



Mamre Road upgrade between the M4 Motorway and Erskine Park Road

Submissions report

Dharug Country

Transport for NSW | July 2022

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Transport for NSW | July 2022

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

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Acknowledgement of Country

Transport for NSW acknowledges the Dharug, the traditional custodians of the land on which the Mamre Road upgrade is proposed. We pay our respects to their Elders, past and present and celebrate the diversity of Aboriginal peoples 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.

Executive summary

The proposal

Transport for NSW (Transport) proposes to upgrade about 3.8 kilometres of Mamre Road between the M4 Motorway, St Clair and Erskine Park Road, Erskine Park to a four-lane divided road (the proposal). Mamre Road is a key transport corridor, which provides connections to the Western Sydney Employment Area and the proposed Western Sydney Aerotropolis. A key aim of the proposal is to improve road safety and movement between the M4 Motorway and Erskine Park Road through increasing the capacity of Mamre Road, which would support future economic and residential growth in the surrounding area.

The key features of the proposal as per the design in the *Mamre Road upgrade Stage 1 Review of Environmental Factors* (the REF) prepared by Transport in August 2021 included:

- an upgrade of Mamre Road to a four-lane divided road with a wide central median that would allow for widening to six lanes in the future, if required
- changes to intersections with Mamre Road including:
 - an upgrade to the existing signalised intersection at Banks Drive including a new western stub for access and a U-turn facility
 - a new signalised intersection at Solander Drive including a new western stub for access and a U-turn facility
 - a new signalised intersection at Luddenham Road with new turning lanes
 - an upgrade to the existing signalised intersection at Erskine Park Road with new turning lanes
 - modified intersection arrangements (left in, left out only) at McIntyre Avenue and Mandalong Close
- a new shared path along the eastern side of Mamre Road and provision for a future shared path on the western side
- reinstatement of bus stops near Banks Drive with provision for additional bus infrastructure in the future
- changes to property access to Mamre House, Erskine Park Rural Fire Service and other private properties
- drainage and flooding infrastructure upgrades including culvert crossings, water quality basins, grass swales and channel tail-out work
- new traffic control facilities including new traffic signals and relocation of existing electronic variable message signage
- roadside furniture and street lighting
- noise walls along the eastern side of Mamre Road at St Clair
- utility relocations
- establishment of temporary ancillary facilities to support construction including compound sites, stockpile and laydown locations, temporary access tracks, temporary waterway crossings and concrete batching plants.

Since the REF was displayed, the design of the proposal has been revised (refer to Chapter 4 for more details).

Display of the Review of Environmental Factors

Transport prepared a Review of Environmental Factors (REF) to assess the potential environmental impacts of the proposal. The REF was publicly displayed for about one month between Wednesday 25 August 2021 and Sunday 26 September 2021. No physical copies of the REF were displayed, and face-to-face community consultation activities were avoided, due to COVID-19 restrictions and social distancing requirements.

The REF was made publicly available for viewing and download on Transport's Mamre Road upgrade project website nswroads.work/mamreroadupgrade. Transport also developed an innovative Digital REF to display the information from the REF in a more interactive and engaging way for the community. This

was available to access directly via <https://tfnsw.ee.alytics.com/mamre-road-upgrade-stage-1/home> as well as via the project website. No physical copies of the REF were displayed, and face-to-face community consultation activities were not carried out due to COVID-19 restrictions and social distancing requirements.

Transport carried out a letterbox drop at the start of the REF display period to inform local residents and other landholders near the proposal that the REF was on display. This involved distributing 5,500 copies of the August 2021 Mamre Road upgrade community update. Transport also contacted 389 stakeholders by email.

Two online community information sessions were held by Transport via Microsoft Teams to provide further information on the proposal, answer questions from the community and encourage the community to provide a formal submission on the REF.

Transport conducted additional consultation activities with Penrith City Council to brief elected representatives and senior staff on the REF, answer questions and enable them to make an informed submission.

Summary of issues and responses

Public display of the REF and the supporting consultation resulted in a total of 41 submissions, which comprised 36 submissions from the general community and five submissions from government agencies: Penrith City Council; Sydney Water; Western Sydney Utilities Collaboration – Technical Working Group; Western Sydney Airport and the Department of Planning and Environment.

Most of the submissions raised by the community related to the proposal design and construction (raised 24 times), which included several submissions related to the noise wall design and construction timing, proposed changes to intersections along Mamre Road and other suggestions to refine the design.

The six most frequently raised sub-issues were related to:

- concerns about operational traffic and transport impacts related to the change to Mandalong Close and McIntyre Avenue to left-in, left-out only (raised 11 times by the community)
- queries about and suggestions to adopt noise and vibration mitigation measures to minimise operational noise impacts of the proposal (raised 10 times by the community)
- concerns about operational landscape character and visual impacts due to the proposed installation of the noise wall, removal of existing trees and increased presence of road infrastructure (raised seven times by the community)
- concerns about noise and vibration impacts during construction, including impacts associated with compound site 3 (raised six times by the community)
- the design of the noise wall, its location, and related height and visual impacts (raised five times by the community)
- queries about potential upgrades to surrounding roads and the broader road network near Mamre Road (raised five times by the community).

The responses to the main issues raised by the community are summarised below.

Change to Mandalong Close and McIntyre Avenue to left-in, left-out only

The proposal would change the existing priority-controlled intersections at Mandalong Close and McIntyre Avenue to be left-in, left-out only. Transport acknowledges that due to the banned right turn movements, vehicles entering or exiting McIntyre Avenue and Mandalong Close would have to travel longer distances compared to the existing arrangements. However, as the overall traffic performance along Mamre Road is expected to improve due to operation of the proposal (including faster travel speeds in both directions along Mamre Road), this longer travel distance would not necessarily result in a notable increase in overall travel time compared to the future scenario without the proposal. Traffic modelling carried out for the REF identified that the proposal would also improve intersection performance at all intersections along Mamre

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Road compared to the future scenario without the proposal (refer to Section 6.4.4 in the REF for further detail).

The U-turn facility proposed at the Solander Drive intersection would allow northbound traffic to change direction on Mamre Road and access the southbound carriageway. Using this facility would allow motorists travelling north along Mamre Road to turn directly left into McIntyre Avenue and motorists exiting Mandalong Close to travel south along Mamre Road.

Noise and vibration mitigation measures

An operational noise mitigation assessment was conducted as part of the REF to determine possible mitigation measures to control the predicted noise impacts during operation of the proposal. As discussed in Section 6.7.5 of the REF, the preferred order of mitigation strategies in line with the *Noise Mitigation Guideline* (NMG) (Roads and Maritime, 2015a) is as follows:

1. At-source mitigation (low noise pavements)
2. In-corridor mitigation (noise barriers)
3. At-property mitigation (architectural treatment)

The design has proposed the installation of noise walls along the eastern side of Mamre Road near the residential area of St Clair. The proposed noise wall alignment does not cover every property near the proposal as there are some locations where its installation is not considered reasonable and feasible or cost-effective. If the indicative noise walls were constructed as assessed in the REF, it is anticipated that 160 sensitive receiver floor exceedances would remain, subject to further investigation during detailed design. These properties would be identified and considered for additional noise mitigation such as at-property treatment where possible. However, the noise wall design and alignment would be refined during detailed design.

The final operational noise mitigation strategy for the proposal would be determined during detailed design and would likely use a combination of approaches. The final approach would consider community preference where appropriate. Inspection and assessment of individual receivers would also be required to determine feasible and reasonable measures where at-property treatment is considered suitable.

Operational landscape character and visual impacts

The objectives and development criteria for the proposal consider the need to improve the urban design of the road corridor and minimise amenity impacts on surrounding properties, including visual impacts.

In accordance with this, several urban design features have been included in the proposal design to improve the amenity of the road corridor. This includes proposing substantial planting and minimisation of vegetation removal, considering opportunities for street art and incorporating transparent panels at the top of the proposed noise wall.

These urban design features have been developed in consideration of the existing landscape character surrounding Mamre Road, including the rural residential landscape. They have also been designed by considering the concerns raised by community members in their submissions, including relating to visual impacts of the noise wall, removal of existing trees and increased presence of road infrastructure due to the proposal. For example, the noise wall has been designed to include transparent panels for the top 1.5 metres to reduce the bulky appearance of the structure and to provide sunlight to nearby backyards. The proposed street lighting along Mamre Road has also been designed to minimise impacts on surrounding residential receivers. It would reduce contrast between shadows and illuminated areas to minimise glare and would be installed in accordance with the Penrith City Council Public Domain Manual.

The urban design concept would be confirmed during detailed design.

Construction noise and vibration impacts

A construction noise assessment has been carried out for the proposal in accordance with relevant guidelines. This assessment considered construction noise from all construction activities, including at the three proposed compound sites.

The assessment identified that noise generated from construction activities and construction traffic has the potential to impact sensitive receivers surrounding the proposal. During standard construction hours, the highest noise levels and impacts would be experienced by residential receivers in NCA03, NCA04, NCA05 and NCA06. During out of hours work periods, noise impacts would be 'Highly Intrusive' at residential receivers to the east and west of Mamre Road in NCA01 – NCA06 and NCA08. There may also be minor construction traffic noise impacts, including due to the establishment of temporary traffic detours.

However, the assessment is generally considered conservative as the noise level calculations assume several items of construction equipment are in use at the same time within individual scenarios. It also represents the worst-case situation where construction equipment is 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 typically only occurs for a relatively short period when noisy equipment is in use nearby.

Transport will review the continued need for compound site 3 during detailed design and minimise its use, where possible, which would reduce the risk of construction noise impacts on sensitive receivers near Mandalong Close.

Potential construction noise impacts would be managed in accordance with the *Interim Construction Noise Guideline* (DECC, 2009) and *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016). This would make sure that noise levels are considered when noise intensive activities are occurring nearby, including during rest periods at the Old MacDonald's Childcare.

Noise wall design

Noise walls have been proposed along the eastern side of Mamre Road near the residential area of St Clair to minimise potential road traffic noise impacts during operation of the proposal. The design has proposed the installation of noise walls that would be about 4.5 metres high, with transparent panels as suggested in the submissions for the top 1.5 metres. This indicative height is considered to provide a reasonable compromise between noise reduction and potential visual impacts.

The noise wall alignment is currently being revised in consultation with Penrith City Council due to potential property impacts and Sydney Water due to the location of the existing sewer. The noise walls would not be on the fence line of the adjoining properties due to the requirement for maintenance access. The final design of the noise walls, including height and location, would be confirmed during detailed design.

Potential upgrades to surrounding roads and the broader road network

Transport acknowledges the respondents' interest in surrounding roads and developments, and notes that potential upgrades to these roads are outside the scope of the proposal. Any upgrades to these surrounding roads would be subject to separate assessment, approval and funding.

Changes to the proposal

Following exhibition of the REF, the proposal design has been refined due to design development and the submissions to include:

- replacement of the space provision for a future shared path on the western side of Mamre Road between Mandalong Close and Banks Drive with a paved shoulder and road verge
- an increase in width of the shared path on the eastern side of Mamre Road from three metres (as per the REF) to 3.5 metres, which would be confirmed during detailed design
- changes to road drainage and supporting infrastructure along the western side of Mamre Road, including removal of most proposed pits and pipes from the REF design and introduction of swales and channels for the collection of stormwater
- removal of future provision for an additional left-turn lane from Mamre Road onto Luddenham Road
- changes to relocation of an existing 11 kilovolt overhead powerline owned by Endeavour Energy to be relocated overhead instead of underground (as per the REF)
- changes to the lane configuration on Mamre Road and Banks Drive at the Banks Drive intersection compared to the REF, including:
 - an increase in the number of through lanes proposed on Mamre Road at this intersection from two to three in each direction
 - changes to the northbound inside lane north of the Banks Drive intersection to become an exclusive right turn lane onto the M4 Motorway westbound on-ramp
 - a change along the westbound carriageway of Banks Drive from one right turn lane and one shared straight, right turn and left turn lane (as per the REF) to be two right turn lanes and a shared straight and left turn lane
- adjustment to three street light lanterns to the north of the original proposal area outlined in the REF
- relocation of the bus stop on Banks Drive further east compared to the REF
- refinement of proposed drainage to one channel near the Erskine Park Road intersection
- minor adjustments to the original proposal area and vegetation clearance boundary outlined in the REF to allow for the connection of utilities to the surrounding network and incorporation of utility easements at Banks Drive
- a slight reduction of land to be leased for construction near Mamre House to reduce property impacts.

The construction staging of the proposal has also been further refined since public display of the REF, so that:

- the northern section of Mamre Road generally between the M4 Motorway and Chad Place has been prioritised for upgrade
- the southern section of Mamre Road generally between Chad Place and Erskine Park Road may be built later than the northern section, depending on funding availability.

The exact timing of the commencement of construction for the upgrades to the northern section and southern section of Mamre Road (as outlined above) would be confirmed during detailed design.

Additional assessment

Additional hydrology modelling and biodiversity assessment has been carried out due to the changes to the proposal since public display of the REF. The results of the additional hydrology modelling carried out for the revised design (particularly focusing on the removal of space for the future shared path along the western side and changes to road drainage) confirmed that it would not cause any additional adverse flood impacts compared to those presented in the REF. As such, the design requirement for the Mamre Road to achieve flood immunity in a one per cent annual exceedance probability (AEP) flood event would be maintained. The other design changes were expected to have negligible impact on flooding.

The additional biodiversity assessment focused on assessing the minor adjustments to the vegetation clearance boundary as per the revised proposal. The assessment concluded that the overall removal of native and non-native vegetation for the proposal would slightly reduce (0.64 hectares less than assessed in the REF), however the amount of PCT 849 Cumberland Plain Woodland, which provides habitat for Cumberland Plain Land Snail and Southern Myotis, that would be directly impacted would slightly increase (0.06 hectares more than assessed in the REF). Overall, these slight changes in magnitude of impact were considered not to change any of the conclusions or mitigation measures outlined in the biodiversity assessment prepared for the REF.

Next steps

Transport as the determining authority will consider the information in the REF and this submissions report and make a decision whether or not to proceed with the proposal.

Transport will inform the community and stakeholders of this decision and where a decision is made to proceed, will continue to consult with the community and stakeholders prior to and during the construction phase.

