5	Temporary access changes	Detours during temporary access changes would be implemented with directional signage along alternate routes.	Contractor	Construction
T6	Heavy vehicle movements	Heavy vehicle movements would be limited during peak traffic periods (i.e., between 7:45 AM to 08:45 AM and 3:30 PM to 5:30 PM on weekdays, and 11:30 AM to 1:30 PM on weekends), where practical.	Contractor	Construction
T7	Traffic management measures	Any temporary traffic diversions, clearways and road closures would be implemented in line with Transport Management Centre (TMC) and Canterbury Bankstown City Council requirements.	Contractor	Construction
T8	Property access	• Property access would be maintained where feasible and reasonable and property owners would be consulted well in advance of work starting that may temporarily restrict or control access. • Consultation would be carried out with the community regarding alternate access arrangements during operation associated with the provision of left-in left-out intersections. • Notification would be issued to emergency services about changes in traffic conditions.	Transport / contractor	Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
T9	Local road or shared path closures	Relevant councils would be consulted with prior to any local road or shared path closures to identify suitable mitigation measures such as detour routes.	Contractor	Construction
T10	Parking	Off-road parking for construction vehicles would be provided within the ancillary facility and construction areas.	Contractor	Construction
T11	Damage to local roads	Any damage to the local road network identified to be caused by construction vehicles for the proposal would be remediated by the contractor to be similar to the existing road condition.	Contractor	Construction
T12	Auld Avenue parking	During detailed design, Transport will consider opportunities to minimise the number of parking spaces that need to be removed on Auld Avenue.	Transport	Detailed design
Noise and vibration				
NV1	Noise and vibration	A Construction Noise and Vibration Management Plan (CNVMP) should be prepared before any work begins which would include: • identification of nearby sensitive receivers • description of works, construction equipment and hours that work would be completed in • criteria for the proposal and relevant licence and approval conditions • requirements for noise and vibration monitoring • details of how community consultation would be completed • procedures for handling complaints • details on how respite would be applied where ongoing high impacts are seen at certain receivers • preparation of an out of hours works assessment and application.	Contractor	Pre-construction / construction
NV2	Noise and vibration	Location and activity specific noise and vibration impact assessments should be carried out prior to activities: • with the potential to result in noise levels at or above 75dBA at any receiver • required outside standard construction hours likely to result in noise levels greater than the relevant NMLs • with the potential to exceed relevant criteria for vibration. The assessments should confirm the predicted impacts at the relevant receivers near activities to aid the selection of appropriate management measures, consistent with the requirements of the CNVG.	Contractor	Pre-construction
NV3	Noise and vibration	Notification should be given to noise-affected residents in the form of letter-box drops or equivalent. The notification would detail work activities, time periods over which these would occur, impacts and mitigation measures. Notification should be a minimum of 5 working days prior to the start of works.	Contractor	Pre-construction
NV4	Noise and vibration	A record of all complaints received, and the subsequent action taken, should be maintained.	Contractor	Construction

No.	Impact	Environmental safeguards	Responsibility	Timing
NV5	Construction noise exceedances	Where noise intensive equipment is to be used near sensitive receivers, the work should be scheduled for standard construction hours, where possible. If it is not possible to restrict the work to the daytime then it should be completed as early as possible in each work shift. Appropriate respite should also be provided to affected receivers in line with the CNVG and/or the proposal's conditions of approval. Monitoring should be carried out at the start of noise and/or vibration intensive activities to confirm that actual levels are consistent with the predictions and that appropriate mitigation measures from the CNVG have been implemented.	Contractor	Construction
NV6	Ancillary facilities with long term work	Hoarding, or other shielding structures, should be used where receivers are impacted near ancillary facilities with long durations. To provide effective noise mitigation, the barriers should break line-of-sight from the nearest receivers to the work and be of solid construction with minimal gaps.	Contractor	Pre-construction / construction
NV7	Construction traffic	The potential impacts from construction traffic should be reviewed at a later stage when more information is available, particularly where it is required to access local roads.	Transport	Detailed design / construction
NV8	Vibration work within minimum working distance	Where work is within the minimum working distances and considered likely to exceed the cosmetic damage criteria: • different construction methods with lower source vibration levels should be investigated and implemented where feasible • vibration measurements should be carried out at the start of construction to determine actual vibration levels throughout the proposal area. Work should be ceased if monitoring indicates that vibration levels do, or are likely to, exceed the relevant criteria. The potential human comfort impacts should also be reviewed as the proposal progresses. Dilapidation reports should also be prepared for properties identified as being within the minimum working distances for cosmetic damage.	Contractor	Pre-construction / construction
NV9	Out of hours work	Out of hours works will be undertaken in accordance with the Construction Noise and Vibration Guideline (for road and maritime works) (Transport, 2022e). This includes: • Offer respite and/or restricted construction hours where noise intensive works are planned over extended periods, especially where they occur outside of standard hours. This may include moving the construction work front to different areas so that sensitive receivers are not impacted for longer than two consecutive days • No more than two consecutive nights of noise with special audible characteristics and/or vibration generating work may be undertaken in the same NCA over any 7-day period, unless otherwise negotiated with affected receivers.	Contractor	Construction
NV10	Out of hours work	Noisiest activities will be limited to standard construction hours, where practicable.	Contractor	Construction
NV11	Operational road traffic	Appropriate noise mitigation measures should be implemented where receivers are likely to exceed NMLs. This could include:	Contractor	Detailed design / construction

No.	Impact	Environmental safeguards	Responsibility	Timing
		• at-source mitigation (quieter road pavement surfaces) • in-corridor mitigation (noise mounds, noise barriers) • at-receiver mitigation (at-property treatments). Appendix D of the RNCG contains road traffic noise assessment criteria to guide this mitigation.		
NV12	Operational road traffic	Further assessment of operational road traffic noise impacts would be carried out to inform consideration of appropriate noise mitigation during detailed design.	Transport	Detailed design
Hydrology and flooding				
H1	Overall flood risk	Further flood impact assessment would be carried out to quantify the flood risk to construction activities and to surrounding areas from the proposal.	Contractor	Detailed design / pre-construction
H2	Overall flood risk	A Flood Management Plan would be developed for the construction area and would include details and procedures to minimise the potential for construction activities to adversely impact on flood behaviour in neighbouring properties. Measures to manage residual flood impacts would include: • staging construction to limit the extent and duration of temporary works on the floodplain • ensuring construction equipment and materials are removed from floodplain areas at the completion of each work activity or when a weather warning of impending flood-producing rain is issued • providing temporary flood protection to properties identified as being at risk of adverse flood impacts during any stage of construction of the proposal • developing flood emergency response procedures to remove temporary works during periods of heavy rainfall. For the ancillary facilities located within the floodplain, the Flood Management Plan would include the following additional requirements: • limits to the extent of works located in floodway areas • a procedure to monitor weather conditions (existing and forecast conditions), including minor rain events, local weather warnings and river water level data • a communication protocol to disseminate warnings to construction personnel of impending flood producing rain or predicted flooding in the Georges River or Milperra Drain and actions required to make construction areas stable and safe • an evacuation plan for construction personnel should a severe weather warning or flood alert for the Georges River or Milperra Drain be issued.	Contractor	Construction
H3	Overall flood risk	Transport would continue to consult with the NSW SES around any anticipated flood risks throughout the detailed design and construction phases of the proposal.	Transport	Detailed design / construction

No.	Impact	Environmental safeguards	Responsibility	Timing
H4	Location of construction activities and materials	To the extent practicable, construction compounds, site sheds, stockpiles and laydown areas would be located outside flood prone areas.	Contractor	Pre-construction / construction
H5	Location of construction activities and materials	Placement of stockpiles, fuels, contaminating material and loose equipment would be avoided within the ancillary facilities affected by flood waters or would be located as far away as is practicable. At ancillary facilities which have the greatest potential to be affected by floodwaters (i.e., the 439 Henry Lawson Drive, Milperra, Auld Avenue, Milperra and Milperra Sports Centre, Milperra ancillary facilities), only materials and buildings which can easily be relocated should be stored, and materials should be stored towards the front of the properties or as far away from potential floodwaters as possible.	Contractor	Pre-construction / construction
H6	Construction activities in flood prone land	The timing and duration of the construction activities in the vicinity of waterways would be planned, where possible, to occur at times of year when the chance of major flood events is low.	Contractor	Detailed design
H7	Construction activities in flood prone land	Where ancillary facilities are located on flood prone land and adverse flood impacts are not acceptable, the use of elevated site sheds that are designed to allow the passage of floodwater beneath the structures should be considered.	Contractor	Detailed design / pre-construction
H8	Management of impacts to existing environment	To the extent practicable, the ground surface slopes and imperviousness at the construction sites would be maintained close to existing conditions.	Contractor	Construction
H9	Management of impacts to existing environment	Flood impacts would be minimised and managed through documentation and implementation of an approved environmental management plan.	Contractor	Detailed design / construction
H10	Milperra Drain bridge impacts	Further design would be carried out to consider alternatives to the Milperra Drain bridge design to reduce the bridge deck depth to minimise flood impacts.	Transport	Detailed design
H11	Milperra Drain bridge impacts	Further design would be carried out to consider approaches to the Milperra Drain bridge to be reduced where possible to maintain existing ground levels.	Transport	Detailed design
Landscape character and visual impacts				
V1	Visual amenity and urban design	Development of the proposal's urban design would continue through to detailed design. Urban design would be integrated into project development processes to ensure the proposal aligns with the urban design objectives. The following policy/guidelines would guide future design development of the proposal: • Transport Urban Design Policy (Beyond the Pavement) • Transport Urban Design Guidelines	Transport	Detailed design