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1. Introduction and background

1.1 The proposal

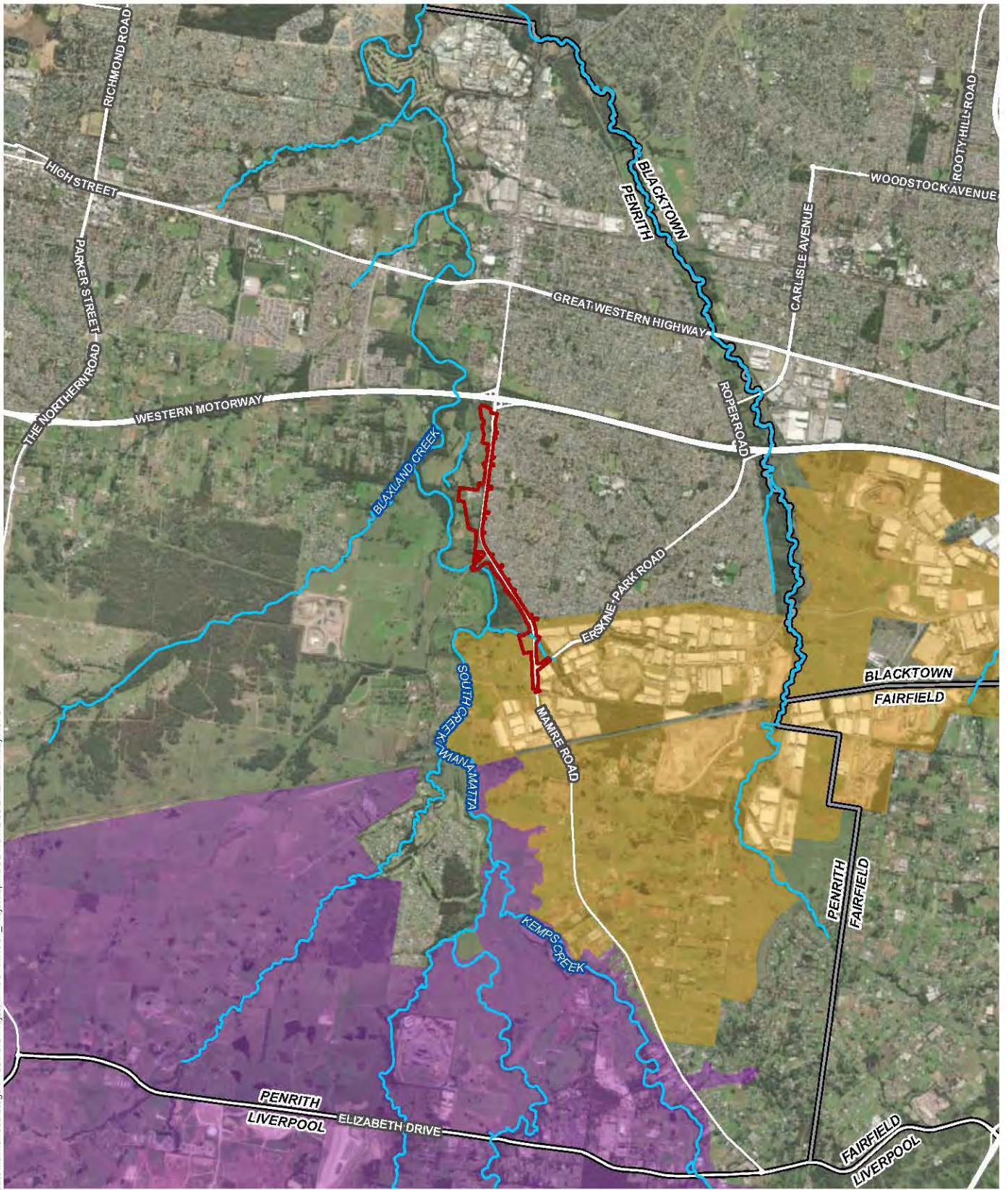
Transport for NSW (Transport) proposes to upgrade about 3.8 kilometres of Mamre Road between the M4 Motorway, St Clair and Erskine Park Road, Erskine Park to a four-lane divided road (the proposal). The proposal is located within the City of Penrith local government area (LGA) in Sydney, New South Wales (NSW). The proposal forms the first stage of the larger Mamre Road upgrade project. Overall, the Mamre Road upgrade project would involve upgrades to a 10 kilometre long section of Mamre Road between the M4 Motorway, St Clair and Kerrs Road, Kemps Creek. Figure 1-1 shows the location of the proposal.

Mamre Road is a key transport corridor, which provides connections to the Western Sydney Employment Area and the proposed Western Sydney Aerotropolis. A key aim of the proposal is to improve road safety and movement between the M4 Motorway and Erskine Park Road through increasing the capacity of Mamre Road, which would support future economic and residential growth in the surrounding area.

The key features of the proposal as per the design in the *Mamre Road upgrade Stage 1 Review of Environmental Factors* (the REF) prepared by Transport in August 2021 included (refer to Figure 1-2):

- an upgrade of Mamre Road to a four-lane divided road with a wide central median that would allow for widening to six lanes in the future, if required
- changes to intersections with Mamre Road including:
 - an upgrade to the existing signalised intersection at Banks Drive including a new western stub for access and a U-turn facility
 - a new signalised intersection at Solander Drive including a new western stub for access and a U-turn facility
 - a new signalised intersection at Luddenham Road with new turning lanes
 - an upgrade to the existing signalised intersection at Erskine Park Road with new turning lanes
 - modified intersection arrangements (left in, left out only) at McIntyre Avenue and Mandalong Close
- a new shared path along the eastern side of Mamre Road and provision for a future shared path on the western side
- reinstatement of bus stops near Banks Drive with provision for additional bus infrastructure in the future
- changes to property access to Mamre House, Erskine Park Rural Fire Service and other private properties
- drainage and flooding infrastructure upgrades including culvert crossings, water quality basins, grass swales and channel tail-out work
- new traffic control facilities including new traffic signals and relocation of existing electronic variable message signage
- roadside furniture and street lighting
- noise walls along the eastern side of Mamre Road at St Clair
- utility relocations
- establishment of temporary ancillary facilities to support construction including compound sites, stockpile and laydown locations, temporary access tracks, temporary waterway crossings and concrete batching plants.

Since the REF was displayed, the design of the proposal has been revised (refer to Chapter 4 for more details).

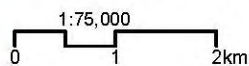


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- Watercourse
- REF proposal area
- Local government area
- Western Sydney Aerotropolis
- Western Sydney Employment Area



Source: Aurecon, Spatial Services, Nearmap, Esri

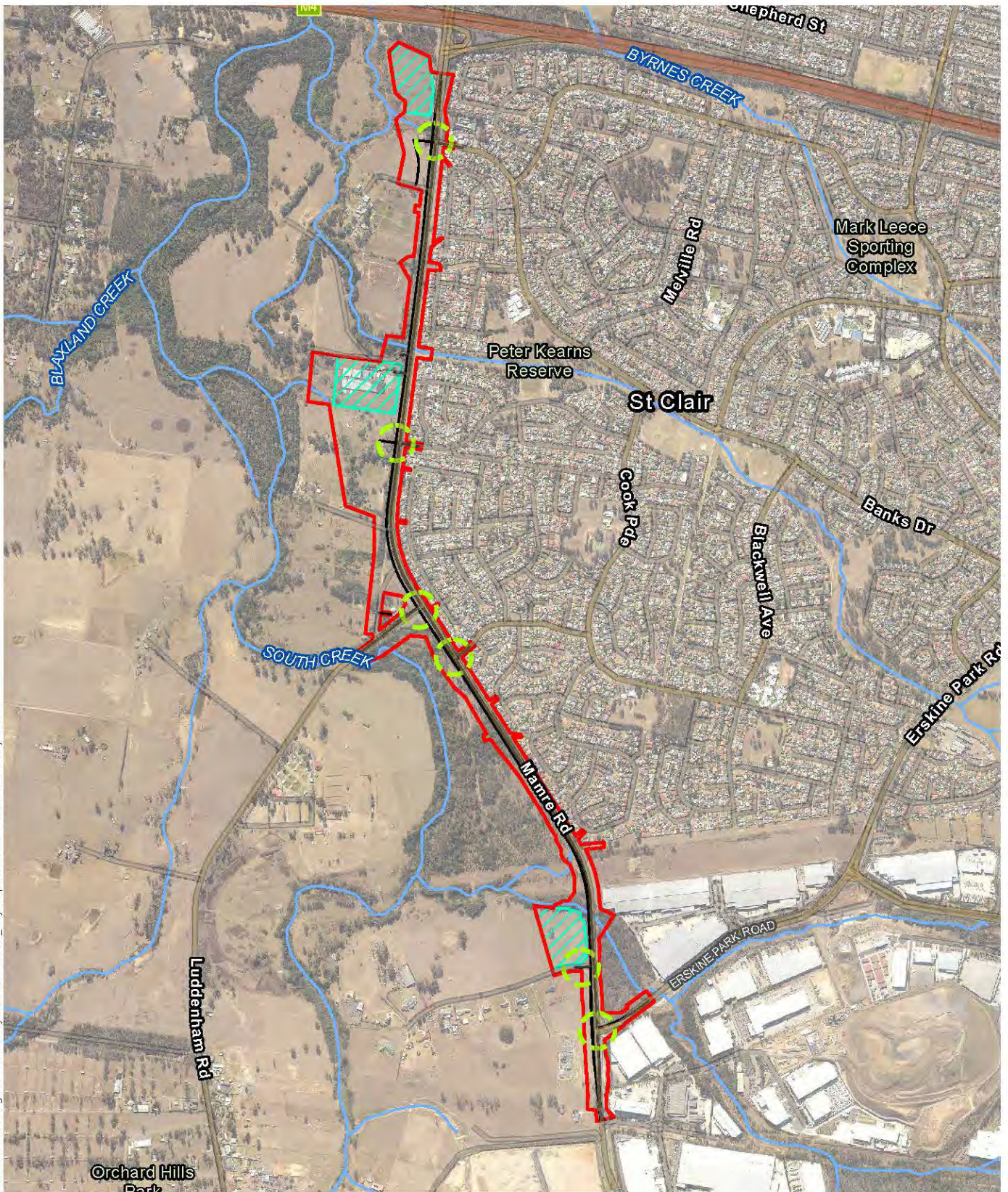


Date: 16/03/2021 Version: 1

Projection: GDA2020 MGA Zone 56

Mamre Road upgrade between the M4 Motorway and Erskine Park Road

Figure 1-1: Location of the proposal

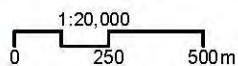


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- Waterways
- Proposed design's centerline
- - - Proposed changes to existing intersections
- Compound Sites
- REF proposal area



Source: Aurecon, Spatial Services, Nearmap, Esri



Date: 31/05/2021 Version: 2

Projection: GDA2020 MGA Zone 56

Mamre Road upgrade between the M4 Motorway and Erskine Park Road

Figure 1-2: Overview of the proposal (as per the REF)

1.2 REF display

Transport prepared a Review of Environmental Factors (REF) to assess the potential environmental impacts of the proposed work.

The REF was publicly displayed for about one month between Wednesday 25 August 2021 and Sunday 26 September 2021. No physical copies of the REF were displayed, and face-to-face community consultation activities were avoided, due to COVID-19 restrictions and social distancing requirements.

The REF was made publicly available for viewing and download on Transport's Mamre Road upgrade project website nswroads.work/mamreroadupgrade. Transport also developed an innovative Digital REF to display the information from the REF in a more interactive and engaging way for the community. This was available to access directly via <https://tfnsw.ee.alytics.com/mamre-road-upgrade-stage-1/home> as well as via the project website. Figure 1-3 shows a screenshot of the digital REF homepage.

The link for the project website was advertised via a social media advertising campaign on the NSW Roads Facebook page. Two variable message signs were installed on Mamre Road during the REF display period, advertising the project website and the proposal's online project information sessions.

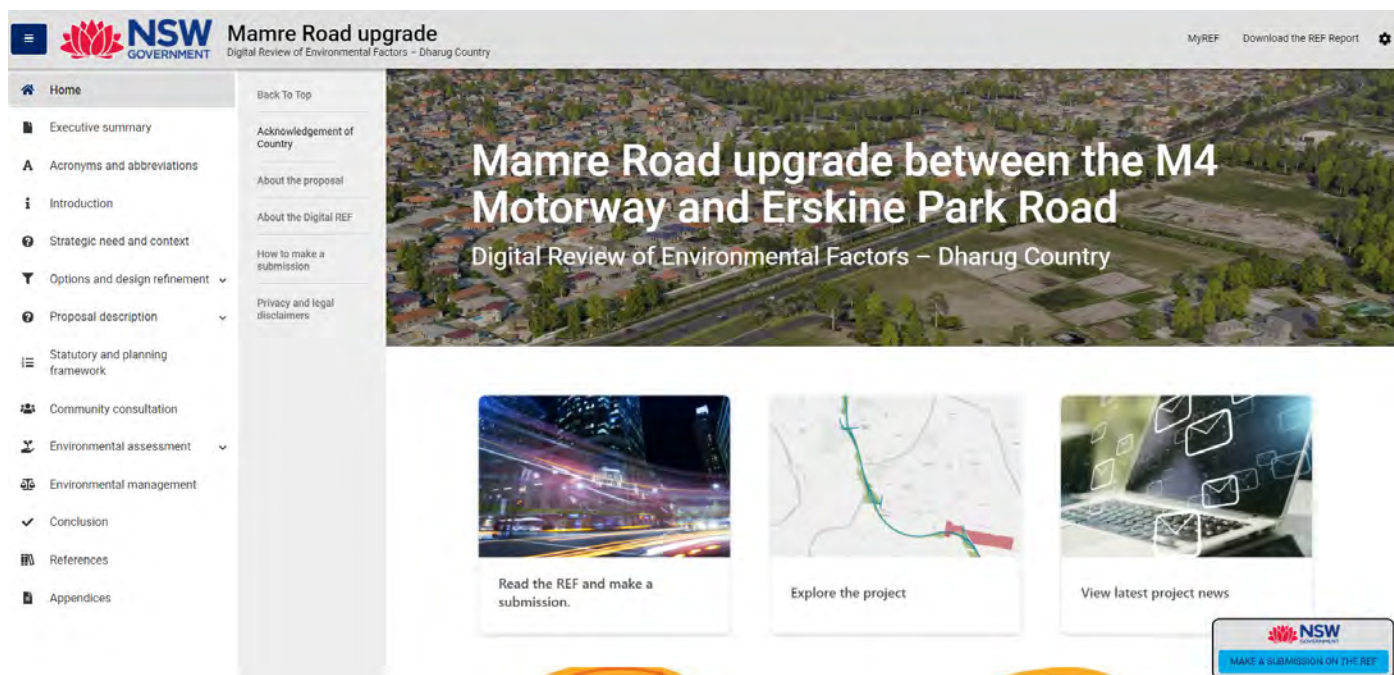


Figure 1-3 Screenshot of the Mamre Road upgrade digital REF interactive platform

Transport carried out a letterbox drop at the start of the REF display period to inform local residents and other landholders near the proposal that the REF was on display. This involved distributing 5,500 copies of the August 2021 Mamre Road upgrade community update. Transport also contacted 389 stakeholders by email.

Two online community information sessions were held by Transport via Microsoft Teams to provide further information on the proposal, answer questions from the community and encourage the community to provide a formal submission on the REF. Further information on the online project information sessions is provided in Section 2.1.2.

Transport conducted additional consultation activities with Penrith City Council to brief elected representatives and senior staff on the REF, answer questions and enable them to make an informed submission.

1.3 Purpose of the report

This submissions report relates to the *Mamre Road upgrade Stage 1 Review of Environmental Factors* (the REF) prepared by Transport in August 2021 and should be read in conjunction with that document.

The REF was placed on public display and submissions relating to the proposal were received by Transport.

This submissions report summarises the issues raised and provides responses to each issue (Chapters 2 and 3). It also details changes to the proposal since finalisation of the REF (Chapter 4), describes and assesses the environmental impact of these changes to the proposal (Chapter 5) and identifies new or revised environmental management measures (Chapter 6).

2. Response to community issues

2.1 Overview of issues raised

2.1.1 Issues raised in formal submissions received from the community

Transport received 36 submissions from the community in response to the display of the REF.

Appendix A lists each respondent's allocated submission number and where the issues from each submission have been addressed in Chapter 2 of this report.

Each submission has been examined individually to identify the issues being raised. The issues raised in each submission have been extracted and collated, and corresponding responses to the issues have been provided. Where similar issues have been raised in different submissions, a single response has been provided. It is noted that most submissions covered multiple issues, therefore the total number of issues raised is greater than the total number of submissions received.

Figure 2-1 provides a summary of key issue categories raised by the community, including the number of times an issue was raised relating to each category.