No.	Impact	Environmental safeguards	Responsibility	Timing
		• the urban design objectives, principles and concept design strategy presented in the urban design report for the proposal would form the basis for future design development and consultation with stakeholders.		
V2	Revegetation	Revegetation as well as biodiversity tree and hollow replacement would be carried out in line with the landscaping principles, urban design concept outlined in the LCVIA and Transport's Biodiversity Guidelines. Revegetation strategies would include but not be limited to: • planting trees at regular intervals to reinstate the existing characteristic avenue treatment parallel to Henry Lawson Drive • planting feature trees, shrubs and ground cover planting to provide visual interest and a sense of place • introducing varied plant species combinations including through type, scale and density of spacing, and with height variations along the length of the road corridor through median planting • restoring ancillary facility areas of the proposal disturbed by major work with appropriate native vegetation • selecting plant species to soften hard elements within the corridor • selecting plant species that are robust and which can survive for the life of the design • replacing existing trees where possible to provide urban cooling • making sure planting complies to sight lines and clear zone requirements with the use of a low height planting mix at intersections.	Contractor	Detailed design
V3	Revegetation	In consultation with Council, opportunities to develop potential 'pocket' and 'linear parks' will be considered during detailed design.	Transport	Detailed design
V4	Road signage and connectivity	Develop the shared path design to contribute to the existing network and linear identity through appropriate connectivity with existing footpaths and roads.	Transport	Detailed design
V5	Road signage and connectivity	Provide appropriate locations for wayfinding and signage along the upgraded road corridor.	Transport	Detailed design
V6	Lighting	Minimise lighting and potential for light spill.	Transport	Detailed design
V7	Earthworks and landscape character	Landscape treatments are to adhere to the guidelines for designated bush fire prone land.	Contractor	Detailed design / pre-construction / construction
V8	Tree management and removal	Minimise the removal of existing roadside remnant vegetation where possible to sustain the existing character of the surrounding suburb. Appropriate vegetation retention areas would include the creek area next to the new link road and the existing trees next to the bioretention basin.	Contractor	Pre-construction / construction
V9	Road signage and connectivity	Existing signage and art is to be protected and preserved in existing locations or reinstated in a suitable location if works require them to be moved.	Contractor	Pre-construction / construction

No.	Impact	Environmental safeguards	Responsibility	Timing
V10	Road signage and connectivity	Consolidate signage structures to minimise the impact of sensitivity receptors within the upgraded precinct.	Contractor	Pre-construction / construction
V11	Lighting	Minimise night works and provide lighting which minimises light spill	Contractor	Construction
V12	Visual amenity and ancillary facilities	The layout of the ancillary facility sites would be designed to minimise visual amenity impacts. The design would consider: • screening of boundaries facing sensitive receivers or views • careful placement of structures and buildings to maintain viewpoints or provide additional screening of site activities.	Contractor	Pre-construction/ Construction
V13	Visual amenity and ancillary facilities	The ancillary facilities would be maintained, kept tidy and well-presented including sorting regular removal of excess materials to reduce visual impact.	Contractor	Pre-construction/ Construction
V14	Visual amenity and ancillary facilities	Ancillary facility sites and temporary construction areas would be progressively restored to at least their pre-construction conditions or in line with Landscaping Plans, when no longer required.	Contractor	Construction
Biodiversity				
B1	Removal of native vegetation	Native vegetation and threatened flora removal would be minimised through detailed design and construction.	Transport	Detailed design
B2	Removal of native vegetation	Pre-clearing surveys would be carried out in line with Guide 1: Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011a).	Transport	Pre-construction
B3	Removal of native vegetation	Vegetation removal would be carried out in line with Guide 4: Clearing of vegetation and removal of bushrock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011a) and native vegetation would be re-established in line with Guide 3: Re-establishment of native vegetation of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011a).	Transport	Construction
B4	Removal of native vegetation	The unexpected species find procedure would be followed under *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011a) if threatened ecological communities, not assessed in the biodiversity assessment, are identified in the proposal site.	Transport	Construction
B5	Removal of native vegetation	The impacts of the proposal to vegetation and threatened species habitat would be offset in line with Transport's Biodiversity Policy (Transport, 2022c), including consideration of no net loss to biodiversity and tree and hollow replacement. A Biodiversity Offset Strategy would be prepared for vegetation zones requiring offsetting.	Transport	Detailed design
B6	Removal of native vegetation	A Tree and Hollow Replacement Plan would be prepared for any residual biodiversity impact that does not require offsets in line with the Biodiversity Policy. Where suitable land is not available for replacement, payment would be made to the Transport Conservation Fund.	Transport	Detailed design
B7	Removal of native vegetation	Vegetation clearance would only occur within the vegetation clearance boundary.	Contractor	Pre-construction / construction

No.	Impact	Environmental safeguards	Responsibility	Timing
B8	Removal of threatened fauna habitat	Threatened fauna habitat removal would be minimised through detailed design and construction.	Transport	Detailed design
B9	Removal of threatened fauna habitat	Fauna would be managed in line with Guide 9: Fauna handling of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011a).	Transport	Construction
B10	Removal of threatened fauna habitat	Habitat removal would be carried out in line with Guide 4: Clearing of vegetation and removal of bushrock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011a) and habitats would be replaced or re-instated in line with Guide 5: Re-use of woody debris and bushrock and Guide 8: Nest boxes of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011a).	Transport	Construction
B11	Removal of threatened fauna habitat	The unexpected species find procedure would be followed under Guide 1: Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011a) if threatened fauna, not assessed in the biodiversity assessment, are identified in the proposal area.	Transport	Construction
B12	Removal of threatened fauna habitat	Targeted surveys for Cumberland Plain Land Snail would be carried out during detailed design to determine the presence of any locally occurring populations. If populations are not present during targeted surveys, the BAR should be revised and liabilities should be offset. If populations are present during targeted surveys, pre-clearing surveys should be carried out for the Cumberland Plain Land Snail. Any individuals found should be relocated to areas of retained native vegetation. In addition, all large woody debris should be removed from impact areas and relocated to areas of retained native vegetation.	Transport / Contractor	Detailed design / Construction
B13	Aquatic impacts	Impacts to aquatic habitat would be minimised through detailed design and construction.	Transport	Detailed design
B14	Aquatic impacts	Aquatic habitat would be protected in line with Guide 10: Aquatic habitats and riparian zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011a) and Section 3.3.2 Standard precautions and mitigation measures of the Policy and guidelines for fish habitat conservation and management Update 2013 (DPI (Fisheries NSW) 2013).	Transport	Construction
B15	GDEs	Depending on the final design, a permit may be required from DPI for dredging and reclamation and obstruction to fish habitat.	Transport	Construction
B16	GDEs	Interruptions to water flows associated with groundwater dependent ecosystems would be minimised through detailed design.	Transport	Detailed design
B17	Changes to hydrology	Changes to existing surface water flows would be minimised through detailed design. New drainage infrastructure and water quality controls would be installed within the proposal area. This includes upgrading drainage pits and pipes, and the installation of bioretention basins and swales.	Transport	Detailed design

No.	Impact	Environmental safeguards	Responsibility	Timing
B18	Fragmentation of identified habitat corridors	For landscape scale connectivity impacts, a Wildlife Connectivity Strategy would be prepared as part of final design in line with the requirements of the Transport Biodiversity Policy. Connectivity measures would be implemented in line with the *Draft Wildlife Connectivity Guidelines for Road Projects* (RTA 2011b) or equivalent updated NSW Guidelines. Connectivity measures would be considered for impacts which are not considered a landscape scale connectivity impact in line with *the Draft Wildlife Connectivity Guidelines for Road Projects (RTA 2011b)* or equivalent updated NSW Transport Guidelines.	Transport	Detailed design / pre-construction / construction
B19	Edge effects on adjacent native vegetation and habitat	Any connectivity measures implemented would be installed under the supervision of an experienced ecologist.	Transport	Construction
B20	Edge effects on adjacent native vegetation and habitat	Exclusion zones would be set up at the limit of clearing in line with Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011a).	Transport	Construction
B21	Injury and mortality of fauna	Fauna would be managed in line with Guide 9: Fauna handling of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011a).	Transport	Construction
B22	Invasion and spread of weeds	Weed species would be managed in line with Guide 6: Weed management of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011a).	Transport	Construction
B23	Invasion and spread of pests	Pest species would be managed within the proposal area.	Transport	Construction
B24	Invasion and spread of pathogens and disease	Pathogens would be managed in line with Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011a).	Transport	Construction
B25	Noise, light, dust and vibration	Shading and artificial light impacts would be minimised through detailed design.	Transport	Detailed design
Socio-economic, property and land use				
SE1	Community impacts during construction including noise, visual, amenity impacts	A Community Liaison Plan (CLP) would be prepared and implemented as part of the construction environmental management plan (CEMP) to help provide timely and accurate information to the community during construction. The CLP would include (as a minimum): • mechanisms to provide details and timing of proposed activities to affected residents, including changed traffic and access conditions • contact name and number for complaints.	Transport / Contractor	Detailed design / pre-construction