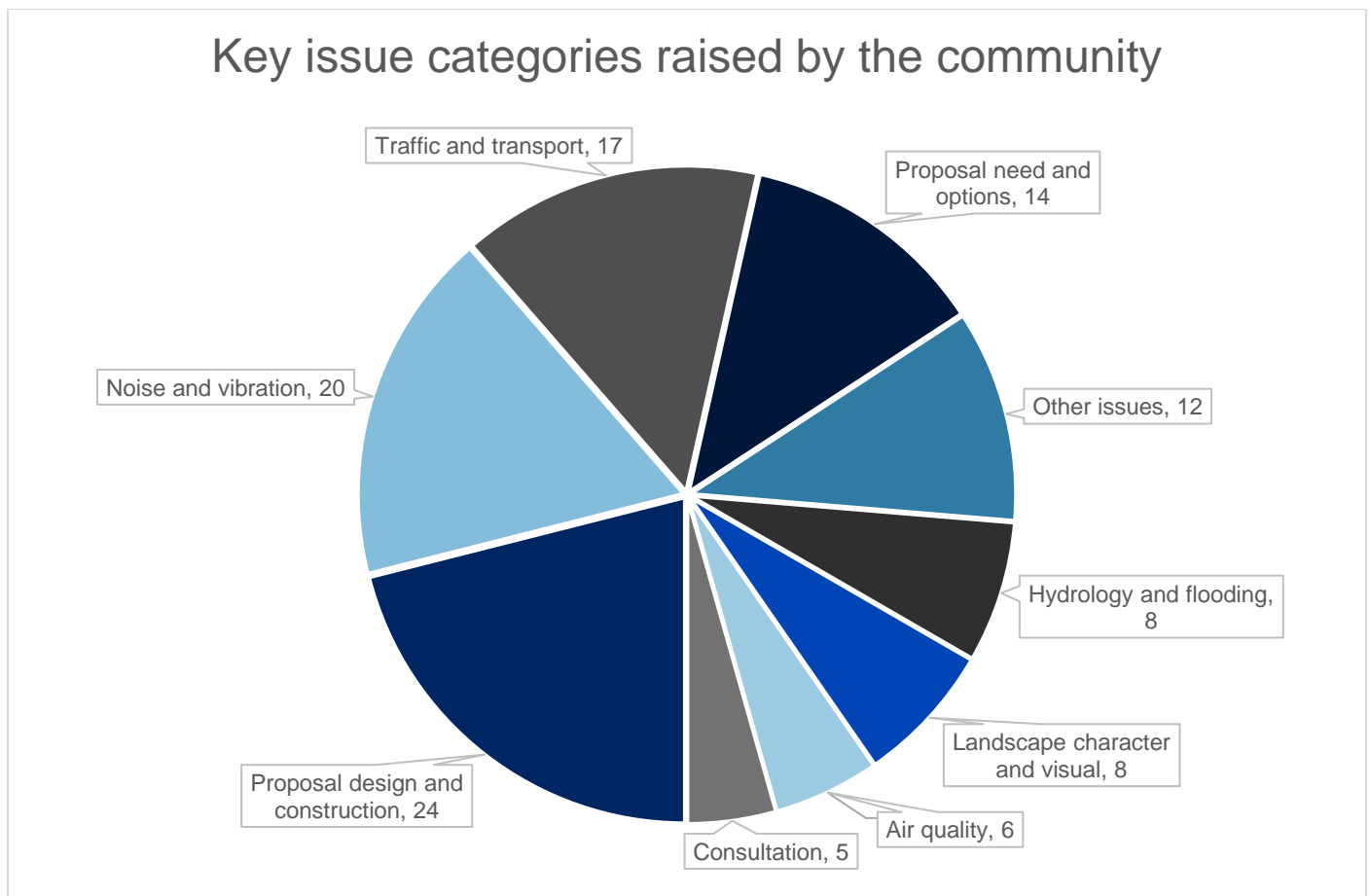


Figure 2-1 Summary of the number of times the key issue categories were raised by the community

Figure 2-1 shows that the top five key issue categories (excluding the other issues category) were:

- proposal design and construction (raised 24 times), which included several submissions related to the noise wall design and construction timing, proposed changes to intersections along Mamre Road and other suggestions to refine the design
- noise and vibration (raised 20 times), which included queries and suggestions for noise mitigation measures proposed and concern regarding construction noise and vibration impacts
- traffic and transport (raised 17 times), which particularly related to impacts during operation of the proposal associated with the change to Mandalong Close and McIntyre Avenue intersections to left-in, left-out
- proposal need and options (raised 14 times), which particularly related to suggestions for the intersection sub-options at McIntyre Avenue and Mandalong Close and queries on the timing of future stages of the Mamre Road upgrade
- landscape character and visual impacts as well as hydrology and flooding (both raised 8 times), which particularly related to operational impacts of the proposal including the blockage of views and afternoon sun from residential properties by the proposed noise wall and changes to flood risk.

2.1.2 Issues raised during the online community information sessions

The Transport project team for the Mamre Road upgrade between the M4 Motorway and Erskine Park Road also responded to several issues and questions raised by the community during the online project information sessions. The online project information sessions were held during the public display period on Wednesday 15 September 2021 and Monday 20 September 2021 over Microsoft Teams. There were 18 attendees in the first session and 21 attendees in the second session.

During the sessions, attendees were encouraged to ask questions to the project team about the proposal and REF. The issues and questions raised were verbally responded to by the project team during the sessions, and as such are not directly addressed within this report.

Attendees were also encouraged to read the REF for more detailed information on the proposal and the environmental assessment and to provide submissions and feedback on the proposal.

2.2 Proposal need and options

2.2.1 Timing of future upgrades

Submission number(s)

1, 7, 30, 31

Issue description

The respondents raised the following comments and queries relating to the timing of future stages of the Mamre Road upgrade:

- why the proposal is proposed to be built initially with two lanes in each direction along Mamre Road rather than the ultimate arrangement with three lanes in each direction, and when the ultimate arrangement would be built
- comment that future upgrades would result in additional construction noise and traffic impacts in the future, which would be avoided if the proposal construction was not staged.

Response

Traffic modelling undertaken as part of the strategic design for the proposal demonstrated that the upgrade of Mamre Road to two lanes in each direction would be sufficient to cater for the current and short to medium term future traffic volumes. The *Traffic and Transport Impact Assessment* (SMEC, 2021) prepared for the REF also concluded that the provision of two lanes provides adequate mid-block capacity for the 2026 and 2036 forecast traffic volumes. This would result in improved travel speeds along key sections of Mamre Road compared to two and five kilometres per hour without the proposal (refer to Appendix G of the REF).

The proposal has been developed with a wide central median that would provide enough space for an additional lane in each direction in the future, should the growth in traffic volumes using Mamre Road require additional lanes. This wide central median would minimise disruptions associated with future upgrades as it has been designed with enough space to be efficiently upgraded, and also provides benefits for visual impacts and amenity as it can accommodate planting to assist in 'greening' the road corridor. It is acknowledged that the timing of further upgrades to Mamre Road to three lanes in each direction is unknown as it is dependent on when the traffic demand increases in the future. Future additional upgrades to Mamre Road would be subject to separate environmental assessment and approval at that time.

However, since public display of the REF, Transport has now proposed three lanes north of the Banks Drive intersection to improve the traffic performance in this section, as traffic modelling carried out for the REF has shown that this further upgrade would be of immediate benefit once the proposal is built (refer to Section 4.5).

In addition, the construction staging of the proposal has been further refined since public display of the REF, so that:

- the northern section of Mamre Road generally between the M4 Motorway and Chad Place has been prioritised for upgrade due to community concern regarding the safety of Mamre Road for the nearby residents (refer to Section 2.1 and Section 2.2 of the REF for further details)
- the southern section of Mamre Road generally between Chad Place and Erskine Park Road may be built later than the northern section, depending on funding availability.

The exact timing of the commencement of construction for the upgrades to the northern and southern sections of Mamre Road (as outlined above) would be confirmed during detailed design. A community update would be released to confirm staging arrangements prior to construction.

2.2.2 Intersection sub-options at McIntyre Avenue and Solander Drive

Submission number(s)

7, 13, 17

Issue description

The respondents raised a suggestion to adjust Luddenham Road to join to McIntyre Avenue at a four-way intersection (potentially with traffic lights), because this option is thought to:

- reduce the number of intersections with Mamre Road
- make it easier to turn right in/out of McIntyre Avenue compared to the REF proposal
- be cost-effective and not involve major additional environmental impacts.

Response

An options assessment was carried out for the Mamre Road upgrade during the strategic design phase. This included consideration of corridor widening options and intersection sub-options.

For the McIntyre Avenue intersection, the following options were considered (refer to Section 2.4.2 of the REF):

- proposed left-in left-out option
- realignment of Luddenham Road to intersect with McIntyre Avenue
- a link road between McIntyre Avenue and Luddenham Road (to the east of Mamre Road)
- a 'do nothing' option.

The realignment of the Luddenham Road option was not progressed because it would require clearing of threatened ecological communities within land reserved for environmental offsets (biobanking area), impact key fish habitat along South Creek, affect two listed heritage items (Canine Council dwelling and Leeholme Horse Stud Rotunda) and involve extensive property acquisition. The link road option was not progressed as it would impact on land set aside for biodiversity offsets and result in road safety issues due to very tight bends that would impact manoeuvrability, cause headlight glare and reduce sight distance for drivers. The 'do nothing' option was not deemed suitable as it would lead to the current network inefficiency continuing to worsen in the future under the predicted increase in traffic volumes. The left-in left-out option was adopted as the preferred approach as it would best minimise impacts to the traffic efficiency on Mamre Road by avoiding a number of signalised intersections close together. This option would also not require major changes to the intersection footprint, would avoid a large amount of property acquisition and would have less impact to the environment.

Further details on the assessment of sub-options for the McIntyre Avenue intersection are summarised in Section 2.4.2 of the REF and available in the *Mamre Road upgrade - Kerrs Road to M4 Motorway options report* (Roads and Maritime Services, 2017) , which is accessible at: <https://roads-waterways.transport.nsw.gov.au/documents/projects/sydney-west/mamre-road-upgrade/mamre-road-upgrade-options-report.pdf>.

Submission number(s)

21, 33

Issue description

The respondents raised the following queries and suggestions relating to the proposed intersection options for McIntyre Avenue and Solander Drive:

- query regarding the purpose of the U-turn facility at Solander Drive as people may choose to access McIntyre Avenue via Feather Street instead of the U-turn facility, and whether the U-turn facility at Solander Drive is proposed to provide access to the future M12 Motorway or rail maintenance yard
- suggestion that the intersection at McIntyre Avenue should be upgraded to a signalised intersection instead of the Solander Drive intersection, as this may be more used.

Response

The proposed U-turn facility on the western side of the Solander Drive intersection is required to:

- provide access to properties on the western side of Mamre Road
- allow motorists travelling northbound on Mamre Road to access McIntyre Avenue via the southbound carriageway
- allow motorists from Mandalong Close to access the southbound carriageway (as motorists would need to turn left out of Mandalong Close and head northbound to access the U-turn facility to travel southbound).

Transport notes that motorists may choose to access McIntyre Avenue via other roads (such as Feather Street), as per the existing scenario, however the proposed upgrade to the Solander Drive intersection provides route flexibility for motorists.

McIntyre Avenue would not be a suitable signalised intersection instead of Solander Drive as it is about 220 metres south of the Luddenham Road intersection, which is also proposed to be signalised. Due to the nearness of the Luddenham Road and McIntyre Avenue intersections, installing traffic lights at the McIntyre Avenue intersection is not viable as the turning lane layout of these intersections would conflict with each other.

2.2.3 Intersection sub-options at Mandalong Close

Submission number(s)

24, 32

Issue description

The respondents raised the following comments relating to alternate options to provide access to Mandalong Close:

- query whether other intersection options were considered for Mandalong Close that would reduce impacts compared to the left-in, left-out arrangement proposed in the REF
- suggestion to design an alternate access road to the childcare to join James Erskine Drive.

Response

As noted in Section 2.2.2, an options assessment was carried out for the Mamre Road upgrade during the strategic design phase.

For the Mandalong Close intersection, the following options were considered (refer to Section 2.4.2 of the REF):

- the proposed left-in left-out option
- a new fourth leg at the intersection with Erskine Park Road and connection to Mandalong Close via an existing lane for the childcare centre
- a 'do nothing' option.

Separately to the proposal, the Mamre West precinct development includes provision for a road network to connect Mandalong Close to the James Erskine Drive intersection in the long term. As part of this, construction of a western leg to the James Erskine Drive intersection has been proposed for the development of the Altis Warehouse and Logistics Hub within the Mamre West Precinct. The development application for the proposed western turning circle was lodged with Penrith City Council for approval as DA21/0517 on 16 July 2021, however the development application for the future access road (which would form a western leg of the James Erskine Drive intersection from Mamre Road to the western turning circle) has not yet been lodged. As James Erskine Drive is managed by Council, planning for a future alternate access road from James Erskine Drive to the childcare would be confirmed by Penrith City Council and does not form part of this proposal.

Transport notes that it has provided comments to Penrith City Council to support future development as part of the Mamre West precinct development. In particular, support for delivery of the western leg at the James Erskine Drive intersection to provide a new local access road and enable safer access to Mandalong Close for residents and childcare centre staff and customers.

Given the potential for alternate access to Mandalong Close via the James Erskine Drive intersection to be built in the future, the left-in, left-out option was preferred as part of the Mamre Road upgrade. A new fourth leg at the Erskine Park Road intersection would involve a large amount of property acquisition and high construction costs, which were not deemed suitable for an interim access measure. The assessment of sub-options for the Mandalong Close intersection is summarised in Section 2.4.2 of the REF and is

available in the *Mamre Road upgrade - Kerrs Road to M4 Motorway options report* (Roads and Maritime Services, 2017), which is accessible at: <https://roads-waterways.transport.nsw.gov.au/documents/projects/sydney-west/mamre-road-upgrade/mamre-road-upgrade-options-report.pdf>.

2.2.4 Alternate alignment suggestions

Submission number(s)

2

Issue description

The respondent raised the following suggestions and comments relating to the current alignment of the proposal:

- suggestion that the alignment of the proposal should be shifted further west to minimise impacts on the residences to the east of the proposal
- comment that the proposal would already require acquisition of land along the western side and so shifting the proposal further west would not result in notable increased impacts
- suggestion to remove all the houses that back onto Mamre Road directly east of the proposal.

Response

The strategic corridor options for the proposal were considered as part of the broader Mamre Road upgrade project, which extended between the M4 Motorway and Kerrs Road. These options were assessed against the development criteria for the proposal (refer to Section 2.4.1 of the REF). The widening of Mamre Road to the west was identified as the preferred option to upgrade Mamre Road as it would maximise the use of the existing 50 metre wide road corridor reservation between the M4 Motorway and Luddenham Road. This would avoid the need to demolish or acquire land from residential properties to the east of Mamre Road and minimise negative amenity impacts compared to the alternative strategic corridor options considered.

While widening the road corridor further to the west would increase distance between the upgraded road corridor and residences to the east of the proposal, this would notably increase the environmental impacts of the proposal. There would be impacts to a greater area (about eight hectares more) of threatened ecological communities than the proposed design and a biobanking area south of Luddenham Road. This would lead to higher offset costs than under the proposal. Widening further to the west would also impact additional waterways, a key fish habitat and Aboriginal cultural heritage items compared to the proposed design.

The removal of houses that back onto Mamre Road would result in substantial private property acquisition and social impacts. This is considered an unacceptable outcome and would likely exceed the funding available for the proposal.

2.2.5 Support for the proposal need

Submission number(s)

7, 33

Issue description

The respondents raised the following comments relating to the need for the proposal:

- The upgrade of Mamre Road is long overdue.
- The proposal is particularly needed given the volume of cars and trucks along Mamre Road has increased.

Response

Transport has noted the support for the upgrade of Mamre Road and the need for the upgrade to occur quickly to support the future increased traffic volumes in the area.

2.3 Proposal design and construction

2.3.1 Noise wall design

Submission number(s)

17, 20, 23, 30, 36

Issue description

The respondents raised the following queries and suggestions relating to the noise wall design:

- requests for the top section of the noise wall to be see-through to minimise shading and visual impacts
- queries regarding the height of the noise wall
- query regarding how close the noise wall would be to property fences
- comment that there is lack of information on the final design of the noise wall.

Response

Noise walls have been proposed along the eastern side of Mamre Road near the residential area of St Clair to minimise potential road traffic noise impacts during operation of the proposal. The design has proposed the installation of noise walls that would be about 4.5 metres high, with transparent panels as suggested in the submissions for the top 1.5 metres. This indicative height is considered to provide a reasonable compromise between noise reduction and potential visual impacts. Further details on the indicative design of the noise walls have been provided in Section 4.1 of the *Urban Design and Landscape Character and Visual Impact Assessment* (Scape, 2021), attached as Appendix K to the REF.

The noise wall alignment is currently being revised in consultation with Penrith City Council due to potential property impacts (refer to Section 3.2.7). The noise walls would not be on the fence line of the adjoining properties due to the requirement for maintenance access. The noise wall alignment also requires coordination with existing utilities including a sewer main. Transport would continue to consult with utility authorities, particularly Sydney Water.

The final design of the noise walls, including height and location, would be confirmed during detailed design.

2.3.2 Timing of noise wall construction

Submission number(s)

29, 30, 35, 36

Issue description

The respondents raised the following queries and suggestions relating to the timing of the noise wall construction:

- queries regarding whether the noise wall would be built at the start of construction
- comments that building the noise walls at the start of construction may help reduce construction noise impacts.