No.	Impact	Environmental safeguards	Responsibility	Timing
		The CLP would be prepared in line with Transport's *stakeholder engagement toolkit* and the *Transport for NSW Stakeholder and Community Engagement Policy 2019.* Continued consultation with the community, recreational groups, businesses, and other stakeholders until the completion of the proposal would be carried out. Discussions would include design changes and construction activities, the nature and timing of construction works, and mitigation measures.		
SE2	Property impacts due to temporary access changes and property acquisition	Continued consultation with affected property owners and land occupiers until the completion of the proposal would be carried out. Discussions including the nature and timing of construction works would be required to identify relevant mitigation measures for noise, traffic, access, and visual impacts. Property acquisition would align with property acquisition requirements including private and crown land acquisition, in line with the Land Acquisition (Just Terms Compensation) Act 1991 and Land Acquisition Reform 2016.	Contractor	Pre-construction / construction
SE3	Noise wall relocation	Consultation would be carried out during detailed design with property owners potentially affected by the relocation of the noise wall near the Henry Lawson Drive / M5 Motorway intersection.	Transport	Detailed design
SE4	Access disruptions and access impacts	Continued consultation with emergency services would be carried out to understand access requirements so that access can be maintained during construction. Communication with the community regarding alternate access arrangement and notification for emergency services due to changes traffic conditions would also be carried out.	Transport / contractor	Detailed design / construction
SE5	Changes in access for all road users	The local community would be notified of temporary changes to local road intersections prior to works at those intersections commencing. Consultation would continue during construction should arrangements change.	Contractor	Pre-construction / construction
SE6	Traffic impacts for all road users, including pedestrians and cyclists	A Traffic Management Plan (TMP) would be developed prior to construction. Active transport should be addressed as part of this TMP. Alternative routes for active transport users would be clearly identified by signage and the use of traffic controllers where required. This includes areas along Henry Lawson Drive and close to Gordon Parker Reserve, which is frequented by school children and families, and near Western Sydney University.	Transport	Pre-construction / construction
SE7	Construction traffic impacts on local businesses' operations and patronage	Continued consultation with businesses within the direct study area about timing and scheduling of construction activities would be carried out.	Contractor	Pre-construction / construction
SE8	Social infrastructure impacts including access and amenity impacts	Wayfinding and the location of signage during construction would be based on the construction staging and where room is available.	Transport / contractor	Detailed design / construction

No.	Impact	Environmental safeguards	Responsibility	Timing
SE9	Social infrastructure impacts including access and amenity impacts	Consultation with Council would be carried out to make sure that construction activities mitigate potential impacts to Council run events that may be occurring in the proposal area at the same time.	Contractor	Pre-construction / construction
SE10	Relocation of bus stops during construction	Consultation with operators of the golf courses, educational facilities, public transport providers and Council in reference to construction activities and mitigation measures during busy periods and events at these facilities would be carried out.	Contractor	Pre-construction / construction
SE11	Relocation of bus stops during construction	Public transport providers and users would be notified in advance of any temporary or permanent changes to bus stop locations through signage at the existing bus stops. Adequate way finding signage would be installed.	Transport / contractor	Detailed design / construction
SE12	Cumulative impacts	Consultation with Council, relevant developers and other stakeholders would be conducted to minimise cumulative impacts. Opportunities would be explored to coordinate construction activities with other construction projects in the area to reduce risk of cumulative impacts.	Transport / contractor	Detailed design / construction
Surface water				
SW1	Soil erosion and water pollution	A Soil and Water Management Plan (SWMP) would be prepared and implemented as part of the CEMP. The SWMP would identify all reasonably foreseeable risks relating to soil erosion and water pollution and describe how these risks would be addressed during construction. The Soil and Water Management Plan (SWMP) would be reviewed by a soil conservationist on the TfNSW list of Registered Contractors for Erosion, Sedimentation and Soil Conservation Consultancy Services. The SWMP would then be revised to address the outcomes of the review.	Transport / Contractor	Detailed design / pre-construction
SW2	Soil erosion and water pollution	Where possible, permanent drainage structures would be installed as early as possible to facilitate effective separation of clean offsite and dirty onsite water.	Contractor	Construction
SW3	Soil erosion and water pollution	The preliminary Erosion and Sedimentation Management Plan (ESMP) and Erosion and Sedimentation Control Plans (ESCP) produced for the proposal would be updated during the detailed design phase to refine the erosion and sedimentation controls for the proposal. Final ESCP will be developed by the construction contractor and would include the need to implement progressive ESCPs and the continual updating of these plans during construction.	Transport / Contractor	Detailed design / construction
SW4	Contamination of surface water	Regular visual water quality checks (including for turbid plumes and hydrocarbon spills or slicks) would be carried out when working in or near waterways. Construction water quality monitoring would be carried out upstream and downstream of the proposal to ensure that controls and site practices are effective at maintaining current water quality conditions. Monitoring would be carried out in line with the Guideline for Construction Water Quality Monitoring (RTA, undated).	Contractor	Construction
SW5	Water pollution due to stockpiles	Stockpile site locations would be confirmed during detailed design and where applicable managed in line with Environmental Procedure Management of Wastes on Roads and Maritime Services Land (RMS, 2014) and the	Transport / Contractor	Detailed design / pre-construction

No.	Impact	Environmental safeguards	Responsibility	Timing
		Stockpile Site Management Guideline (RMS, 2015b). This would consider measures to manage cross contamination within a stockpile area. Further consideration of how to manage stockpiles, material laydown and chemical storage with respect to floodwaters would be carried out by the construction contractor.		
SW6	Water pollution from accidental spills	A site-specific emergency spill plan would be developed and include spill management measures in line with the Transport for NSW Code of Practice for Water Management (RTA, 1999) and relevant EPA guidelines. The plan would address measures to be implemented in the event of a spill, including initial response and containment, and notification of emergency services and relevant authorities (including TfNSW and EPA officers).	Contractor	Detailed design / pre-construction
SW7	Water pollution from accidental spills	An emergency spill kit would be kept on site at all times. Spill kits would be located at all ancillary facilities and main construction work areas. All staff would be made aware of the location of spill kits and trained in their use. The refuelling and maintenance of plant and equipment would be carried out in a designated sealed bunded area at ancillary facilities, where possible. Vehicle wash downs and concrete washouts would be carried out within designated sealed bunded areas at construction ancillary facilities or carried out off-site.	Contractor	Construction
SW8	Stormwater discharges leading to pollution	A Construction Water Quality Discharge Assessment would be completed during detailed design in line with the EPA's Assessing and managing water pollution from road works and the Draft Guideline for Assessing the Impacts of Treated Water Discharge from Water Quality Treatment Controls (TfNSW, 2020c).	Transport	Detailed design
SW9	Works on waterfront land	Works within Milperra Drain to construct the culvert would be carried out with consideration to the design and construction considerations in the Guidelines for instream works on waterfront land, Department of Primary Industries, Office of Water, July 2012, Guidelines for watercourse crossings on waterfront land, Department of Primary Industries, Office of Water, July 2012 and in line with relevant Transport specifications and guidelines.	Transport / Contractor	Detailed design / pre-construction
Groundwater				
G1	Overall groundwater impacts	Further investigations would be carried out at the detailed design stage to gain an understanding of site-specific potential interactions with groundwater during construction and operations.	Transport	Detailed design
G2	Groundwater dewatering during excavation	In the event that groundwater/aquifer dewatering must occur to lower the groundwater table and reduce or prevent groundwater ingress into excavations, potential impacts on GDEs would be quantitatively assessed prior to dewatering along with the implementation of appropriate management measures and documentation in a site dewatering management plan. Quantitative assessment would include assessment of the magnitude and duration of drawdown and whether impacts are likely to adversely affect the habitat conditions and ecological communities within the GDEs. Relevant approvals and permits would be obtained prior to groundwater/ aquifer dewatering.	Contractor	Pre-construction
G3	Encountering acid sulphate soils	An Acid Sulphate Soil Management Plan (ASSMP) would be prepared and implemented to manage acid sulphate soils exposed by excavations of soils between 2-4 metres, changes to groundwater levels and stockpiling.	Contractor	Detailed design