Response

Transport acknowledges that there may be benefits if the proposed noise walls are built in the early phases of construction to reduce construction noise as well as from road traffic during operation of the proposal. However, early investigations into the construction methodology of the proposal have found that building the noise wall during early work may not be feasible as it may prevent other necessary construction activities from being carried out. The noise wall design and the timing of its construction will be reviewed and confirmed during detailed design as per mitigation measure NV9, with an aim to build the noise walls as early as possible during construction (refer to Section 6.2).

Regardless of this, temporary noise barriers (such as hoarding or other shielding structures) would be considered for use during construction, as required, to minimise noise impacts as per mitigation measure NV6 (refer to Section 6.2). Other mitigation measures would be implemented to reduce construction noise, including:

- a Construction Noise and Vibration Management Plan as part of the Construction Environmental Management Plan, which would outline procedures for monitoring and management of construction noise levels and respite (refer to mitigation measure NV1 in Section 6.2)
- scheduling of noisy work near sensitive receivers to be during Standard Construction Hours where possible (refer to mitigation measure NV5 in Section 6.2)
- awareness of proximity to sensitive receivers when constructing the noise wall along the eastern side of Mamre Road (refer to mitigation measure GEN3 in Section 6.2).

2.3.3 Suggestion to signalise McIntyre Avenue intersection

Submission number(s)

8, 12, 25

Issue description

The respondents requested traffic lights at the McIntyre Avenue intersection.

Response

As discussed in Section 2.2.2, the intersection at McIntyre Avenue is about 220 metres south of the intersection at Luddenham Road, which is proposed to be signalised. As such, due to the nearness of the intersections, installing traffic lights at the intersection at McIntyre Avenue is not viable as the turning lane layout of the intersections would conflict with each other.

2.3.4 Length of turning and/or exit lanes

Submission number(s)

10, 31

Issue description

The respondents suggested to make the turning lanes and exit lanes as part of the proposal as long as possible to minimise congestion and potential car crashes.

Response

The length of turning and exit lanes will continue to be refined during detailed design in accordance with relevant standards developed by Transport, Austroads and Standards Australia. The length of these lanes will be informed by traffic modelling to minimise congestion and potential road safety risks.

2.3.5 Length of Mamre Road upgrade

Submission number(s)

7, 31

Issue description

The respondents queried why Mamre Road is not proposed to be upgraded along its entire length.

Response

The NSW Government has identified the need to upgrade Mamre Road to provide an improved link between the M4 Motorway in the north and Elizabeth Drive in the south (referred to as the Mamre Road upgrade project). This would be required to support economic and residential growth in the surrounding area.

The 3.8-kilometre-long section of Mamre Road between the M4 Motorway and Erskine Park Road was initially prioritised as the first stage of the Mamre Road upgrade due to funding availability and the immediate priority to address community concern regarding the safety of Mamre Road for the residents within St Clair and Erskine Park (refer to Section 2.1 and Section 2.2 of the REF for further details).

2.3.6 Mandalong Close intersection

Submission number(s)

3, 6

Issue description

The respondents raised concern that it would be difficult to turn right into Mandalong Close due to the proposed left-in, left-out arrangement and queried how they could access this street.

Response

The proposal as described in the REF would change the existing priority-controlled intersections at Mandalong Close to be left-in, left-out only and have 'give-way' signage for motorists turning left out of Mandalong Close onto Mamre Road (refer to Section 3.2.3 of the REF). With this arrangement:

- Motorists exiting Mandalong Close wishing to travel southbound on Mamre Road would be able to turn left onto Mamre Road and travel about two kilometres north to use the proposed U-turn facility at Solander Drive. At this location, they would be able to turn around and turn right back onto Mamre Road to travel south.
- Motorists travelling southbound on Mamre Road wishing to turn into Mandalong Close would be able to turn left into James Erskine Drive about 580 metres south of Mandalong Close and use the existing roundabout to turn around. From James Erskine Drive, they would be able to turn right onto Mamre Road to travel north and turn left into Mandalong Close.

2.3.7 Road design north of Banks Drive intersection

Submission number(s)

11

Issue description

The respondent raised concern that the proposed design north of Banks Drive would still result in congestion due to the need for vehicles to merge and suggested that this design should be reconsidered.

Response

Since the display of the REF, the road design north of Banks Drive has been revised to improve the traffic performance of this section. As a result, the number of through lanes proposed on Mamre Road at this intersection has been increased from two to three in each direction (refer to Sections 4.5 and 5.4 for further details). This change would allow for free flow traffic on the through lanes without the need for lane merges between the Banks Drive and M4 Motorway intersections along Mamre Road.

2.3.8 Property acquisition

Submission number(s)

36

Issue description

The respondent queried whether any properties along Mamre Road are being acquired.

Response

Transport would need to acquire, lease and/or otherwise negotiate access to land prior to and during construction of the proposal. For the design proposed in the REF, this included about 11.10 hectares of land to be permanently acquired and 29.25 hectares of land to be leased. The proposal would not require the demolition of any residences and would only require minor partial acquisition of private properties. Refer to Section 3.6 of the REF for further details on these properties.

However, the property acquisition requirements for the proposal will be revised during detailed design in response to the design changes outlined in Chapter 4 and ongoing negotiations with Penrith City Council regarding the community land (refer to Section 3.2.7). This would reduce the area of land proposed to be acquired or leased compared to that outlined in the REF and would not impact any new properties.

All land acquisition would be carried out in consultation with the relevant landholders in accordance with the requirements of the *Land Acquisition (Just Terms Compensation) Act 1991* and the supporting NSW Government Land Acquisition Reform 2016. Transport would also need to abide by the requirements of the *Crown Lands Management Act 2016* and *Crown Land Legislation Amendment Act 2017* when seeking to acquire or lease Crown Land and the *Local Government Act 1993* when seeking to acquire or lease Council-owned land for construction of the proposal.

2.3.9 Other design suggestions

Submission number(s)

15, 28, 31

Issue description

The respondents raised the following comments and suggestions relating to the design of the proposal:

- suggestion to consider the root system of trees planted along Mamre Road and their potential impact on adjoining property
- comment that access to back fences of adjoining houses needs to be maintained for property maintenance, deliveries and safety
- suggestion to provide bike lanes that are separated from the road to increase safety and for any shared path lanes to be wide enough to avoid cyclists injuring pedestrians
- suggestion for signage to allow people to turn left at any time at key intersections
- suggestion to provide filtered right hand turns at signalised intersections.

Response

The design suggestions raised by the community will be considered during detailed design, where feasible and reasonable. With regard to the specific issues raised, Transport notes that:

- Design solutions to manage tree roots from new trees planted along Mamre Road (such as strata cell vaulting systems) and minimise impacts on adjoining property would be confirmed during detailed design (as per additional mitigation measure SE10 in Section 6.2). Tree root channelling is unlikely to be needed next to private property and is expected to only be used to provide additional topsoil access to street trees under the footpath.
- The noise wall design and alignment will continue to be refined during detailed design in consideration of property maintenance, access and safety requirements (as suggested by the respondents) as well as the property issues raised by Penrith City Council (refer to Section 3.2.7).
- The shared path along the eastern side of Mamre Road would separate cyclists from road traffic and improve safety compared to the existing situation. Since public display of the REF, the proposed width of the shared path on the eastern side of Mamre Road has increased from 3.0 metres (as per the REF) to 3.5 metres in the revised design (refer to Section 4.1). This would be confirmed during detailed design and improve safety for pedestrians and cyclists using the shared path.
- 'Left turn at any time' signage has been considered but is not proposed at the signalised intersections due to the potential risk of increased danger to pedestrians using pedestrian crossings.
- A filtered right turn has been considered but is not proposed at the traffic signals as the line of sight of oncoming vehicles may be obstructed by vehicles waiting in the opposing right turn bay.

2.4 Noise and vibration

2.4.1 Existing environment

Submission number(s)

24, 29

Issue description

The respondents raised the following comments relating to the existing noise near the proposal:

- comment that the worst sources of noise from the road are due to compression braking, motorbikes accelerating and truck air horns at the end of the merge lane
- query regarding the noise monitoring results for L07 (25-31 Mandalong Close, Orchard Hills), in particular:
 - the lack of traffic noise noted (just dogs barking and aircraft) given the distance to the childcare driveway
 - whether the timing of the noise monitoring (mid-morning) may have missed most of the morning traffic along Mandalong Close
- query whether noise monitoring has been carried out at the childcare on Mandalong Close.

Response

Transport acknowledges that existing noise sources experienced near the proposal include compression braking, motorbikes accelerating and truck air horns at the end of merge lanes.

Long-term unattended noise monitoring was carried out next to the driveway of the childcare on Mandalong Close (noise monitoring location L07 at 25-31 Mandalong Close, Orchard Hills) between 14 and 28 October

2020. The purpose of unattended noise monitoring is to determine the representative background noise levels (RBLs). The RBLs were used to develop the noise level criteria for each noise catchment area (NCA).

The unattended noise monitoring continuously measured existing noise levels in 15-minute periods during the daytime, evening and night-time between these dates. As a result, this noise monitoring would have captured noise associated with 24 hour traffic along Mandalong Close during this period, including morning traffic associated with operation of the childcare.

In addition, short-term attended noise monitoring was carried out during the late morning at L07 on 14 October 2020. The purpose of these additional measurements is to allow the contributions of the various noise sources to the background noise levels at each location to be determined. The attended monitoring at L07 determined that:

- ambient noise environments are influenced by road traffic on Mamre Road, with light-vehicle traffic and heavy vehicle traffic contributing about 40-45dB(A) and 44-50dB(A) respectively towards the maximum noise levels
- there were other noise sources which were recorded with a higher maximum noise level, including:
 - dogs at residences (78dB(A))
 - birds (up to 49dB(A))
 - light aircraft (50dB(A)).

Overall, the attended noise monitoring results were found to be consistent with the results of the unattended noise monitoring and show that existing background noise levels are typically dominated by road traffic noise from the surrounding road network, with some other noise sources such as dogs barking and aircraft. Refer to Appendix J of the REF for further details.

2.4.2 Construction impacts

Submission number(s)

24, 30, 32

Issue description

The respondents raised the following issues relating to construction noise impacts from the proposal:

- concerns regarding the construction noise impacts associated with use of compound site 3, including potential sleep disturbance
- concern about construction noise during rest periods at the childcare
- concern about general construction noise impacts during construction.

Response

A construction noise assessment has been carried out for the proposal in accordance with relevant guidelines. This assessment considered construction noise from all construction activities, including at the three proposed compound sites. The results of the assessment are detailed in Section 6.7 and Appendix J of the REF. The assessment identified that noise generated from construction activities and construction traffic has the potential to impact sensitive receivers surrounding the proposal. During standard construction hours, the highest noise levels and impacts would be experienced by residential receivers in NCA03, NCA04, NCA05 and NCA06. During out of hours work periods, noise impacts would be 'Highly Intrusive' at residential receivers to the east and west of Mamre Road in NCA01 – NCA06 and NCA08. There may also be minor construction traffic noise impacts, including due to the establishment of temporary traffic detours.

At the Old MacDonald's Childcare Centre, there would be exceedances recorded during six construction scenarios, which includes consideration of rest periods (refer to Table 6-54 in Section 6.7.4 of the REF). Construction noise impacts that may be experienced by the childcare during construction and operation of the proposal have been assessed using specific criteria required for childcare centres (refer to Section 6.7.3 of the REF), which accounts for their sensitivity to construction noise due to activities such as rest periods. Transport will review the continued need for compound site 3 during detailed design and minimise its use, where possible, which would also reduce the risk of construction noise impacts on sensitive receivers near Mandalong Close.

Sleep disturbance impacts are predicted when night work occurs near residential receivers. Refer to Appendix J (Section 5.3) of the REF for details on the greatest predicted night-time construction noise impacts.

However, the assessment is generally considered conservative as the noise level calculations assume several items of construction equipment are in use at the same time within individual scenarios. It also represents the worst-case situation where construction equipment is 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 typically only occurs for a relatively short period when noisy equipment is in use nearby.

As outlined in Section 6.7.5 of the REF, a construction noise and vibration management plan would be prepared in accordance with the *Interim Construction Noise Guideline* (DECC, 2009) to manage potential construction noise impacts. This plan would outline the specific mitigation measures, consultation procedures and other contingency measures to be implemented during construction to minimise noise impacts. Monitoring would also be carried out at the start of noise intensive activities to confirm that actual levels are consistent with the predictions and that appropriate mitigation measures from the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016) have been implemented. This would make sure that noise levels are considered when noise intensive activities are occurring nearby, including during rest periods at the childcare.

Submission number(s)

20, 29, 36

Issue description

The respondents raised the following issues relating to construction vibration impacts from the proposal:

- concerns that construction vibration could cause subsidence and damage to nearby properties such as granny flats, older houses and pools built near fence line next to Mamre Road
- concern that the ground underneath nearby houses is quite unstable due to historical backfilling and dehydration of soil.

Response

The construction vibration assessment carried out for the proposal was conservative. It identified the worst-case source of vibration during construction as vibratory rollers required during the '*W.04 – Road, pathway and intersection upgrades – peak*' scenario. Without mitigation, properties within 20 metres from the proposal area may experience cosmetic building damage and properties within 100 metres from the proposal area may experience amenity-related vibration impacts during construction of the proposal. When vibration intensive work is occurring, this would impact properties in NCA01 – NCA06 and NCA08 – NCA09 (refer to Section 6.7.4 in the REF).

The potential for vibration impacts and requirement for vibration intensive work and equipment will be reviewed during detailed design.

Several mitigation measures have been proposed to be implemented during detailed design and construction to minimise the risk of any vibration related damage from construction of the proposal (refer to Section 2.4.4 and mitigation measures NV1 – NV4, NV7, NV8 and NV11 in Section 6.2). In particular, an additional mitigation measure NV11 has been added in response to community concern to further consider the risk of unstable soils in area during detailed design to minimise ground vibration related damage. Additional geotechnical investigations are also proposed to be carried out during detailed design to confirm the ground condition within and near the proposal area.

2.4.3 Operational impacts

Submission number(s)

2, 30

Issue description

The respondents raised the following issues relating to operational noise impacts from the proposal:

- concern the proposal would increase traffic noise to the point that nearby residences may not be able to hear computers or TVs in their houses if they have back doors or windows open (noting it is only just possible with the current level of traffic noise)
- concern regarding the future traffic noise levels when Mamre Road is upgrade to three lanes in each direction.

Response

The operational noise assessment carried out for the proposal considered residential and non-residential receivers that may be affected by noise and vibration generated by the proposal (refer to Appendix J to the REF).

As noted in the submission, the assessment found that the nearest residential receivers to the proposal, particularly receivers to the east of Mamre Road in NCA01, NCA03, NCA05 and NCA06, are subject to relatively high existing road traffic noise levels, which already exceed the relevant noise criteria in many cases. Both with and without the proposal, most front-row residential receivers to the east are predicted to be subject to acute noise levels (i.e. daytime noise levels of 65 dBA or higher, or night-time noise levels of 60 dBA or higher).

It is anticipated that there would be increases in traffic noise of up to 2.0 dB for some residential receivers, compared to existing traffic noise levels. This is partially due to the widening of the road, which would decrease the distance between the road corridor and the sensitive receivers on the western side of Mamre Road, as well as an assumption that more vehicles may use Mamre Road during operation. However, overall, the assessment concluded that operation of the proposal is not predicted to substantially alter road traffic noise levels. In addition, the noise levels experienced at residential receivers to the east of Mamre Road are likely to be lower than predicted, where private boundary fences exist that are in good condition.

The assessment shows a total of 174 sensitive receiver buildings (209 receiver floors) predicted to have exceedances of the *Noise Criteria Guideline* (NCG) (Roads and Maritime Services, 2015) operational road traffic noise criteria, when assuming no 'additional noise mitigation', such as noise walls.