No.	Impact	Environmental safeguards	Responsibility	Timing
		The ASSMP would be informed by the results of the Detailed Site Investigation that would include the identification of presence and extent of acid sulphate soils, particularly around the culvert works over Milperra Drain.		
G4	Disposal of groundwater	Should off-site disposal be selected by the contractor as the primary method of water management then the following measures must be implemented: • Site Environmental Coordinator or representative must contact the waste disposal contractor and receiving facility to determine the correct analytical suite and documentation required before water is transported. • All liquid waste must be characterised with the documentation made available to both the waste disposal contractor and receiving facility • All produced water must be collected and stored in a sealed, bunded or similar storage vessel • Daily inspections of the stored water must be made and include the following items: – Date/ time and location of dewatering – Estimated inflow rate – pH – Turbidity – Signs of visible oil or fuel (hydrocarbon) sheen on the water Any unusual odour colour slime or foamy scum.	Contractor	Construction
Non-Aboriginal heritage				
NA1	Non-Aboriginal heritage	A Non-Aboriginal Heritage Management Plan (NAHMP) would be prepared and implemented as part of the CEMP. It would provide specific drafting guidance on measures and controls to be implemented to avoid and mitigate impacts to non-Aboriginal heritage. The NAHMP would be prepared in consultation with the Office of Environment and Heritage.	Contractor	Pre-construction
NA2	Non-Aboriginal heritage	The *Transport for NSW Unexpected Heritage Items Procedure – EMF-HE-PR-0076* (Transport, 2022f) would be followed in the event that any unexpected heritage items, archaeological remains or potential relics of non-Aboriginal origin are encountered. Work would only re-commence once the requirements of that Procedure have been satisfied.	Contractor	Construction
NA3	Non-Aboriginal heritage	If potential future changes occur to the concept design resulting in works extending further into the LEP listed Milperra Soldier Settlement (former), further assessment would be required to address potential heritage impacts.	Contractor	Detailed design / pre-construction
NA4	Non-Aboriginal heritage	Further investigation into interpretation opportunities should be explored in the detailed design stage of the proposal by a qualified heritage interpretation specialist. This should take form of a Heritage Interpretation Plan (HIP). Recommendations for ideal locations for interpretation include along the shared path aligning with	Contractor	Detailed design

No.	Impact	Environmental safeguards	Responsibility	Timing
		Ganmain Crescent, near the location of the Milperra Solider Tree, and in the small reserve to the south of the Bullecourt Avenue and Henry Lawson Drive intersection.		
NA5	Milperra Soldier Tree	Design change should be considered to look at how to minimise impacts to the Milperra Soldier Tree structural root zone to allow retention of the tree.	Contractor	Detailed design
NA6	Milperra Soldier Tree	If the Milperra Soldier Tree and Commemorative Plaque cannot be avoided during works, it is recommended the former location of the tree is marked by the existing plaque, which should, at a minimum, be reinstated and refurbished. Heritage interpretation associated within this tree must be investigated within the HIP to be prepared for the proposal. It is also recommended that a re-planting strategy along this side of Henry Lawson Drive occur which would include the planting of a new tree as close to the original location of the former tree, or within the vicinity of its original location, to symbolise the tree's former location and mitigate the loss of the mature tree.	Contractor	Pre-construction / construction
NA7	Street signage	All local street signage is to be retained and relocated once the proposal is completed to ensure that the character of the former soldier settlement is retained, and to mark the former alignments of significant streets	Contractor	Pre-construction / construction
NA8	Street signage	The Milperra suburb road sign must be retained and relocated to a similar vantage point along Henry Lawson Drive once the proposal is completed.	Contractor	Pre-construction / construction
NA9	Milperra Drain Bridge	Should works be undertaken on the existing Milperra Drain Bridge superstructure or pre-cast concrete parapets, further heritage assessment would be required.	Contractor	Detailed design
NA10	Archaeological impacts	A qualified NSW historical archaeologist should be engaged during detailed design to provide a historical archaeological assessment for subsurface archaeological potential in the Milperra Soldier Settlement footprint and any archaeological potential associated with any other eras of development in the Milperra area.	Contractor	Detailed design / pre-construction
Aboriginal cultural heritage				
AH1	Aboriginal heritage	An Aboriginal Heritage Management Plan (AHMP) would be prepared in line with the Procedure for Aboriginal cultural heritage consultation and investigation (Transport, 2012) and Transport for NSW Unexpected Heritage Items Procedure – EMF-HE-PR-0076 (Transport, 2022f) and implemented as part of the CEMP. It would provide specific drafting guidance on measures and controls to be implemented for managing impacts on Aboriginal heritage. The AHMP would be prepared in consultation with all relevant Aboriginal groups.	Contractor	Detailed design / Pre-construction
AH2	Aboriginal heritage	The *Transport for NSW Unexpected Heritage Items Procedure – EMF-HE-PR-0076* (Transport, 2022f) would be followed in the event that an unknown or potential Aboriginal object/s, including skeletal remains, is found during construction. This applies where Transport does not have approval to disturb the object/s or where a specific safeguard for managing the disturbance (apart from the Procedure) is not in place. Work would only re-commence once the requirements of that Procedure have been satisfied.	Contractor	Detailed design / Pre-construction

No.	Impact	Environmental safeguards	Responsibility	Timing
Other impacts				
O1	Soils	• A Contaminated Land Management Plan would be prepared in line with the Guideline for the Management of Contamination (Transport for NSW, 2013) and implemented as part of the CEMP. The plan would include, but not be limited to: – capture and management of any surface runoff contaminated by exposure to the contaminated land – further investigations required to determine the extent, concentration and type of contamination, as identified in the detailed site investigation (Phase 2) – management of the remediation and subsequent validation of the contaminated land, including any certification required – measures to ensure the safety of site personnel and local communities during construction. • If contaminated areas are encountered during construction, appropriate control measures would be implemented to manage the immediate risks of contamination. All other works that may impact on the contaminated area would cease until the nature and extent of the contamination has been confirmed and any necessary site-specific controls or further actions identified in consultation with the Transport for NSW Senior Manager Environment and Sustainability and/or EPA. – A site-specific emergency spill plan would be developed and include spill-management measures in line with the Transport Code of Practice for Water Management (RTA, 1999) and relevant EPA guidelines. The plan would 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 EPA officers).	Contractor	Detailed design / pre-construction
O2	Contamination	• A detailed site investigation (DSI) should be carried out during detailed design in the areas showing a moderate risk of COPCs to assess if concentrations are above the tier 1 screening values, as described in the National Environmental Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) Schedules B1 and B2 (NEPM, 2013). These include: – the onsite area in the northwest section with historical agricultural uses – the current BP petrol station – the former landfills and current Flower Power complex and Kelso Waste Facility – the general filling of ground – the current Bankstown and Riverland Golf Courses – the southern ancillary facility. • The scope of the DSI should be detailed in a sampling analysis and quality plan (SAQP) which should include collection of soil, groundwater and landfill gas samples near associated moderate risk areas. Since the southern ancillary facility would be used as a storage facility with no intrusive works, a licenced asbestos assessor should conduct a walkover to assess the impact of asbestos containing material onsite and to assess the need for an asbestos management plan and a management plan to contain soil material	Transport / Contractor	Detailed design / construction

No.	Impact	Environmental safeguards	Responsibility	Timing
		brought onsite and minimise cross-contamination with asbestos. It should also be in accordance with the NEPM 2013 and analytical results compared to the applicable Tier 1 screening values in Schedule B2 of the NEPM 2013. • If deeper excavation is required based on the detailed design, further site investigation would be required for the area next to the BP petrol station within the proposal area. The site investigation would need to assess soil, groundwater and vapour risks to the proposal area. • Analytical results from any spoil requiring off-site disposal should be compared to the concentrations in the NSW EPA Waste Classification Guidelines Parts 1 to 4 and Addendum 1. If natural soil is disturbed, it may meet the definition of ENM for reuse and the analytical data should be compared to the concentrations and requirements in the ENM Resource Recovery Order and Exemption under the Protection of Environmental Operations (Waste) Act 2000. • If soils between two and four metres are disturbed with the proposal area, an ASSMP should be included in the CEMP. The ASSMP should be informed by the results of the DSI that would include the identification of presence and extent of ASS/PASS, particularly around the northern section of the proposal area.		
03	Air quality	An Air Quality Management Plan (AQMP) would be prepared and implemented as part of the CEMP. The AQMP would include, but not be limited to: • potential sources of air pollution • air quality management objectives consistent with any relevant published EPA and/or Office of Environment and Heritage (OEH) guidelines • mitigation and suppression measures to be implemented • methods to manage work during strong winds or other adverse weather conditions • a progressive rehabilitation strategy for exposed surfaces.	Contractor	Detailed design / pre-construction
04	Waste	A Waste Management Plan (WMP) would be prepared and implemented as part of the CEMP. The WMP would include but not be limited to: • measures to avoid and minimise waste associated with the proposal • classification of wastes and management options (re-use, recycle, stockpile, disposal) • statutory approvals required for managing on- and off-site waste, or application of any relevant resource recovery exemptions • procedures for storage, transport and disposal • monitoring, record keeping and reporting. The WMP would align with the *Environmental Procedure - Management of Wastes on Transport for NSW Land* (Transport, 2014b) and relevant Transport Waste fact sheets.	Contractor	Pre-construction
05	Waste	A Material Re-use and Management Plan (MRMP) would be prepared to:	Transport	Detailed design

No.	Impact	Environmental safeguards	Responsibility	Timing
		• identify strategies to avoid, reduce, reuse and recycle all materials • identify the type, classify and estimate volumes of all materials to be generated and used. Identify storage, treatment, transport and disposal options and pathways		
O6	Bushfire risk	The CEMP would include a bushfire management plan prepared in line with the Planning for Bush Fire Protection 2019 (Rural Fire Service 2019). Measures to be implemented to manage bushfire risk include: • monitoring of weather and local bushfire ratings • consultation requirements for community notifications in the event of a bushfire • maintaining equipment in good working order • ensuring plant and equipment are fitted with appropriate spark arrestors, where practicable • ensuring site workers are informed of the site rules including designated smoking areas and putting rubbish in designated bins. • obtaining hot work permits and implementing total fire bans as required • implementing adequate storage and handling requirements for potentially flammable substances in line with the relevant guidelines.	Contractor	Pre-construction / Construction
O7	Consultation with emergency services	Consultation with emergency services, including the Rural Fire Service and Fire and Rescue NSW to: • ensure emergency access is maintained during construction • co-ordinate any bush fire emergency actions as outlined in the proposal's Bushfire Management Plan.	Contractor	Construction
Cumulative impacts				
C1	Cumulative impacts	Ongoing consultation would be carried out between proponents and construction contractors of surrounding projects to identify the potential for cumulative impacts to occur should construction occur concurrently with the proposal. Co-ordination of traffic management controls would be considered to minimise cumulative traffic impacts, particularly during peak holiday periods. Co-ordination of out of hours work would be considered to minimise cumulative noise impacts to sensitive receivers and to ensure respite periods are achieved for sensitive receivers.	Transport / contractor	Detailed design / pre-construction / construction

7.3 Licensing and approvals

Table 7-2 outlines the relevant licences and other approval requirements needed to construct and operate the proposal.

Table 7-2 Summary of licensing and approvals required

Instrument	Requirement	Timing
Roads and work permits	All impacts to the road network would be carried out in line with a Road Occupancy Licence (ROL) to be obtained from the Traffic Management Centre	Pre-construction

8 Conclusion

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 Section 193 of the Environmental Planning and Assessment Regulation 2021.

8.1 Justification

The proposal is considered to be consistent with a number of strategies and plans including:

- Premier's Priorities
- Future Transport Strategy
- State Infrastructure Strategy 2018-2038: Building Momentum
- Greater Sydney Region Plan: A Metropolis of Three Cities.

The proposal would meet the key strategic objectives within the above strategies and plans (refer Section 2.1 for further detail).

The proposal is needed to:

- improve travel times, journey time reliability and road safety outcomes for all road users
- improve freight efficiency and reduce vehicle operating costs on the road network
- support new development in the precinct by improving traffic flow and connectivity to Bankstown Airport, Milperra Industrial Estate and proposed residential development in the area and the surrounding road network
- improve connectivity and safety for pedestrians and cyclists.

Without the development of the proposal, road and traffic conditions within the proposal area that would continue into the future include:

- worsening congestion along the corridor causing frustrating and costly delays for all road users across spreading peaks
- localised delays and safety concerns along Henry Lawson Drive at local road intersection
- poor driver behaviour in an unforgiving road environment contributing to a high rate of casualty crashes.

8.1.1 Social factors

The proposal supports the overall strategic objectives as outlined in the Council policy framework as the upgrades to Henry Lawson Drive would improve the efficiency and ease congestion, while increasing road safety and providing active transport options through the local community. The proposal would align with the themes and direction explored in NSW and local strategic planning documents with a focus on safety, efficiency and meeting the future needs of local and regional motorists.

Adverse impacts during construction and operation would be mitigated through a range of mitigation measures. Transport would continue to consult the community stakeholders and landholders and work with Council to mitigate potential impacts.

8.1.2 Biophysical factors

Henry Lawson Drive features two rows of trees along its western side and one row of trees on the eastern side. The development of the proposed design aimed to minimise tree removal by shifting the road alignment between the rows of trees as much as possible. This has meant that trees in the row closest to the existing road on the western side of Henry Lawson Drive would need to be removed as they are within the footprint of the proposed widened road.

To determine whether other trees near the edge of the proposed design elements could be retained, 109 trees along Henry Lawson Drive and the Auld Avenue to Keys Parade local link road were assessed in an Arboricultural Impact Assessment. The trees selected for assessment were identified due to their proximity to

the edge of proposed design elements that would require excavation during construction such as kerbs or shared paths. Of the 109 trees assessed, 90 would be removed due to encroachment of the proposal into their root systems.

The proposal would not have a significant impact on any TECs or threatened species habitat. However, as noted in Section 6.6.1, due to proposal timing not aligning with the optimal timing or conditions to detect some species, targeted surveys have not been conducted for the Cumberland Plain Land Snail or the Southern Myotis. As these species have a moderate to high likelihood of occurrence but have not been adequately surveyed, these species have been assumed present in the proposal area in accordance with Transport guidelines. Targeted surveys for these species would be carried out during detailed design to determine the presence of any locally occurring populations.

The biodiversity offsetting thresholds have been reached under the Biodiversity Policy for threatened species habitat, meaning a Biodiversity Offset Strategy has been recommended to be prepared as an environmental safeguard.

8.1.3 Economic factors

There would be economic flow on benefits due to the proposal to economic productivity and growth for freight carriers and vehicles travelling to the industrial precincts in the broader study area, in addition to benefits for existing and future businesses in the surrounding area (such as Bankstown Airport). This is due to the proposal increasing capacity and reducing intersection delays.

8.1.4 Public interest

The proposal works are in the public interest by improving travel times, journey time reliability and road safety outcomes for all users of Henry Lawson Drive. The improved connectivity would provide support to new industrial and residential developments as well as improve freight efficiency, reducing vehicle operating costs on the network.

8.2 Objects of the EP&A Act

Table 8-1 Objects of the Environmental Planning and Assessment Act 1979

Instrument	Requirement
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 is needed to ensure Henry Lawson Drive, which is a major metropolitan transport and freight route, remains a functional and improved route in the future. The proposal would increase capacity and reduce intersection delays, thereby improving movement and connectivity along the Henry Lawson Drive corridor.
1.3(b) To facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment.	Ecologically sustainable development has been considered throughout the proposal, with the legislative context of ecological sustainable development considered in Section 4 and the impact of the proposal and the proposal is considered in detail in Section 6. An options process was also carried out for the proposal that has considered a range of constraints (refer Section 2) as well as feedback from the community during early consultation activities (refer Section 5). Mitigation measures are proposed to be implemented to minimise direct and indirect impacts including potential water quality impacts. This includes preparation of a Construction Soil and Water Management Plan, Construction Flora and Fauna Management Plan and a Clearing and Grubbing Plan to identify further opportunities to minimise direct impacts to GDEs.
1.3(c) To promote the orderly and economic use and development of land.	The proposal is required to cater for the safe and efficient movement of people and goods along Henry Lawson Drive, and to support the nearby large-scale traffic generating development
1.3(d) To promote the delivery and maintenance of affordable housing.	Not relevant to the proposal.

Instrument	Requirement
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.	Construction of the proposal would require the removal of vegetation. These impacts have however been minimised where possible and offsets would be provided where impacts could not be mitigated. The potential impacts on vegetation, threatened species, population and ecological communities are discussed in Section 6.6.3. Native vegetation would be re-established in line with *Guide 3: Re-establishment of native vegetation of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA Projects* (Roads and Traffic Authority, 2011) and the REF and proposal's Landscaping Plans.
1.3(f) To promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage).	There would be no impact to known Aboriginal heritage items during construction of the proposal. An unexpected finds procedure would be put in place during construction should any sites/items be identified.
1.3(g) To promote good design and amenity of the built environment.	The urban design and the landscape concept for the proposal has been developed to achieve an integrated outcome that helps fit the proposal as sensitively as possible into its context and to minimise the impacts of the proposal on the existing landscape character of the surrounding area. Mitigation measures would be implemented in the detailed design stage to ensure that the design objectives are realised. Activities within the proposal would also directly support improved connectivity and safety for pedestrians and cyclists through the provision of pedestrian and shared paths. Progressive landscaping would be carried out throughout the construction, and Landscaping Plans would include revegetation with local native vegetation species, suitable for the riparian zone. During construction and operation there would be impacts on amenity and community values. These are discussed in Section 6.7.3. Adverse amenity impacts during construction and operation would be mitigated through a range of mitigation measures.
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.	Section 5 outlines the community and stakeholder consultation carried out during various stages of the proposal. This REF will be placed on display and further consultation will be carried out with the community if the proposal is determined to proceed.