If the indicative noise walls were constructed as assessed in the REF, it is anticipated that 160 sensitive receiver floor exceedances would remain, subject to further investigation during detailed design. These properties would be identified and considered for additional noise mitigation such as at-property treatment where possible. Inspection and assessment of individual properties where at-property treatment is considered suitable, would also be required to determine feasible and reasonable measures. Properties that are identified as being eligible for at-property treatment would be offered treatment in line with

Transport's *At-Receiver Noise Treatment Guideline* (Roads and Maritime, 2017). Refer to Section 6.7.5 of the REF for further details.

These predicted exceedances are based off the design displayed as part of the REF. Further assessment of operational noise impacts would be carried out during detailed design to consider any further design changes. This would include refinement of the noise wall design and revision of other 'additional noise mitigation' measures required for impacted receivers. The mitigation strategy for each residential property would be confirmed during detailed design and in consultation with individual property owners.

A future upgrade of Mamre Road to three lanes in each direction would not bring traffic closer to houses as the third lane would be within the central median strip. This is intended to ease congestion and improve traffic flow along Mamre Road, rather than generate any additional traffic, so any increase in traffic noise is expected to be minor. Any potential traffic noise changes and the need for additional mitigation would be confirmed prior to a further upgrade of Mamre Road in the future, separately to this proposal.

2.4.4 Mitigation measures

Submission number(s)

5, 14, 16, 19, 29, 34, 35

Issue description

The respondents raised the following queries and suggestions relating to noise mitigation measures:

- queries regarding the extent of the proposed noise wall and why certain properties may not be directly covered by the proposed noise wall alignment
- requests for double glazing and insulation to be considered in addition to noise walls for further noise reduction and that residences should be reimbursed for this installation
- suggestion for trees to be planted along the eastern side of Mamre Road to minimise noise
- suggestion for signage to be considered near Erskine Park Road intersection to discourage compression braking, which is an existing traffic noise issue in the area.

Response

An operational noise mitigation assessment was conducted as part of the REF to determine possible mitigation measures to control the predicted noise impacts during operation of the proposal.

As discussed in Section 6.7.5 of the REF, the preferred order of mitigation strategies in line with the *Noise Mitigation Guideline* (NMG) (Roads and Maritime, 2015a) is as follows:

1. road design and traffic management, which includes consideration of:
 - shielding the road with the natural landscape (including positioning the road within a cutting)
 - minimising the need for compression release engine braking (such as by reducing the number of signalised intersections and signage (refer to the following sections of this response for further details about signage for compression braking)).
2. quieter road pavement surfaces, which includes consideration of:
 - dense graded asphalt (which reduces noise by approximately 3 dB compared to spray seal)
 - low noise stone mastic asphalt or open graded asphalt (which reduces overall noise emissions by 5 dB compared to concrete)
3. noise barriers, which includes consideration of noise walls or mounds
4. at-property treatment, which includes consideration of architectural upgrades such as sealing windows, mechanical ventilation or localised screening.

Vegetation is not identified as an effective noise mitigation measure in the NMG and therefore has not been considered as a potential noise mitigation strategy for the proposal.

The design has proposed the installation of noise walls along the eastern side of Mamre Road near the residential area of St Clair. The proposed noise wall alignment does not cover every property near the proposal as there are some locations where its installation is not considered reasonable and feasible or cost-effective due to:

- lack of closely spaced receivers
- locations where noise wall sections cannot achieve the level of noise mitigation required at the desired height
- engineering or environmental constraints.

Refer to Section 7.2.2 of Appendix J to the REF for further details on the assessment of noise wall sections and expected benefits of the proposed noise walls. The noise wall design and alignment would be refined during detailed design.

If the indicative noise walls were constructed as assessed in the REF, it is anticipated that 160 sensitive receiver floor exceedances would remain, subject to further investigation during detailed design. These properties would be identified and considered for additional noise mitigation such as at-property treatment where possible. Inspection and assessment of individual properties where at-property treatment is considered suitable, would also be required to determine feasible and reasonable measures. Properties that are identified as being eligible for at-property treatment would be offered treatment in line with Transport's *At-Receiver Noise Treatment Guideline* (Roads and Maritime, 2017). In accordance with this guideline, financial compensation would not be offered in lieu of Transport carrying out at-property treatments.

Quieter road pavement surfaces are not expected to remove any baseline exceedances of the operational noise criteria and so are not considered a suitable noise mitigation strategy for this proposal (refer to Section 6.7.5 of the REF).

Transport is aware of the distress noisy heavy vehicle compression brakes can cause when heard near residential areas. These issues are typically addressed through inspections, a Compression Brake Sign Education Strategy and by installing signs. Transport has found that installing additional compression brake signs following a resident complaint does not reduce the incidence of compression braking in the long term. Installing multiple signs along every section of arterial road where compression braking is an issue could also detract from other road safety sign messages and increase visual impacts. Therefore, no signage for compression braking is proposed to be installed as part of the proposal.

The final operational noise mitigation strategy for the proposal would be determined during detailed design and would likely use a combination of approaches. The final approach would consider community preference where appropriate. Inspection and assessment of individual receivers would also be required to determine feasible and reasonable measures where at-property treatment is considered suitable.

Submission number(s)

20, 24, 36

Issue description

The respondents queried how vibration impacts would be managed during construction of the proposal to prevent damage to properties and discomfort.

Response

A construction noise and vibration management plan would be prepared and implemented as part of the CEMP and include measures to manage potential construction vibration impacts. This plan would outline a vibration monitoring program, consultation procedures and other contingency measures to be implemented during construction to minimise vibration impacts. Transport would notify all sensitive receivers likely to be affected by noise or vibration at least seven days prior to commencement of the relevant construction work activities.

Other mitigation measures to be implemented to minimise vibration impacts during construction include:

- investigation of different construction methods with lower source vibration levels where work is within the minimum working distances and considered likely to exceed the cosmetic damage criteria
- carrying out attended vibration measurements and ceasing work if the measurements are likely to, or do, exceed construction vibration criteria
- carrying out building condition surveys before and after work where buildings or structures are within the minimum working distances and considered likely to exceed the cosmetic damage criteria during the use of vibration intensive equipment
- further consideration of the risk of there being unstable soils in areas which would experience vibration impacts during detailed design.

For further details on construction vibration mitigation measures, refer to Section 6.2.

2.5 Traffic and transport

2.5.1 Existing environment

Submission number(s)

9, 25

Issue description

The respondents raised the following issues relating to the description of existing traffic patterns:

- comment that they believe most of the traffic along Mamre Road is from Erskine Park Road to Elizabeth Drive rather than the section between the M4 Intersection to Erskine Park Road
- comment that McIntyre Avenue is usually congested during school times, which may not have been observed during preparation of the REF due to the COVID-19 restrictions.

Response

The NSW Government has identified the need to upgrade Mamre Road to provide an improved link between the M4 Motorway in the north and Elizabeth Drive in the south (referred to as the Mamre Road upgrade project). This would be required to support economic and residential growth in the surrounding area.

Following the exhibition of the strategic design for the Mamre Road upgrade project in 2017, community concern about the safety of Mamre Road for residents within St Clair and Erskine Park has led to the prioritising of the 3.8 kilometre long section of Mamre Road between the M4 Motorway and Erskine Park Road for upgrade.

Between July 2009 and June 2019 there were a total of 219 crashes on Mamre Road between the M4 Motorway and Kerrs Road, Kemps Creek, with at least one fatal crash (Transport 2017, 2018). Although

accounting for only 38 per cent of this total road distance, 60 per cent or 129 of these total crashes occurred within the section between the M4 Motorway and Erskine Park Road.

Without intervention, the forecasted increase in traffic volumes and congestion would see the deterioration of safety along Mamre Road within the proposal area for all road users in the future. As such, this proposal is being delivered first due to funding availability and the immediate priority to improve road safety. Refer to Section 2.1 and Section 2.2 of the REF for further details.

The section of Mamre Road between Erskine Park Road and Kerrs Road may be upgraded in the future separately to this proposal.

The traffic and transport assessment carried out for the proposal did not identify high levels of existing congestion on McIntyre Avenue (refer to Appendix G to the REF), however it is noted that traffic volumes may increase during school times. Mid-block traffic volume surveys were carried out on Mamre Road continuously between Tuesday 3 March 2020 and Monday 9 March 2020 (inclusive), which included monitoring during school times. The modelling carried out also did not show any noticeable delay for the left in and left out access in the 2026 and 2036 with proposal scenarios for the McIntyre Avenue intersection. The time periods of 6.30am – 9am and 3.30pm – 6pm were selected for the future traffic modelling, which includes times when there would be school traffic on the road.

The traffic data collected for the proposal in early March 2020 was before the widespread restrictions to combat the COVID-19 virus pandemic were introduced in Australia in mid-March 2020. As a result, the data collected by the proposal is unlikely to be notably affected by the COVID-19 restrictions and is considered representative of relatively normal traffic conditions.

2.5.2 Construction impacts

Submission number(s)

30, 32

Issue description

The respondents raised concerns regarding the safety and suitability of the proposed access to compound site 3 via Mandalong Close, including for nearby residents and users of the childcare centre, and the need for local residents to compete with increased construction traffic to enter/exit their properties.

Response

The gate for compound site 3 would be accessed from Mandalong Close, about 100 metres from the intersection with Mamre Road. It is acknowledged that construction vehicles using site access gates may pose a risk to pedestrians and local traffic if inappropriately managed.

The gate location to compound site 3 would be refined by the construction contractor in consideration of appropriate acceleration and deceleration lanes for vehicular access as well as safe arrangements for pedestrians and/or cyclists near gates. Typically, construction vehicles would need to enter and exit these gates under live traffic control to minimise impacts on the local road network and the local community. These interruptions to traffic on Mandalong Close are expected to be short in duration and minor.

Potential impacts from site access would be managed through a construction traffic management plan (CTMP). This would include requirements for appropriate signage to businesses, local roads and residences to maintain access and minimise confusion for motorists.

Transport will review the continued need for compound site 3 during detailed design and minimise its use, where possible. Traffic and transport modelling has identified that there may be safety risks posed by heavy

vehicles using Mandalong Close to access compound site 3. Should this compound site be used, further assessment would be carried out to determine the most appropriate access to the compound site.

2.5.3 Operational impacts

Submission number(s)

3, 6, 8, 12, 13, 21, 24, 30, 32, 33

Issue description

The respondents raised the following concerns regarding traffic impacts associated with the change to Mandalong Close and McIntyre Avenue to left-in, left-out:

- reduce accessibility and substantially increase travel times by making people drive longer and less direct routes
- increase congestion along the alternative access routes, particularly along Feather Street, Banks Drive, Solander Drive U-turn facility, James Erskine Drive roundabout and other local streets in St Clair
- concern that residents in Mandalong Close would be affected more than residents in McIntyre Avenue, as Mamre Road is the only access road to Mandalong Close.

Response

The proposal as described in the REF would change the existing priority-controlled intersections at Mandalong Close and McIntyre Avenue to be left-in, left-out only. The U-turn facility proposed at the Solander Drive intersection would also allow northbound traffic to change direction on Mamre Road more easily to turn directly left into McIntyre Avenue.

It is acknowledged that due to the banned right turn movements, vehicles entering or exiting McIntyre Avenue and Mandalong Close would have to travel longer distances compared to the existing arrangements. However, as the overall traffic performance along Mamre Road is expected to improve due to operation of the proposal (including faster travel speeds in both directions along Mamre Road), this longer travel distance would not necessarily result in a notable increase in overall travel time compared to the future scenario without the proposal.

The traffic modelling carried out for the proposal, including for the Banks Drive, Solander Drive and James Erskine Drive intersections, considered the change in access arrangements proposed at McIntyre Avenue and Mandalong Close. The proposal as outlined in the REF, would improve the intersection performance of all these intersections compared to the future scenario without the proposal (refer to Section 6.4.4 in the REF for further detail).

The potential traffic impacts on Feather Street have not been directly modelled for the proposal. However, travelling on Mamre Road is expected to be quicker during operation of the proposal than using the local roads for certain routes. As such, a large percentage of vehicles are still expected to use Mamre Road to access McIntyre Avenue rather than the local road network (including Feather Street), however road users would make their own decision depending on which outcome was better for them.

Submission number(s)

2, 24

Issue description

The respondents raised the following issues relating to road safety during operation of the proposal:

- concern the reduced distance between traffic on Mamre Road and residential properties may increase safety risks associated with cars accidentally driving through backyard fences, and that the existing fences and proposed noise wall may not be strong enough to minimise this risk
- concern regarding the reduced access and increased travel times for emergency services to respond to potential emergencies at the childcare centre on Mandalong Close.

Response

The proposal aims to improve road safety along Mamre Road in line with the *NSW Road Safety Strategy 2012-2021* 'Safe System Directions and Safer Roads Key Focus' for all road users. The proposal has been designed to NSW and Australian engineering, road safety, environmental and transport planning standards developed by Transport, Austroads and Standards Australia. These standards describe the criteria that should be adopted for specific road classifications and conditions. The criteria have been developed to ensure all roads are designed to be safe, effective, well-planned and easily maintained.

Safety barriers have been proposed at some locations along Mamre Road, where identified to be required in accordance with the relevant road design standards, to minimise safety risks including cars driving off the road.

Designated 'Emergency Vehicle Only' access points would be considered at some locations within the central median to allow for U-turn movements and minimise impacts on emergency vehicle access associated with the proposed median along Mamre Road. This would minimise travel time impacts for emergency vehicles responding to any emergencies.

2.5.4 Mitigation measures

Submission number(s)

8, 33

Issue description

The respondents raised the following comments relating management of potential traffic impacts during operation of the proposal:

- query regarding how potential traffic impacts on Feather Street would be managed
- suggestion to install strategic speed humps along Feather Street.

Response

Feather Street is a local road managed by Penrith City Council. The local traffic patterns within St Clair may change upon opening of the M4 Roper Road westbound on-ramp project as well as the operation of the proposal, therefore the potential traffic impacts on this street and the need for this to be managed is unknown. If a notable increase in traffic is identified on Feather Street during operation of the proposal, a broad range of treatments (including strategic speed humps) to manage local traffic may be considered. Any proposed change to Feather Street would need to be confirmed and implemented by Penrith City Council separately to this proposal.

2.6 Landscape character and visual

2.6.1 Construction impacts

Submission number(s)

32

Issue description

The respondent raised concern regarding lighting impacts due to use of compound site 3 on nearby residences.

Response

The concern is noted. An additional mitigation measure 'LV5' has been proposed, so that "lighting of construction areas (if required) would be orientated to minimise glare and light spill impacts on nearby residences" (refer to Section 6.2).

2.6.2 Operational impacts

Submission number(s)

2, 19, 20, 23, 29, 30, 33

Issue description

The respondents raised the following issues relating to impacts on landscape character and visual amenity during operation of the proposal:

- concerns regarding visual impacts associated with removal of existing trees along Mamre Road
- concerns that the noise wall would block afternoon sunlight to nearby backyards and existing views of rural landscapes and sunsets
- concerns that the proposed noise walls would be an eye sore
- concerns that the proposal would detract from the existing rural residential feel of the landscape, including due to the lighting proposed and increased presence of road infrastructure.

Response

The objectives and development criteria for the proposal consider the need to improve the urban design of the road corridor and minimise amenity impacts on surrounding properties, including visual impacts (refer to Section 2.3 of the REF).

In accordance with this, several urban design decisions have been made in preparation of the proposal design to improve the amenity of the road corridor. This includes proposing substantial planting and minimisation of vegetation removal, considering opportunities for street art and incorporating transparent panels at the top of the proposed noise wall. This approach has been developed in consideration of the existing landscape character surrounding Mamre Road, including the rural residential landscape. Refer to Section 3.2.3 of the REF and Appendix K to the REF for further details on the urban design and landscape concept for the proposal.

A shading assessment of the summer and winter solstices is presented in Figure 4-6 and Figure 4-7 of Appendix K to the REF. It is expected that any direct shadowing impacts to the backyards of the nearest

houses to the east of the proposal would occur late in the afternoon. However, the noise wall has been designed to include transparent panels for the top 1.5 metres to reduce the bulky appearance of the structure and to provide sunlight to nearby backyards. The design and location of the noise wall would be confirmed during detailed design. During detailed design, an additional shading assessment would be carried out, including modelling of the final noise wall design and impact of noise walls against a typical house at 9am and 3pm. This updated shading assessment would identify properties which would experience shading due to the noise wall and allow consideration of mitigation measures, where possible.