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 proposal.

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 in the following sections.

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.

This principle was considered during route options development (refer to Section 2). The precautionary principle has guided the assessment of environmental impacts for this REF and the development of mitigation measures.

Stakeholder consultation considered themes raised by stakeholders and a range of specialist studies were carried out for key themes to provide accurate and impartial information to assist in the evaluation of options. The concept design of the proposal has sought to minimise impacts on the amenity of the proposal area while maintaining engineering feasibility and safety for all road users.

A number of safeguards have been proposed to minimise potential impacts and to respond to stakeholder concerns and areas of scientific uncertainty. These safeguards are identified by the REF and would be implemented during construction and operation of the proposal. No safeguards have been postponed as a result of lack of scientific certainty. A CEMP would be prepared before construction starts. This requirement would ensure the proposal achieves a high-level of environmental performance. No safeguards and management measures would be postponed as a result of a lack of information.

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 (as part of the proposal) would not result in any impacts that are likely to adversely impact on the health, diversity or productivity of the environment for future generations. The proposal (as part of the proposal) would ensure that road and traffic conditions within the proposal area would not continue to worsen in the future design year of 2036. The key risks of 'do nothing' are that:

- congestion would worsen along the corridor causing frustrating and costly delays for all road users across spreading peaks
- poor driver behaviour would occur in an unforgiving road environment which would contribute to a high rate of casualty crashes
- traffic demand from nearby future developments would not be accommodated with the existing road capacity.

Should the proposal not proceed, the principle of intergenerational equity may be compromised, as future generations would inherit a lower road condition which could involve substantial increases in travel times due to a lack of alternative routes. Section 2 also highlights the lack of options for the proposal due to the need to work within the existing road environment, which is very constrained due to the surrounding urban environment.

Conservation of biological diversity and ecological integrity

The REF and proposal have been designed to limit the removal of native vegetation and TECs where practical. A thorough assessment of the existing biodiversity environment was carried out to identify and manage any potential impacts of the proposal on local biodiversity. It is acknowledged that the proposal would result in impacts on biodiversity, largely due to the 5.68 hectares of vegetation removal that is the habitat to several native plant communities, TECs, flora and fauna species.

The BAR determined that the proposal is unlikely to lead to a significant impact on threatened species, populations, ecological communities or their habitats, with the exception of the Cumberland Plain Land Snail as no targeted survey has been conducted. A survey of suitable habitat for the Cumberland Plain Land Snail has been recommended to determine its presence (or absence). A Biodiversity Offset Strategy has also been recommended to be prepared as an environmental safeguard for a vegetation zone and habitat clearing (see Section 6.6.5).

It is noted that residential and infrastructure development in the locality in historic and recent times has led to extensive vegetation clearing in the locality and at the catchment scale. Remaining remnant vegetation/habitat has also been affected by a variety of disturbance mechanisms, including clearing of undergrowth, altered fire regimes, feral animals and weed invasion. This habitat loss and disturbance has resulted in the local extinction

of a number of species which are less tolerant of habitat loss and disturbance (eg woodland birds and small mammals) and an increased risk of extinction to a number of vegetation communities.

Improved valuation, pricing and incentive mechanisms

The principle of internalising environmental costs into decision making requires consideration of all environmental resources that may be affected by the carrying out of a project, including air, water, land and living things.

The REF has examined the environmental consequences of the proposal and identified safeguards and management measures to manage the potential for adverse impacts. The requirement to implement these safeguards and management measures would result in an economic cost to Transport. Some of these measures include:

- replacement or re-instated of revegetation with local native vegetation species
- urban design and landscaping, including visual screening within impact areas identified as moderate or high impact
- biodiversity offsetting
- survey of presence or absence of the Cumberland Plain Land Snail
- further investigations into the flood risk to construction and operation of the proposal
- ongoing consultation with the community and stakeholders through detailed design and construction phases
- provision of operational water quality controls, scour protection and energy dissipation measures.

The implementation of safeguards and management measures would increase both the capital and operating costs of the proposal (as part of the proposal). This signifies that environmental resources have been given appropriate valuation. The concept design has been developed with an objective of minimising potential impacts on the surrounding environment. This indicates that the proposal is being developed with an environmental objective in mind.

8.3 Conclusion

The proposed upgrade of Henry Lawson Drive (Stage 1B) at Milperra 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 (where 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 proposal objectives but would still result in some impacts on biodiversity, flooding, landscape character and visual, and social/economic considerations. Safeguards and management measures as detailed in this REF would ameliorate or minimise these expected impacts. The proposal would also increase capacity to alleviate congestion and provide additional capacity to address future development and would improve the road environment to assist in the reduction of safety 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 nor approval to be sought from the Minister for Planning 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 nor the environment of Commonwealth land within the meaning of the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth). A referral to the Australian Department of Climate Change, Energy, the Environment and Water is not required.

9 Certification

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.

Name:	Lucia Coletta
Position:	Associate, Environment and Planning
Company name:	Aurecon
Date:	14/06/2023

I certify that I have reviewed and endorsed the contents of this REF and, to the best of my knowledge, it is in line with the EP&A Act, the EP&A Regulation and the Guidelines approved under Section 170 of the EP&A Regulation, and the information is neither false nor misleading. I accept it on behalf of Transport for NSW.

Name:	Alex Lyle
Position:	Project Development Manager
Transport region/program:	Infrastructure & Place, Development – Central River & Eastern Harbour City
Date:	16/06/2023

10 EP&A Regulation publication requirement

Table 10-1 EP&A Regulation publication requirement

Requirement	Yes/No
Does this REF need to be published under section 171(4) of the EP&A Regulation?	Yes

11 References

Aurecon (2023a) Henry Lawson Drive Stage 1B: Hydrology and Flooding Assessment.

Aurecon (2023b) Henry Lawson Drive Stage 1B: Socio-economic impact assessment.

Aurecon (2023c) Henry Lawson Drive Stage 1B: Soils, Surface Water and Groundwater Working Paper.

Aurecon (2023d) Non-Aboriginal Heritage Statement of Heritage Impact – Henry Lawson Drive Stage 1B.

Bankstown Airport Limited (2019) Bankstown Airport Masterplan 2019.

Canterbury Bankstown Council (2019) Canterbury Bankstown Local Strategic Planning Statement 'Connective City' 2036.

Cardno (2018) Milperra Drain Widening Review of Environmental Factors.

Department of Environment and Climate Change NSW (2006) Assessing Vibration – a technical guideline.

Department of Environment and Climate Change NSW (2009) Interim Construction Noise Guideline.

Department of Planning and Environment (2022a) Guidelines for Division 5.1 assessments.

Department of Planning and Environment (2022b) NSW State Vegetation Type Mapping.

Department of Planning and Environment (2022c) NSW Vegetation Information Sydney (VIS) Classification Database.

Department of Planning, Industry and Environment (2020) Biodiversity Assessment Methodology.

Department of Premier and Cabinet NSW (2021) Premier's Priorities.

Department of Primary Industries (2013) Policy and Guidelines for fish habitat conservation and management.

Department of Urban Affairs and Planning (1996) Roads and Related Facilities EIS Guideline.

DPI Office of Water (2012) NSW Aquifer Interference Policy.

EcoPlanning (2022) Henry Lawson Drive, Stage 1B: Biodiversity Assessment Report.

Georges Riverkeeper (2022) Georges Riverkeeper Strategic Plan 2022-2026.

GML Heritage (2018) Henry Lawson Drive (M5 to Hume Highway) Strategic Phase Statement of Heritage Impact.

Greater Sydney Commission (2018a) Greater Sydney Region Plan – A Metropolis of Three Cities.

Greater Sydney Commission (2018b) South District Plan.

Greater Sydney Commission (2019) Bankstown CBD and Bankstown Airport Place Strategy.

GTA Consultants (2019) Investment Logic Mapping.

Infrastructure NSW (2022) State Infrastructure Strategy 2022-2042: Staying Ahead.

Kelleher Nightingale Consulting (2020) Henry Lawson Drive – Hume Highway to M5 Upgrade: Aboriginal Cultural Heritage Assessment.

NSW EPA (2014) Waste Classification Guidelines.

NSW EPA (2017) Noise Policy for Industry.

NSW Rural Fire Service (2019) Planning for Bushfire Protection 2019.

Office of Environment and Heritage (2013) Floodplain Management Program.

Roads and Maritime Services (2005) Guidelines for the Management of Acid Sulphate Materials 2005.

Roads and Maritime Services (2011) Procedure for Aboriginal Cultural Heritage Consultation and Investigations.

Roads and Maritime Services (2014) Environmental Procedure Management of Wastes on Roads and Maritime Services Land.

Roads and Maritime Services (2015a) Noise Mitigation Guidelines.

Roads and Maritime Services (2015b) Stockpile Site Management Guideline.

Roads and Maritime Services (2016) Construction Noise and Vibration Guideline.

Roads and Traffic Authority (undated) Guideline for Construction Water Quality Monitoring.

Roads and Traffic Authority (1999) Code of Practice for Water Management.

Roads and Traffic Authority (2010) Traffic Control at Work Sites Manual.

Roads and Traffic Authority (2011a) Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects.

Roads and Traffic Authority (2011b) Draft Wildlife Connectivity Guidelines for Road Projects.

SCAPE Design (2022) Henry Lawson Drive Upgrade, Stage 1B: Urban design report including landscape character and visual impact assessment.

SLR Consulting (2022) Henry Lawson Drive Stage 1B Noise and Vibration Assessment.

Transport for NSW (2008) QA Specification G10 Control of Traffic.

Transport for NSW (2013) Guideline for the Management of Contamination.

Transport for NSW (2014a) Land Acquisition Information Guide.

Transport for NSW (2014b) Environmental Procedure – Management of Wastes on Transport for NSW Land.

Transport for NSW (2018a) NSW Movement and Place Framework.

Transport for NSW (2018b) Greater Sydney Services and Infrastructure Plan.

Transport for NSW (2018c) Freight and Ports Plan 2018 – 2023.

Transport for NSW (2018d) Road Safety Plan 2021.

Transport for NSW (2018e) Road Network Plan Summary Report: Henry Lawson Drive and Woodville Road.

Transport for NSW (2019a) Traffic benefit and economic analysis.

Transport for NSW (2020a) Environmental Impact Assessment Practice Note: Guideline for Landscape Character and Visual Impact Assessment – EIA N04.

Transport for NSW (2020b) Environmental Impact Assessment Practice Note: Socio-economic Assessment – EIA-N05.

Transport for NSW (2020c) Draft Guideline for Assessing the Impacts of Treated Water Discharge from Water Quality Treatment Controls.

Transport for NSW (2021) Henry Lawson Drive Upgrade Stage 1A Submissions Report.

Transport for NSW (2022a) Future Transport Strategy.

Transport for NSW (2022b) Henry Lawson Drive Upgrade Stage 1B, Milperra Consultation Report.

Transport for NSW (2022c) Biodiversity Policy.

Transport for NSW (2022d) Road Noise Mitigation Guideline.

Transport for NSW (2022e) Construction Noise and Vibration Guideline.

Transport for NSW (2022f) Transport for NSW Unexpected Heritage Items Procedure – EMF-HE-PR-0076.

Transport Planning Partnership Pty Ltd (2020) Riverlands development.

Tree Survey (2022) Arboricultural Impact Assessment & Tree Protection Plan: Henry Lawson Drive Upgrade.

Terms and acronyms used in this REF

Table 11-1 Terms and acronyms used in this REF

Term / Acronym	Description
AEP	Annual Exceedance Probability
AHD	Australian Height Datum
AHIP	Aboriginal Heritage Impact Permit
AHMP	Aboriginal Heritage Management Plan
AIA	Arboricultural impact assessment
AIP	Aquifer Interference Policy
AQMP	Air Quality Management Plan
ASSMP	Acid Sulphate Soil Management Plan
BAM	Biodiversity Assessment Methodology
BAR	Biodiversity Assessment Report
BC Act	*Biodiversity Conservation Act 2016 (NSW)*
Bgl	Below ground level
CEEC	Critically endangered ecological community
CEMP	Construction environmental management plan
CHAR	Cultural heritage assessment report
CLP	Community liaison plan
CNVG	Construction Noise and Vibration Guideline
CNVMP	Construction noise and vibration management plan
COPC	Contaminant of potential concern
DA	Development application
DBH	Diameter at breast height
DCP	Development Control Plan
DPE	Department of Planning and Environment
DSI	Detailed site investigation
ECTRN	Environmental Criteria for Road Traffic Noise
EEC	Endangered ecological community
EIA	Environmental impact assessment
EIS	Environmental Impact Statement
EP&A Act	*Environmental Planning and Assessment Act 1979 (NSW).* Provides the legislative framework for land use planning and development assessment in NSW
EPA	NSW Environment Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth).* Provides for the protection of the environment, especially matters of national environmental significance, and provides a national assessment and approvals process
ESCP	Erosion and Sedimentation Control Plan
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
ESMP	Erosion and Sedimentation Management Plan
FM Act	*Fisheries Management Act 1994 (NSW)*
FPP	Freight and Ports Plan 2018-2023
FSI	Fatality or serious industry

Term / Acronym	Description
GDE	Groundwater-dependent ecosystem
GSRP	Greater Sydney Region Plan
Heritage Act	*Heritage Act 1977 (NSW)*
HGG	Hazardous ground gas
HGL	Hydrogeological landscape
ICNG	Interim Construction Noise Guideline
ILM	Investment Logic Mapping
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
MNES	Matters of national environmental significance under the *Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)*
MRMP	Material Re-use and Management Plan
NAHMP	Non-Aboriginal Heritage Management Plan
NCA	Noise Catchment Area
NCG	Noise Criteria Guideline
NML	Noise management level
NorBE	Neutral or Beneficial Effect assessment
NPW Act	*National Parks and Wildlife Act 1974 (NSW)*
OEH	Office of Environment and Heritage within the Department of Planning and Environment.
OOHW	Out-of-hours work
PACHCI	Procedure for Aboriginal Cultural Heritage Consultation and Investigations
PAD	Potential archaeological deposits
PBP	Planning for bushfire protection
PCB	Polychlorinated biphenyls
PCT	Plant Community Type
PMF	Probable maximum flood event
POEO Act	*Protection of the Environment Operations Act 1997 (NSW)*
PSI	Preliminary site investigation
QA Specifications	Specifications developed by Transport for use with road work and bridge work contracts let by Transport.
RBL	Rating background level
REF	Review of Environmental Factors
RMS	NSW Roads and Maritime Services, now Transport for NSW
RNMG	Road Noise Mitigation Guideline
RNP	NSW EPA Road Noise Policy
Roads Act	*Roads Act 1993 (NSW)*
ROL	Road Occupancy Licence
SAQP	Sampling analysis and quality plan
SEIA	Socio-economic impact assessment
SEPP	State Environmental Planning Policy. A type of planning instrument made under Part 3 of the EP&A Act.

Term / Acronym	Description
SEPP (Biodiversity and Conservation)	State Environmental Planning Policy (Biodiversity and Conservation) 2021
SEPP (Planning Systems)	State Environmental Planning Policy (Planning Systems) 2021
SEPP (Precincts – Central River City)	State Environmental Planning Policy (Precincts – Central River City) 2021
SEPP (Precincts – Eastern Harbour City)	State Environmental Planning Policy (Precincts – Eastern Harbour City) 2021
SEPP (Precincts – Regional)	State Environmental Planning Policy (Precincts – Regional) 2021
SEPP (Precincts – Western Parkland City)	State Environmental Planning Policy (Precincts – Western Parkland City) 2021
SEPP (Resilience and Hazards)	State Environmental Planning Policy (Resilience and Hazards) 2021
SEPP (Transport and Infrastructure)	State Environmental Planning Policy (Transport and Infrastructure) 2021
State Heritage Register	SHR
SIS	Species Impact Statement
SOHI	Statement of Heritage Impact
SRZ	Structural root zone
STARS	Significance of a Tree, Assessment Rating System
SWMP	Soil and Water Management Plan
TDS	Total dissolved solids
TMP	Traffic management plan
TPP	Tree protection plan
TPZ	Tree protection zone
Transport	Transport for NSW
TRAQ	Tool for Roadside Air Quality
TSS	Total suspended solids
UST	Underground storage tank
Vegetation clearance boundary	The area within which vegetation may be removed to accommodate for the proposal. The boundary has assumed a five metre buffer from the edge of design. The footprint also takes into account ancillary facilities and work areas for equipment and machinery.
VHT	Vehicle-hour travelled
VKT	Vehicle-kilometre travelled
VM	Value Management
VTA	Visual tree assessment
WM Act	*Water Management Act 2000 (NSW)*
WMP	Waste Management Plan

Appendix A – Consideration of section 171 factors and matters of national environmental significance and Commonwealth land

Section 171 Factors

In addition to the requirements of the Guideline for Division 5.1 assessments (DPE 2022a) and the Roads and Related Facilities EIS Guideline (DUAP 1996) as detailed in the REF, the following factors, listed in section 171 of the Environmental Planning and Assessment Regulation 2021, have also been considered to assess the likely impacts of the proposal on the natural and built environment.