The proposed street lighting along Mamre Road has been designed to minimise impacts on surrounding residential receivers. It would reduce contrast between shadows and illuminated areas to minimise glare and would be installed in accordance with the Penrith City Council Public Domain Manual. The final location and design of street lighting would be confirmed during detailed design. Refer to Section 4.1 of Appendix K to the REF for further details on the street lighting proposed.

2.7 Hydrology and flooding

2.7.1 Assessment methodology

Submission number(s)

24

Issue description

The respondent raised concern relating to the timing of the flood modelling during detailed design to confirm operational impacts of the proposal being too late in the design process.

Response

Flood modelling was carried out for the proposal using DRAINS and TUFLOW hydraulic models during the concept design stage of the proposal (refer to Appendix H to the REF). This flood modelling informed the assessment of operational flooding and hydrology impacts that was summarised in Section 6.5.3 of the REF. The flood modelling has been run for a range of scenarios including:

- five, two and one per cent Annual Exceedance Probability (AEP) South Creek main stream flood events
- 0.5 and 0.2 Exceedances per Year (EY) local catchment flood events with coincident low South Creek tailwater
- ten, five and two per cent AEP local catchment flood events with coincident low South Creek tailwater
- one per cent AEP local catchment flood event with five per cent AEP coincident South Creek tailwater event
- probable Maximum Flood (PMF) local catchment flood event with one per cent AEP coincident South Creek tailwater event.

The proposal has generally been designed so that at least one traffic lane along Mamre Road in either direction would be trafficable in a one per cent AEP storm event (refer to Section 6.5.3 of the REF).

Since public display of the REF, additional flood modelling has been carried out for the proposed changes to the proposal. This additional flood modelling showed that the impacts of the revised proposal (including changes to the road drainage along the western side of Mamre Road) on flood risk during operation would be relatively consistent with the impacts as outlined in the REF (refer to Section 5.5). The design of the proposal is subject to further refinement during detailed design. This would include refinement of the design and alignment of the proposed noise wall in consideration of the PMF. As such, further flood modelling would be carried out during detailed design to provide revised flood modelling on the final design. This

modelling would inform the design process, which would aim to not worsen any flood impacts compared to those assessed in Section 6.5.3 of the REF.

2.7.2 Existing environment

Submission number(s)

24

Issue description

The respondent raised the following comments relating to the existing flood risk near Mamre Road:

- stormwater has been previously observed to flood the childcare access driveway and nearby residences on Mandalong Close including:
 - during the most recent flooding that occurred March 2021, which wasn't mentioned in the assessment and resulted in the driveway of properties on Mandalong Close becoming submerged for three to four days and closure of the childcare due to safety concerns
 - several years ago, emergency services had to get children and employees out from the childcare due to the driveway access point being flooded
- the assessment did not mention Mandalong Close as a following connecting road, however 150-200 metres west from the connection to Mamre Road it floods due to backup.

Response

The hydrology and hydraulic assessment carried out for the proposal identified existing flood prone land within and near the proposal area based on flood modelling as well as observations made by Penrith City Council during the February 2020 South Creek flood event. Flood modelling results for the existing scenario without the proposal in various flood events are mapped in Appendix A to Appendix H to the REF.

The assessment identified that Mandalong Close currently experiences flooding in a five per cent AEP South Creek flood event. During a local catchment flood event, Mandalong Close has a flood immunity of less than 0.5 exceedances per year (EY). During this event, the road experiences overtopping where the road dips to the west of the proposal area.

The observations made by the respondent during the March 2021 flood event of South Creek are considered consistent with the findings of this assessment. The risk of flooding impacting on access to the childcare along Mandalong Close is also noted and will continue to be considered during refinement of the design. Potential impacts on the risk of flooding at Mandalong Close during operation of the proposal are discussed in Section 2.7.4.

2.7.3 Construction impacts

Submission number(s)

36

Issue description

The respondent queried whether construction of the proposal would increase the likelihood of their property flooding.

Response

Construction activities that could affect existing flood behaviour and hydrology within the proposal area include earthworks, drainage work (such as construction of temporary waterway crossings and headwalls for drainage pipe outlets and removal of redundant culverts) and use of construction compound sites.

Temporary construction impacts would be managed by implementing standard construction techniques and effective protection measures to minimise the impact of these activities on flood risk for nearby properties. As per mitigation measure HF7, the CEMP would include a Construction Flood Management Plan, which would include details and procedures to minimise the potential for construction activities to adversely impact on flood behaviour. This would include provision of temporary flood protection to properties identified as being at risk of adverse flood impacts during any stage of construction of the proposal, where feasible and reasonable. Construction equipment and materials would also be removed from floodplain areas should a weather warning be issued of impending flood producing rain.

Other mitigation measures designed to minimise the impact of construction on flood risk include:

- a flood evacuation plan to manage a potential flood event during construction (mitigation measure HF8)
- storage of hazardous materials outside of the one per cent AEP extent or removal of these materials during flood events (mitigation measure HF9).

For further details on the mitigation measures to manage flooding risks during construction, refer to Section 6.2.

2.7.4 Operational impacts

Submission number(s)

24, 29, 30, 36

Issue description

The respondents raised the following queries and concerns relating to flooding impacts due to operation of the proposal:

- query whether the raised road sections would result in more flooding of adjacent private properties that are lower than the road
- concern that increased pavement areas would increase water runoff to nearby properties
- concern the proposal would increase flooding frequency, volumes and speed near Mandalong Close, which would post safety risks for nearby residents and users of the childcare
- query why flood impacts to Mandalong Close have not been specifically mentioned, and whether this is because their properties are zoned rural residential rather than just residential.

Response

The proposal has been designed so that Mamre Road would achieve one per cent AEP flood immunity without causing flood impacts to private properties above floor level. For the South Creek main stream flood event, the proposal as described in the REF would lead to a worsening of flood levels (with a flood level increase greater than 20 millimetres) during the one per cent AEP scenario at:

- a large area of agricultural land west of Mamre Road
- 43 McIntyre Avenue, St Clair
- 44 McIntyre Avenue, St Clair.

These properties would experience upstream impacts due to the proposed raising of Luddenham Road. The hydrology and flooding impacts of the final design would also be confirmed during detailed design,

which would be informed by an allotment and floor level survey of 43 and 44 McIntyre Avenue, St Clair to confirm flood inundation risk for these properties as per mitigation measure HF2. During lower flood events, there would be reduced flood impacts at 43 and 44 McIntyre Avenue, St Clair compared to the one per cent AEP scenario.

During a local catchment flood event, there would be no worsening of flood impacts to private properties. A number of properties upstream of Mamre Road would either experience flood level reductions or no change in flood levels during a one per cent AEP flood event. Refer to Section 7.1 of Appendix H to the REF for further details.

The widening of Mamre Road would result in minor changes to surface water flow patterns and runoff due to the increased impervious area from the new road pavement and altered topography from the earthworks. However, impacts associated with these hydrological changes would be negligible as the proposal includes provision of new and modified drainage infrastructure. This includes new longitudinal drains, transverse drains, channel work and water quality management and stormwater treatment measures (refer to Section 3.2.3 of the REF). These drainage measures have been designed to maintain existing flow patterns and minimise adverse impacts on hydrology, where possible.

The hydrology and hydraulics assessment (Appendix H to the REF) has considered the potential impacts of the proposal on all parts of the South Creek and local catchments, including Mandalong Close, one of the connecting roads to Mamre Road. As noted in Section 6.3.3 of Appendix H to the REF, flooding of Mandalong Close is an existing situation which would not be exacerbated by the proposal and there would be no worsening of flood immunity of property accesses. Mapping of existing and predicted future flood impacts along Mandalong Close are provided in Appendix A to Appendix H to the REF.

However, design refinements may influence the potential impacts of the proposal on hydrology and flooding identified in Section 6.5.3 of the REF. Additional flood modelling has been carried out for the proposed changes to the proposal since public display of the REF, which showed that the impacts of the revised proposal on flood risk during operation would be relatively consistent with the impacts as outlined in the REF (refer to Section 5.5).

Flood impacts within the South Creek and local catchments would continue to be reviewed during detailed design to consider the impact of design changes to flood risk. This would involve carrying out detailed flood modelling on the final drainage design (including preparation of additional flood maps) during detailed design. This would confirm the potential flooding impacts that are expected to occur due to operation of the proposal. Following this, Transport would consult with any identified affected landowners regarding the potential flooding impacts on private properties to identify if any additional mitigation measures are required.

The potential impacts of other future developments along Mamre Road on flood risk is outside the scope of this proposal. These developments would be required to assess and manage stormwater, and identify any required measures to minimise any changes to stormwater flows and flooding.

2.7.5 Mitigation measures

Submission number(s)

24

Issue description

The respondent queried how the drainage design proposed would minimise flood risk associated with increased stormwater flow and speed.

Response

The widening of Mamre Road would result in minor changes to surface water flow patterns and runoff due to the increased impervious area from the new road pavement and altered topography from the earthworks. However, impacts associated with these changes would be negligible as the proposal includes provision of new and modified drainage infrastructure (including upgraded culverts, drainage pits and pipes) that would be suitable for the small increase in impervious area and changed flow patterns. The new drainage outlets would be designed with appropriate scour and dissipation measures, to control the potential impacts such that impacts are likely to be negligible.

As shown in the velocity impact mapping in Appendix A of the Hydrology and Hydraulics Assessment, the change in velocity from the existing to proposed scenario would be no greater than five per cent for areas of land experiencing flood velocities greater than two metres per second, which is considered a minor increase.

The drainage design for the proposal would continue to be developed during detailed design in consideration of the design changes proposed, with an aim to minimise increases to flood risk associated with stormwater. Detailed flood modelling on the final drainage design would be carried out during detailed design to confirm the potential flooding impacts. Following this, Transport would consult with any identified affected landowners to identify if any additional mitigation measures are required.

2.8 Air quality

2.8.1 Construction impacts

Submission number(s)

20, 30, 32

Issue description

The respondents raised concerns relating to dust generated during construction and how this may impact quality of life for nearby residents, including nearby pools, washing lines and asthma prone residents. One respondent also raised concern that temporary worker toilets at compound site 3 may smell and affect their property nearby.

Response

Construction activities for the proposal that typically result in the temporary and localised generation of dust include:

- site preparation including clearing of vegetation, removal of topsoil and demolition
- earthworks, for example cutting, profiling and breaking, crushing and grinding, and stockpiling of materials
- surface grading and compaction
- vehicle and plant movement on unsealed haul roads
- hard and soft landscape work, including cutting pavers
- concrete batching.

The potential quantity of dust expected to be generated from these construction activities is expected to be relatively minor and able to be adequately managed through implementation of standard safeguards and management measures (refer to Section 2.8.2). As such, no major increase in dust is expected to impact nearby pools, washing lines or asthma prone residents within their properties.

The need for compound site 3 (including any associated temporary worker toilets) will be confirmed during detailed design in consideration of the design changes outlined in Chapter 4. Regardless of this, a new mitigation measure 'AQ4' has been proposed so that 'any portable toilets established for use by construction workers for the proposal would be appropriately sited and maintained to minimise any offensive odours impacting nearby sensitive receivers.'

2.8.2 Mitigation measures

Submission number(s)

24, 27, 35

Issue description

The respondents raised the following queries relating to management of air quality impacts from the proposal:

- what management measures are proposed to minimise air quality pollution from increased traffic along Mamre Road
- how would dust, dirt and vehicle emissions be minimised from construction of the proposal, particularly near the childcare on Mandalong Close
- whether compensation would be paid for nearby residents to use dryers instead of washing lines
- how does notification of nearby receivers prior to the commencement of work assist in maintaining air quality for children and employees (for example, are they expected to remain inside).

Response

The air quality assessment for the proposal (Appendix L of the REF) concluded that operation of the proposal would not result in an unacceptable increase in incremental or cumulative air quality impacts at the nearest sensitive receptors. Concentrations of pollutants are predicted to be slightly higher in 2036 compared to 2026 due to the higher traffic numbers used for these scenarios. However, the proposal is expected to improve traffic flows and minimise congestion levels that might otherwise be expected to occur without the proposal. This would assist in minimising air pollutant emissions from the associated stop/start and acceleration driving patterns and has potential to reduce pollutant concentrations at the nearest receptors. Beyond this expected reduction in congestion, there is little ability for the proposal to implement measures to directly reduce emissions from traffic.

As outlined in Section 6.9.5 of the REF, an air quality management plan would be prepared as part of the CEMP to manage potential construction air quality impacts. This plan would include emission and dust mitigation and suppression measures, methods to manage work during adverse weather conditions (such as strong winds) and a rehabilitation strategy for exposed surfaces to minimise air quality impacts. There would also be daily visual observations of dust to identify construction activities, vehicles, plant or equipment that are generating excessive air emissions. Implementation of this plan would minimise the potential air quality impacts due to dust, dirt and vehicle emissions.

The potential impacts due to operation of the proposed compound site 2 would be mitigated through the location of the concrete batching plant at least 200 metres (where feasible) from residences.

At least five days prior to commencement of construction work, Transport would notify all businesses, residential properties and other key stakeholders (e.g. schools, local councils) affected by construction of the proposal. In line with Transport's *Air Quality Management Guideline* (Transport, 2016), the mitigation measures identified to manage construction air quality impacts target the source of dust and emissions rather than place restrictions on nearby receivers. As such, there would not be further additional notification

of nearby receivers when high dust or vehicle emission emitting activities are occurring nearby. Transport also notes that no compensation is available for residents during construction.

It is noted that the use of compound site 3 would be reviewed during detailed design in consideration of the design changes and scope, which may further minimise potential air quality impacts on surrounding receivers.

2.9 Consultation

2.9.1 Issues with consultation

Submission number(s)

2, 24, 32, 35

Issue description

The respondents raised the following comments relating to the consultation carried out for the proposal:

- comment that they had not been notified of the proposal via mail despite their house backing onto Mamre Road
- comments that the concerns of Mandalong Close residents and landholders had been ignored
- comment that the links to make an online submission and access the online information session were hard to find.

Response

Transport has carried out several community consultation activities during development of the proposal and to advertise public display of the REF (refer to Sections 5.2 and 5.6 of the REF). This included distribution of community update newsletters to 6000 local properties in 2017 and 5500 local properties in 2021, including all properties that back on to Mamre Road within or adjacent to the proposal area. As noted in Section 1.2, 389 stakeholders were contacted by email and two online community information sessions were held by Transport to provide further information on the proposal during public display of the REF. These sessions were advertised on two variable message signs located along Mamre Road. There have also been meetings with Old MacDonald's Farm Child Care and other impacted property owners on Mandalong Close to notify local community members about the proposal and provide opportunities to receive feedback. All issues raised by the community have been and will continue to be considered.

Should the proposal be approved to proceed, the community would continue to be updated prior to and during construction.

Transport notes the feedback that the links to make an online submission and access the online community information session held during the REF display period were hard to find. This feedback will be considered for any future online information sessions held. It is also noted that Transport responded directly to queries on how to make a submission raised during the public display period, including by providing email responses with the requested links and screenshots for where to find these on Transport's website and digital REF.

During strategic design development prior to the REF, Transport's project team also attended community information sessions for the exhibition of the draft rezoning package for Mamre Road Precinct in November and December 2019 to provide another opportunity for the community to learn about the proposal.

2.9.2 Request for further updates

Submission number(s)

23

Issue description

The respondent requested to be updated on the proposal via email.

Response

Community members who have made a submission during the REF display period for the proposal will be contacted by Transport with information on where they can find responses to their submission, including their relevant submission number. They will also be offered the opportunity to join a mailing list for the Mamre Road upgrade project to receive future updates on the proposal from Transport. This would include notifications when community updates, reports or other material relating to the proposal are published.

2.10 Other issues

2.10.1 Socio-economic, property and land use impacts

Submission number(s)

2, 24, 30, 32

Issue description

The respondents raised the following issues relating to socio-economic, property and land use impacts during operation of the proposal:

- concerns that the proposal would affect the quality of life and wellbeing of nearby residents from:
 - increased road traffic noise that would be depressing
 - increased road lighting that may affect ability to sleep
 - changes to the rural feel of the area
- comment that affected residents do not have the money to move elsewhere
- concerns that the value or potential revenue of properties along Mandalong Close would be affected due to the reduced accessibility
- comment that the proposal is inconsistent with the current residential, semi-rural land zoning.