Factor	Impact
• Any environmental impact on a community? The proposal would result in the following environmental impacts on the community: • improved road safety and network reliability during operation • potential noise and vibration impacts to surrounding sensitive receivers during construction and operation of the proposal • traffic delays and increased travel time during the construction of the proposal • temporary disruption to active transport and public transport facilities during construction • removal of vegetation during construction.	Long-term minor negative impacts Short term moderate negative impacts
• Any transformation of a locality? The proposal is unlikely to result in any broadscale transformation of a locality. However, it would result in changes in land use in areas that were previously vacant or vegetated land alongside Henry Lawson Drive as well as land near the proposed Raleigh Road extension and Auld Avenue to Keys Parade local link road. These changes would result in negligible changes to the Milperra locality through implementation of the proposal's urban design objectives (refer to Section 2.3.2).	Nil
• Any environmental impact on the ecosystems of the locality? The proposal would result in the removal of 5.68 hectares of native vegetation that would result in a reduction of threatened species habitat in the proposal area. There would also be 5.76 hectares of exotic (non-native) vegetation removed. Safeguards and mitigation measures have been proposed in section 6.6.4, to manage and minimise these impacts where possible	Long term minor negative impact
• Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality? The proposal would 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 vegetation clearing and water quality/drainage impacts during construction. Safeguards and mitigation measures have been proposed to manage and minimise these impacts where possible	Short term minor negative impact
• 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? The proposal would result in the removal of a tree of local significance. The removal of this tree and changes to its immediate setting would result in irreversible impacts to the Local significance of this tree.	Short term moderate negative impact

Factor	Impact
• Any impact on the habitat of protected fauna (within the meaning of the *National Parks and Wildlife Act 1974*)? The proposal would result in the removal of 5.68 hectares of vegetation that would result in a reduction of threatened species habitat in the proposal area. Safeguards and mitigation measures have been proposed in section 6.6.4, to manage and minimise these impacts where possible.	Long term minor negative impact
• Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air? 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.	Short term minor negative impact
• Any long-term effects on the environment? The proposal would result in loss of vegetation due to the works, however this would not result in a significant impact to the environment.	Long term minor negative impact
• Any degradation of the quality of the environment? 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.	Nil
• Any risk to the safety of the environment? By improving the road environment as part of the proposal could result in increased safety for road users through provision of additional turning lanes and shoulders.	Long term major positive impact
• Any reduction in the range of beneficial uses of the environment? The proposal would not result in a reduction in the range of beneficial uses of the environment.	Nil
• Any pollution of the environment? 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.	Nil
• Any environmental problems associated with the disposal of waste? The proposal is not likely to cause environmental problems associated with the disposal of waste. Standard mitigation measures have been proposed in Section 7.2.	Nil
• Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply? The proposal is not likely to result in increased demands on resources which are or are likely to become in short supply.	Nil
• Any cumulative environmental effect with other existing or likely future activities? Cumulative impacts could occur due to a number of other developments occurring at a similar construction timeframes as the proposal. This could include cumulative impacts around amenity and traffic disruption.	Short term minor negative impact Long term minor positive impact

Factor	Impact
During operation, in conjunction with other infrastructure projects along Henry Lawson Drive, would result in cumulative positive traffic impacts.	
• Any impact on coastal processes and coastal hazards, including those under projected climate change conditions? The proposal would not impact on coastal processes or hazards, including those under projected climate change conditions.	Nil
• Applicable local strategic planning statements, regional strategic plans or district strategic plans made under the Act, Division 3.1,	Nil
• Other relevant environmental factors.	In considering the potential impacts of this proposal all relevant environmental factors have been considered, refer to Chapter 6 of this assessment.

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 Commonwealth land are required to be considered to assist in determining whether the proposal should be referred to the Australian Department of Climate Change, Energy, the Environment and Water .

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 line with Australian Government significant impact criteria and taking into account relevant guidelines and policies.

Factor	Impact
• Any impact on a World Heritage property?	Nil
• Any impact on a National Heritage place?	Nil
• Any impact on a wetland of international importance?	Nil
• Any impact on a listed threatened species or communities?	Nil
• Any impacts on listed migratory species? The proposal would result in the removal of native vegetation that is habitat for threatened species listed under the EPBC Act, including the migratory species White-throated Needletail and Grey headed flying fox.	No significant impact on threatened species would occur from the proposal, provided appropriate safeguards and management measures are implemented.
• Any impact on a Commonwealth marine area?	Nil
• Does the proposal involve a nuclear action (including uranium mining)?	Nil
• Additionally, any impact (direct or indirect) on the environment of Commonwealth land?	Nil

Appendix B – Statutory consultation checklists

Transport and Infrastructure SEPP

Certain development types

Development type	Description	Yes / No	If 'yes' consult with	SEPP (Transport and Infrastructure) Section
Car Park	Does the project include a car park intended for the use by commuters using regular bus services?	No		Section 2.110
Bus Depots	Does the project propose a bus depot?	No		Section 2.110
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		Section 2.110

Development within the Coastal Zone

Development type	Description	Yes / No	If 'yes' consult with	SEPP (Transport and Infrastructure) Section
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		Section 2.14

Note: See interactive map at ***Planning Portal NSW spatial viewer - find a property***. Note the coastal vulnerability area has not yet been mapped.

Note: a certified coastal zone management plan is taken to be a certified coastal management program.

Council related infrastructure or services

Development type	Potential impact	Yes / No	If 'yes' consult with	SEPP (Transport and Infrastructure) Section
Stormwater	Are the works likely to have a *substantial* impact on the stormwater management services which are provided by council?	Yes	Canterbury Bankstown Council	Section 2.10
Traffic	Are the works likely to generate traffic to an extent that will *strain* the capacity of the existing road system in a local government area?	No		Section 2.10
Sewerage system	Will the works involve connection to a council owned sewerage system? If so, will this connection have a *substantial* impact on the capacity of any part of the system?	No		Section 2.10

Development type	Potential impact	Yes / No	If 'yes' consult with	SEPP (Transport and Infrastructure) Section
Water usage	Will the works involve connection to a council owned water supply system? If so, will this require the use of a *substantial* volume of water?	No		Section 2.10
Temporary structures	Will the works 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, will this cause more than a *minor* or *inconsequential* disruption to pedestrian or vehicular flow?	Yes	Canterbury Bankstown Council	Section 2.10
Road & footpath excavation	Will the works involve more than *minor* or inconsequential excavation of a road or adjacent footpath for which council is the roads authority and responsible for maintenance?	Yes	Canterbury Bankstown Council	Section 2.10

Local heritage items

Development type	Potential impact	Yes / No	If 'yes' consult with	SEPP (Transport and Infrastructure) Section
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 works? If yes, does a heritage assessment indicate that the potential impacts to the heritage significance of the item/area are more than minor or inconsequential?	Yes	Canterbury Bankstown Council	Section 2.11

Flood liable land

Development type	Potential impact	Yes / No	If 'yes' consult with	SEPP (Transport and Infrastructure) Section
Flood liable land	Are the works located on flood liable land? If so, will the works change flood patterns to more than a *minor* extent?	Yes	Canterbury Bankstown Council	Section 2.12
Flood liable land	Are the works located on flood liable land? (to any extent). If so, do the works comprise more than minor alterations or additions to, or the demolition of, a building, emergency works or routine maintenance?	Yes	State Emergency Services Email: erm@ses.nsw.gov.au	Section 2.13

Note: Flood liable land means land that is susceptible to flooding by the probable maximum flood event, identified in line 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

Development type	Potential impact	Yes / No	If 'yes' consult with	SEPP (Transport and Infrastructure) Section
National parks and reserves	Are the works adjacent to a national park or nature reserve, or other area reserved under the *National Parks and Wildlife Act 1974*, or on land acquired under that Act?	No	Environment and Heritage Group, DPE	Section2.15
National parks and reserves	Are the works on land in Zone E1 National Parks and Nature Reserves or in a land use zone equivalent to that zone?	No	Environment and Heritage Group, DPE	Section 2.15
Navigable waters	Do the works include a fixed or floating structure in or over navigable waters?	No	Transport for NSW - Maritime	Section 2.15
Bush fire prone land	Are the works 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 (RFS) [Refer to the NSW RFS publication: *Planning for Bush Fire Protection (2006)*]	Section 2.15
Artificial light	Would the works 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	Section 2.15

Development type	Potential impact	Yes / No	If 'yes' consult with	SEPP (Transport and Infrastructure) Section
Defence communications buffer land	Are the works on buffer land around the defence communications facility near Morundah? (Note: refer to Defence Communications Facility Buffer Map referred to in section 5.15 of Lockhart LEP 2012, Narrandera LEP 2013 and Urana LEP 2011.	No	Secretary of the Commonwealth Department of Defence	Section 2.15
Mine subsidence land	Are the works on land in a mine subsidence district within the meaning of the *Mine Subsidence Compensation Act 1961*?	No	Mine Subsidence Board	Section 2.15

Appendix C – Henry Lawson Drive Upgrade Stage 1B, Milperra Consultation Report

Appendix D – Traffic and Transport Impact Assessment

Appendix E – Noise and Vibration Impact Assessment

Appendix F – Hydrology and Flooding Assessment

Appendix G – Landscape Character and Visual Impact Assessment

Appendix H – Biodiversity Assessment Report

Appendix I – Socio-Economic Impact Assessment

Appendix J – Soils, Surface water and Groundwater Working Paper

Appendix K – Non-Aboriginal Heritage Statement of Heritage Impact

Appendix L – Aboriginal cultural heritage assessment report

Appendix M – Stage 1 PACHCI

NSW GOVERNMENT