Response

Transport acknowledges the concerns of nearby residents about the proposal. Respondents' concerns about increased road traffic noise have been addressed in Section 2.4. Concerns about road lighting and impacts to the rural feel of the area have been addressed in Section 2.6.

As outlined in Section 2.5.3, vehicles entering or exiting Mandalong Close may have to travel longer distances compared to the existing arrangements during operation of the proposal. However, the overall traffic performance along Mamre Road is expected to improve due to operation of the proposal, including faster travel speeds in both directions along Mamre Road. This means that the longer travel distance would not necessarily result in a notable increase in overall travel time compared to the future scenario without the proposal.

The proposal occurs on land zones identified under the *Penrith Local Environment Plan 2010* which permit road infrastructure. The proposal is marginally located within R2: Low Density Residential zoned land on the eastern side of Mamre Road. The proposal is consistent with the objectives of this zone as it would improve access, active transport infrastructure, safety, amenity and liveability along Mamre Road near St Clair and no dwellings would be acquired. The proposal is also located on RU2: Rural Landscape zoned land. The design of the proposal has been refined in this zone to minimise impacts on the existing agricultural activities and maintain the rural landscape character of the land, where possible. Further details on the consistency of the proposal with land zones are provided in Section 4.1.2 of the REF.

2.10.2 Biodiversity impacts

Submission number(s)

18

Issue description

The respondent queried whether the trees along Mamre Road would be removed and noted that several bird species have been observed to live and nest in these trees.

Response

The proposal area includes several areas of native vegetation that comprise threatened and endangered ecological communities and habitat for native species, including birds. The biodiversity field surveys carried out for the proposal identified 17 bird species within the proposal area (refer to Section 4.2.5 of Appendix D to the REF). As such, the observations made by the respondent about bird species near the proposal are considered consistent with the findings of the biodiversity assessment.

While the design for the proposal has been specifically refined to minimise removal of vegetation, where possible, the removal of several trees along Mamre Road is unavoidable for construction of the proposal (refer to Section 2.5 of the REF).

The proposal would require the removal of trees and other vegetation within the vegetation clearance boundary, which is mapped in Figure 6-3 in Section 6.1.2 of the REF. Since public display of the REF, the vegetation clearance boundary has been refined due to several design changes (refer to Chapter 4). The revised design would result in direct impacts on biodiversity from the removal of 9.30 hectares of native vegetation and the removal of 34.90 hectares of non-native vegetation. This would impact species which use this vegetation as habitat, including bird species. Refer to Section 6.3.1 of the REF and Section 5.1 of this report for further details on the impacts on biodiversity due to the revised proposal.

The vegetation clearance boundary (which is the area beyond which no vegetation clearance or construction activities would be permitted) would continue to be refined during detailed design. This would focus on minimising native vegetation or habitat removal within the proposal area wherever possible.

Submission number(s)

35

Issue description

The respondent raised concern about termites having been found in a neighbour's property. They requested a pest inspection and asked for trees to be treated if termites are found prior to removal of trees along Mamre Road for the proposal.

Response

In response to this potential issue, an additional mitigation measure 'B12' has been added, which states that 'an investigation will be carried out prior to the commencement of clearing and grubbing to confirm the potential for termites in the trees along Mamre Road that may be directly affected by construction of the proposal. This would occur during pre-construction and as early work and main construction work during construction. If termites are identified during the inspection, affected trees that will be directly impacted by the proposal will be treated to minimise the potential for termites to impact surrounding properties as a result of disturbance due to the proposal'.

2.10.3 Queries about surrounding roads

Submission number(s)

1, 4, 7, 21, 22, 26

Issue description

The respondents raised queries relating to upgrades of surrounding roads, including:

- why the intersection with the M4 Motorway north of the proposal requires vehicles to turn right when travelling to Sydney from St Marys
- whether there are any plans for a new road to access the future metro station at Orchard Hills from Mamre Road
- whether Luddenham Road would be upgraded to two lanes each way at the same time as the proposal
- whether there are there any plans to widen Feather Street due to increased traffic from the proposal
- why noise walls were not installed as part of the Roper Road upgrade, and whether there is a standard for all road upgrades.

Response

Transport acknowledges the respondents' interest in surrounding roads and developments, and notes that the identified roads are outside the scope of the proposal. Any upgrades to these surrounding roads would be subject to separate assessment, approval and funding.

To assist with the community's understanding of the context of the proposal, Transport has and will continue to provide information on other nearby projects within the community updates for the proposal.

With regard to the projects raised by respondents, Transport notes that:

- The Mamre Road / M4 Motorway intersection was constructed in the 1990s and contains a cloverleaf (G-loop) on-ramp interchange configuration. These types of ramp configurations are often beneficial due to their small footprint, management of vehicle speed and space for vehicles within the loop. The M4 Smart Motorways project REF (Transport, 2015) considered options for the upgrade of the Mamre Road / M4 Motorway intersection. This REF determined that the most cost-effective approach was to maintain the existing loop design and upgrade the ramps (refer to Section 2.4.4 of the M4 Smart Motorways project REF (Transport, 2015), which can be accessed via: <https://roads-waterways.transport.nsw.gov.au/projects/01documents/m4/m4-smart-motorway-ref-vol1.pdf>). The upgrades associated with the M4 Smart Motorways project have been completed and are outside the scope of this proposal.
- Future development of the Orchard Hills area, including additional roads beyond the new station precinct, forms part of the approved Sydney Metro project. Additional roads would be subject to separate environmental assessments and planning approvals processes. However, future road and rail connections for Western Sydney are currently under investigation, and more information on transport

corridors in the Future Transport Strategy 2056 can be accessed via:

<https://future.transport.nsw.gov.au/future-transport-strategy>.

- Luddenham Road, Feather Street and James Erskine Drive are roads managed by Penrith City Council. As such, any future planning for the upgrade of these roads would be managed by Penrith City Council separately to this proposal. However, the traffic and transport assessment carried out for the proposal assumes that Luddenham Road would be upgraded to two lanes in each direction by 2036 (refer to Section 2.6.3 of Appendix G to the REF). While the timing of this upgrade is to be confirmed by Penrith City Council, due to the removal of the future provision for a second left turn lane from Mamre Road to Luddenham Road (refer to Section 4.3), it is unlikely to be constructed at the same time as the proposal.
- While all Transport projects adopt the *Noise Mitigation Guideline* (Roads and Maritime, 2015a) when considering noise mitigation measures, noise walls may not be considered feasible and reasonable for all projects. The M4 Roper Road Westbound On-ramp Project REF (Transport, 2021) provides assessment of the noise and vibration impacts and identification of feasible and reasonable mitigation measures for that project. That REF is accessible via: <https://roads-waterways.transport.nsw.gov.au/projects/01documents/m4-roper-road-westbound-on-ramp/m4-roper-road-westbound-on-ramp-ref.pdf>.

2.10.4 Safety and security

Submission number(s)

30

Issue description

The respondent raised concern regarding security, as construction workers at compound site 3 would be very close to their property.

Response

Transport acknowledges the concern of the respondent and notes that behaviour of workers at construction sites would be managed through the CEMP.

Submission number(s)

35

Issue description

The respondent raised concern regarding the potential for construction of the proposal to disturb snakes in the area, which may instead move into nearby properties causing safety issues and requested that they should be removed.

Response

Health and safety plans would be developed for construction of the proposal, which would consider minimising potential disturbance of snakes where possible. However, it is noted that snakes are a natural part of the environment and play an important role in many types of ecosystems, so are not generally proposed to be removed during construction of the proposal. Any snakes encountered during construction of the proposal would be managed in accordance with the procedures outlined in the Flora and Fauna Management Plan (refer to mitigation measure B1 in Section 6.2).

3. Response to government agency issues

3.1 Overview of issues raised

A total of five formal submissions were received from government agencies in response to the display of the REF, which have been responded to in the following sections. This included submissions from:

- Penrith City Council
- Sydney Water
- Western Sydney Utilities Collaboration – Technical Working Group
- Western Sydney Airport
- Department of Planning and Environment (DPE).

Transport has and will continue to consider any informal feedback provided by government agencies during detailed design and the construction of the proposal.

3.2 Penrith City Council

3.2.1 Proposal design and construction

Urban design

Issue description

Penrith City Council provided several comments and suggestions for consideration relating to the proposed urban design response, which included the following aspects:

- a review of the proposal's compliance with several urban design principles
- the need for lighting, CCTV and wayfinding signage at bus shelters and pedestrian access points, which is recommended to be informed by a wayfinding study
- the lighting design and location should consider any adverse impacts on residential amenity
- the need for the design of the proposal to consider Crime Prevention through Environmental Design (CPTED) principles
- the requirement for the proposal to be designed in accordance with the *Disability Discrimination Act 1992* (DDA Act) and an opportunity for careful colour selection for the proposed bus bays and noise walls informed by an access/disability consultant to assist users to visibly identify their stop or access point
- the urban design strategy for the entire Mamre Road corridor had not been provided to Council for review and comment so the overall urban design context is not explained
- recommendation for a detailed arboricultural assessment to be carried out for all existing trees to be retained
- suggestions for planting in the median strips including support for planting in medians and the need to consider the future arrangement of Mamre Road with six lanes as well as the initial four lane arrangement
- request for hold points for Council inspection of tree protection measures, soil preparation, shrub and tree stock inspection prior to planting and regular progress inspections.

Response

The urban design objectives and concept for the proposal has been developed in consideration of urban design principles and strategies. Refer to Section 2.3.3. of the REF for further details.

The proposal includes objectives to:

- improve quality of service, sustainability and liveability by providing facilities for walking, cycling and future public transport needs and improving the urban design of the road corridor
- maintain a safe and efficient environment for all road users.

As such, the design for the proposal has and will continue to take into account considerations such as the safety and suitability of the shared path for all users and residential amenity. In accordance with this:

- lighting has been provided in the proposed design, including along the shared path, and has been designed to minimise light spillage onto neighbouring properties (refer to Section 4.1 of Appendix K to the REF)
- the proposal has been designed to meet Council's CPTED principles (urban design objective three)
- the proposal would be designed in accordance with the *Disability Discrimination Act 1992* (DDA Act)
- mitigation measure LV4 has been adjusted to consider 'colour selection informed by an access/disability consultant to help users visibly identify their stop or access point' in accordance with Penrith City Council requirements (refer to Section 6.2).

The proposal as described in the REF would increase the number of CCTV cameras installed along this section of Mamre Road from one to four. This would increase the visibility of obstructions or incidents along the road section and would assist the Transport Management Centre to efficiently manage the operation of the road. CCTV cameras managed by Transport are intended for traffic management and incident response on the State road network. The installation of CCTV cameras within the broader precinct away from the road corridor would be within the remit of Penrith City Council. No need for CCTV to be installed away from the road corridor at bus shelters and pedestrian access points along Mamre Road has been identified, however, installation of additional CCTV in the future is not precluded by the design. Penrith City Council can install CCTV if it is determined to be required in the future based on a security risk assessment.

Transport has not prepared an urban design strategy for the entire Mamre Road corridor. However, an overarching Western Sydney urban design strategy has been prepared for Mamre Road (including consideration of the section of Mamre Road between Erskine Park Road and Kerrs Road), which has been provided to Council for their information.

During the detailed design and construction phase, when the extent of clearing and any vegetation trimming is confirmed, a preliminary tree assessment, Arborist Impact Assessment and tree risk assessment would be undertaken for the proposal. All assessments would be carried out in accordance with Australian Standards and Transport guidelines. The preliminary assessment would identify any trees or groups of trees that might present a specific concern when determining the options to retain or remove vegetation. This commitment has been reflected in additional mitigation measure B14 (refer to Section 6.2). However, it is noted that some trees would be identified to be removed regardless of their health or significance due to their location within the proposed road corridor. It is also anticipated that there would be a number of trees of low significance because of their location or species (such as Casuarina).

The landscape design in the median strips would consider the future arrangement of Mamre Road with six lanes so as not to preclude the potential future widening of Mamre Road. However, it would continue to include vegetation, which may be removed during widening, if it provided sufficient benefit for the interim period. Plant selection would include consideration of Transport's *Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects* (RMS, 2011) in line with mitigation measure B1.

Council would not hold a regulatory or approval role during the design and construction phase of the proposal, however Transport will continue to consult with Council (refer to Section 3.2.11).

Issue description

Penrith City Council provided detailed recommendations to minimise increases in urban heat in line with Council's *Cooling the City* strategy and other relevant guidelines, which included recommendations:

- to minimise the removal of mature trees
- to increase tree canopies through tree planting and consideration of targets to increase tree canopy by 40 per cent from the existing number of trees
- for minimum tree and shrub planting sizes
- to select "cool pavement" (untinted concrete) for shared user path to minimise maintenance and reduce urban heat
- to plant shade trees between the path and kerb.

Response

The proposal has been designed with consideration to the Penrith City Council *Cooling the City Strategy*. Opportunities to minimise increases in urban heat have been considered during the development of the proposal and including minimising vegetation removal, substantial tree planting and adoption of untinted concrete for the shared path (as per Penrith City Council's suggestion).

As discussed in Section 2.10.2, while the design for the proposal has been specifically refined to minimise removal of vegetation, where possible, the removal of several trees along Mamre Road is unavoidable for construction of the proposal (refer to Section 2.5 of the REF). The vegetation clearance boundary (which is the area beyond which no vegetation clearance or construction activities would be permitted) has been refined since the public display of the REF (refer to Chapter 4) and would continue to be refined during detailed design. This has reduced the expected clearance of vegetation for the proposal from (refer to Section 5.1):

- 9.38 hectares of native vegetation (as outlined in the REF) to 9.30 hectares
- 35.46 hectares of non-native vegetation (as outlined in the REF) to 34.90 hectares.

Transport has also committed to contribute to the 'Greening our City' Premier's Priority, which includes a pledge to plant one million trees by 2022 and five million trees by 2030. As such, Transport would maximise opportunities to plant trees as part of the proposal and other nearby projects.

Tree planting is proposed to be maximised along the eastern edge of the road corridor and wide central median, where practical, however it is noted that this would need to be considered alongside safety and other design requirements. Tree planting has been provided on the western side of the road corridor to a lesser degree due to the importance of maintaining open views to the west and the Mamre House heritage curtilage (as identified in the landscape character and visual impact assessment for the proposal summarised in Section 6.8 of the REF). Tree planting opportunities have also been limited by the provision for future widening and utilities allocation along the western side of Mamre Road. Any vegetation planted would be required to meet minimum tree and shrub planting sizes identified in the *Landscape Design Guideline* (RMS, 2018), which would be confirmed during detailed design.

Issue description

Penrith City Council provided several detailed recommendations regarding the planting strategy for the proposal including:

- opportunities for planting to reflect the different landscape character zones surrounding the proposal and the need for any land rehabilitation to be appropriate to its context
- areas where use of turf and planting of grasses and groundcovers is not supported by Council including medians
- requirements for ameliorated soils to sustain plant health and structure
- consideration of bushfire risk in the planting strategy
- considerations for species selection including consideration of future habitat, use of endemic species, shade provision, species diversity, suitability from previous experience and drought resilience
- suggestion for structural plantings at select intersections to assist wayfinding
- recommendation to avoid locating utility corridors in tree planting areas
- the need for the planting to provide screening to the childcare centre.

Response

The planting strategy for the proposal has considered opportunities for planting to reflect the landscape character zones identified in the landscape character and visual impact assessment (refer to Section 6.8.2 of the REF). In general, this has been reflected in four different types of planting strategies along the western side of Mamre Road:

- sparse trees in clumps to allow views within rural residential landscapes
- no tree planting within the infrastructure corridor itself for safety
- tree planting at intersections with gully/creek within riparian zones
- more formal/linear tree planting in heritage or pastoral areas.

The use of turf and other groundcovers within the planting strategy (including within the median) would be considered further during detailed design. This would include consideration of proximity of proposed turf to endangered ecological communities as well as consideration of the provision of a masonry edge where turf is next to planting.

Ameliorated soils would be used in accordance with Transport's vegetation and landscape planting specifications so that plant health and structure can be maintained.

As noted in Section 2.8 of Appendix K to the REF, parts of the proposal area are located within land mapped as bush fire prone land. This bushfire risk has been considered in the planting strategy, with the designation of asset protection zones (APZ) within which the planting of trees is restricted.

Transport appreciates Council's suggestions on suitable species based on past experience and will continue to consult with Penrith City Council during detailed design on planting species selection.

The utility corridors have been generally proposed in areas where tree planting opportunities were limited or potentially undesirable due to the need to maintain views and open landscapes, to minimise loss of planting opportunities. This includes easements for the overhead powerlines that are proposed to be relocated along the western side of Mamre Road.

The childcare centre is about 60 metres from the edge of proposed pavement, which is about 15 metres less than the existing Mamre Road corridor. Outdoor spaces at the centre generally face west. Additional tree planting would be provided to improve screening.

Issue description

Penrith City Council provided several detailed recommendations for consideration relating to proposed noise wall design, which included the following aspects:

- concern that staggered noise walls can reduce opportunities for screening and tree planting
- support for transparent sections of noise walls to minimise shading and amenity impacts
- suggestions for pattern design, materials and colours to be considered
- the need for appropriate landscaping (such as climbers) near the noise wall to provide screening and shading
- suggestions to consider opportunities for sculptural/installation public art including cultural interpretation and Indigenous art along the noise walls and pedestrian access portals
- maintenance considerations, such as related to potential graffiti and replacement.

Response

Staggered noise walls are required due to drainage requirements and to provide access points to the residential streets of St Clair to the east of Mamre Road.

Transport acknowledges Penrith City Council's support of the transparent sections of the proposed noise wall design and will consider the detailed suggestions for the proposed noise wall design further during detailed design in consultation with Council. As per mitigation measure LV4, this would include consideration of opportunities for heritage interpretation and art in the noise wall design.

Issue description

Penrith City Council provided several detailed comments and suggestions for consideration relating to how heritage is addressed in the proposed design, which included the following aspects:

- the need for detailed design to be informed by specialist heritage advice
- a suggestion for a tree lined avenue along the new access road to Mamre House informed by specialist heritage advice
- the need to consider appropriate landscaping near the Leeholme Horse Stud Rotunda
- the design of gates, signs, property road junction, cross over treatments, interpretation design and details, text and landscaping, which are suggested to continue to be developed in consultation with Council's heritage advisor.

Response

The design for the proposal has minimised impacts on Aboriginal and non-Aboriginal heritage through development of a sympathetic urban design response and identification of heritage interpretation opportunities based on specialist heritage advice. This has involved consultation with Heritage NSW due to potential impacts on Mamre House, which is listed on the State Heritage Register, who were generally supportive of the proposed design.

As noted in Section 4.1 of Appendix K to the REF, feature planting near Mamre House would be sensitive to the site's heritage. In addition, as per mitigation measure NAH5, during detailed design 'a landscape solution for the redundant gated entrance and signage to Mamre Homestead off Mamre Road would be informed by specialist heritage advice and consider the significant pastoral setting and the heritage significance of the property beyond, and might include but not be limited to updated signage, an interpretation node for vehicles, and lighting.' However, the proposal would not provide a tree-lined avenue along the new access road to Mamre House, as this may affect the existing open views and setting to Mamre House.

The proposal would not involve any landscape work near the Leeholme Horse Stud Rotunda as it is located about 150 metres away from the proposal.

During detailed design, Transport would consult with Penrith City Council further about how the design considers heritage elements.

Shared path design

Issue description

Penrith City Council provided several comments and suggestions for consideration relating to the shared path design proposed, which included the following aspects:

- support for the provision of the three-metre-wide shared path on the eastern side
- recommendation for a minimum three-metre-wide shared user path on the western side to be constructed as part of the proposal (as well as the eastern shared path) to provide pedestrian amenity and access to bus services/stops
- request for the design of the future shared path on the western side of Mamre Road to be future-proofed in consideration of plans for future development and infrastructure, including connections to Council's proposed Green Grid
- suggestion to construct a dedicated, separated cycleway away from the pedestrian paths and traffic lanes to improve amenity and safety
- suggestion to increase separation of the shared path from traffic lanes by moving it closer to the proposed noise wall or install a safety barrier between the traffic lanes and shared path, as Council is concerned that the 1.2 metre setback is not enough
- suggestion to align the shared path so it meanders between vegetation on the eastern side of Mamre Road
- suggestion to consider points where cyclists are encouraged to dismount or areas where pedestrians could be passed safely by cyclists
- request to consider the continuation of the shared path to meet compatible infrastructure on the M4 Motorway.

Response

Transport acknowledges Penrith City Council's support for the provision of new shared paths.

The proposal does not include provision of a separate, dedicated cycleway along Mamre Road. However, as outlined in Section 4.1, the design has been refined to increase the width of the shared path on the eastern side of Mamre Road from three metres wide as proposed in the REF to 3.5 metres wide. This would be confirmed during detailed design. In addition, the shared path has been set back further away from the road at several locations and is proposed to meander between vegetation where space allows. Locations for cyclists to dismount would be provided within break out spaces and stopping points along the shared path. These proposed design features are intended to improve the amenity, safety and comfort for pedestrians and cyclists using the shared path.

Since public display of the REF, space provision for a future shared path on the western side of Mamre Road has been removed from the proposed design (refer to Section 4.1) but is not precluded from being built in the future separate to this proposal. However, there would still be short sections of footpaths to allow pedestrians to access the bus stops on the western side of Mamre Road near intersections.

The proposed shared path would connect directly to the existing footpath which is on the eastern side of Mamre Road north of the Banks Drive intersection that connects to the M4 Motorway.

Issue description

Penrith City Council provided several comments and suggestions for consideration relating to pedestrian access to the proposal, which included the following aspects:

- suggestion for additional mid-block pedestrian crossing points at the pedestrian connections to St Clair near Dutch Place, Palena Crescent and McIntyre Avenue to allow residents to easily cross Mamre Road and / or access public transport, as well as access any possible future development on the western side of Mamre Road
- request to include upgrades to the pedestrian portals from the eastern side of Mamre Road to the nearest local road
- the need for Transport to replace and/or reinstate any Council-owned laneway assets removed during construction (such as lighting, bollards and signage)
- suggestion to extend the kerb at the Luddenham Road intersection to reduce the crossing distance.

Response

Mamre Road does not include existing or proposed mid-block crossing facilities as there is currently little pedestrian demand for mid-block crossings. In addition, mid-block crossings may impact on the traffic performance and safety of Mamre Road as it is a high-speed road. However, the proposal includes additional pedestrian crossings along Mamre Road at the new signalised intersections at Solander Drive and Luddenham Road, which would increase the opportunities for pedestrians to safely cross Mamre Road compared to the existing scenario (crossings only at Banks Drive and Erskine Park Road).

Upgrades between pedestrian portals and the nearest local road (including local laneways) are outside of the scope of the proposal, except where the shared path is proposed to connect to the local road. Transport would replace or reinstate any Council-owned laneway assets impacted during construction on a like for like basis. This has been added as additional mitigation measure SE11 (refer to Section 6.2).

The refinement to the Luddenham Road intersection proposed since public display of the REF (outlined in Section 4.3) removes space provision for a future second lane for motorists travelling northbound on Mamre Road turning left into Luddenham Road. As such, the crossing distance at Luddenham Road has been reduced in the revised design. However, the design does not preclude this second left-turn lane being built in the future separately to this proposal, if determined to be required based on increase in traffic volumes.

Maintenance

Issue description

Penrith City Council provided several comments and suggestions for consideration relating to the maintenance of the proposal, which included the following aspects:

- steep batters (such as 1:2 grades) are not supported as all batters require safe and manageable maintenance access, including for someone to stand on them for extended periods
- water sensitive urban design (WSUD) is supported, provided maintenance and access requirements are carefully considered
- need to consider the potential for areas to be used for illegal dumping, littering, and loitering
- Council request Transport to liaise with Council's Asset Management Department and to be provided with the roadside maintenance schedule and service level agreement
- access for vehicles to carry out work on drains, sound walls and trees needs to be provided and shown on a Utility Service Plan
- the verge on both sides of road would need a Road Occupancy Licence (ROL) to safely maintain turf and garden beds, which would be costly
- safety barriers have long stretches with turf underneath, which would be dangerous and time/cost intensive to maintain, and so concrete to kerb is preferred

- need to confirm ongoing maintenance of structures and land adjacent to the noise walls as there would be long stretches with minimal access and space between the wall and residential fences.

Response

There are areas where the proposal is heavily constrained due to engineering or environmental considerations and steep batters are required. The batter steepness has already been optimised during the concept design stage of the proposal and would be reviewed further during detailed design in consideration of the need for safe and manageable maintenance access.

Further details on maintenance and access requirements for the WSUD design features would be confirmed and provided to Council during detailed design.

Transport would consider the need for additional design features in areas where potential for illegal dumping, littering and loitering has been identified during detailed design to discourage this behaviour. This commitment has been added as additional mitigation measure O10 (refer to Section 6.2).

Transport has provided details on the maintenance program and utility access as part of ongoing discussions with Penrith City Council's Asset Management Department, which would continue during detailed design. There is potential that an additional access track is required to be established within the proposal area to provide safe access to the utilities along the western side of Mamre Road. The design of this track and any additional associated environmental assessment, if required, would be carried out during detailed design.

The roadside maintenance schedule and service level agreement would be provided to Council.

The locations of turf proposed (including sections beneath safety barriers) would be reviewed during detailed design to avoid the need to obtain a ROL and any associated temporary disruption to traffic along Mamre Road during maintenance, where possible.

Transport would maintain the noise wall. However, Council would be responsible for maintaining any planting and the land adjacent to the noise wall.

Road cross section

Issue description

Penrith City Council commented that the road cross section of the proposal should include at least six-metre-wide verges with three-metre-wide shared paths on both eastern and western side.

Response

Typical cross sections of the proposal are shown in Section 3.2.1 of the REF. These indicate that the width of verges alongside Mamre Road would vary, with a width of at least 1.2 metres on the eastern side of Mamre Road and up to 5 metres on the western side of Mamre Road. Six-metre-wide verges would increase the footprint of the proposal, and increase its potential environment and property impacts.

As noted in Section 4.1, the revised design does not include provision for, however does not preclude, a shared path on the western side of Mamre Road, however the width of the shared path on the eastern side of Mamre Road has been increased from three metres to 3.5 metres. This would be confirmed during detailed design.

Issue description

Penrith City Council commented that the cross section of the proposal should include left turn lanes that are at least four metres wide.

Response

The proposed design includes left turn lanes that are four metres wide.

Issue description

Penrith City Council commented that the cross section of the proposal should include two-metre-wide bicycle lanes between left turn lanes and through lanes.

Response

A four-metre-wide shared path along the eastern side of Mamre Road has been provided in the proposed design for cyclists to use. As such, no bicycle lanes have been included on Mamre Road.

Issue description

Penrith City Council commented that the cross section of the proposal should include widening to accommodate B-triple vehicle turn paths.

Response

The proposal does not accommodate B-triples. This is because B-triples cannot currently access Mamre Road off the M4 Motorway at either the Mamre Road or Erskine Park Road intersections.

Issue description

Penrith City Council commented that the cross section of the proposal should include a six-metre-wide ultimate centre median to accommodate landscape work.

Response

The proposal would provide for a median width of at least 10 metres. This would include provision of a minimum ultimate median width between about 2.2 and 5.9 metres for the potential future upgrade of Mamre Road to three lanes in each direction. This ultimate median width has been narrowed to minimise environmental impact.

Issue description

Penrith City Council commented that the cross section of the proposal should include kerbside lanes that would be at least 5.5 metres wide, instead of the four-metre-wide lanes currently proposed, to comply with Austroads best practice to provide a kerbside shoulder, even at locations that are generally “No Stopping” along the kerbside. This is recommended because a kerbside shoulder would provide:

- a clear zone from the edge of traffic lane to any obstruction (which includes trees, poles, kerbs) and clearance to any pedestrians on verges (including persons at bus stops)
- a safe stopping point for bus stops that is clear of conflicts with through traffic for road safety and traffic efficiency
- allowance as use for left turn lanes into side streets and right turn lanes from side streets
- on-road bicycle facility for road safety and traffic efficiency (in addition to the shared path).

Response

The proposal would provide an additional lane in each direction along Mamre Road, which would increase the capacity of the road to cater for any obstructions. For example, any broken down vehicles could occupy the kerbside lane, leaving one lane spare for traffic to continue to travel along Mamre Road. In addition to this, bus bays and dedicated turning lanes have been proposed at several locations along Mamre Road to assist in the traffic flow. As such, the width of the kerbside lanes is considered sufficient.

There are also one metre wide shoulders next to the inner lanes of Mamre Road, which would increase the width of the road corridor.

In addition to this, the proposal would increase the number of CCTV cameras installed along this section of Mamre Road from one to four. This would increase the visibility of obstructions or incidents along the road section, and would assist the Transport Management Centre to efficiently manage the operation of the road.

Public transport provision

Issue description

Penrith City Council provided the following comments relating to the design of bus stops, shelters and access points as part of the proposal:

- recommendation for bus stop boarding points with bus shelters along both sides of Mamre Road to accommodate the existing and future bus services
- all bus stops, shelters and access points are to be fully DDA compliant, with adequate lighting in accordance with the relevant Australian Standards
- all pedestrian access points and bus set-down and pick up zones are to be accessible. Bus shelters (shelter from elements) are to be provided.

Response

Transport would replace the existing bus facilities impacted by the proposal like for like.

The shared path along the eastern side and short footpath sections on the western side of Mamre Road would provide safe access to bus facilities and incorporate adequate lighting and DDA considerations.

The proposal would also provide sufficient reserved space for some future bus stops along Mamre Road, including future bus stop signs, seating, shelters and tactile markers. Penrith City Council would need to implement any additional facilities that are not currently provided by the proposal, if identified to be required.

Issue description

Penrith City Council provided the following comments relating to public transport provision and future proofing for additional planned public transport services as part of the proposal:

- Provision for shuttle bus lanes at intersections and along Mamre Road and Luddenham Road is recommended.
- Clarification is required whether the bus priority left turns lanes are provided as part of the proposal. If not, timeframes should be provided, noting Council's preference to construct all priority bus lanes as part of this project.
- As part of the Western Sydney Rapid Bus Project (WSRBP), a future rapid bus route between Blacktown and the Western Sydney Airport is identified. It is noted that there will be congestion and queueing delays for buses turning left in/right out of the intersections of Luddenham Road/ Mamre Road and Erskine Park Road /Mamre Road. The WSRBP report has not considered any infrastructure-based solution at these locations as the intersections are being reviewed as part of the first stage of the Mamre Road upgrade. It is Council's preference for Transport to provide public transport options as part of the proposal to support mode shift within this corridor.

Response

Traffic modelling for the proposal has indicated that bus priority or shuttle bus lanes are not required at present to manage public transport travel times. However, the proposed design doesn't preclude the installation of priority bus lanes or shuttle bus lanes on Mamre Road or Luddenham Road in the future.

The future bus priority left turn lanes identified in the proposal would be constructed as part of the proposal, however, they won't be line marked. As such, any future adjustments to implement bus priority such as line marking and traffic signal adjustments would be able to be implemented in the future, as required.

Transport will discuss the proposal with the WSRBP team and consider any recommendations about bus priority during detailed design.

Fauna connectivity/habitat

Issue description

Penrith City Council provided the following comments relating to design measures for provision for fauna connectivity and habitat as part of the proposal:

- consider the use of bridges rather than culverts as per the Saving our Species actions for the Cumberland land snail, particularly at South Creek tributary opposite 1/23-107 Erskine Park Road
- the design should maintain and enhance existing fauna connectivity and where this is not possible, provide opportunities for animals to cross, particularly land-based animals and those that may utilise waterways and wetland/swales/basin areas, particularly near the Erskine Park Road intersection and compound site 3
- details of mitigation measures (such as crossing points) to enable migration of fauna across the corridor are to be informed by specialist ecologist advice and developed in consultation with Council's biodiversity officer
- the design of the noise wall and stormwater infrastructure should incorporate design elements which include bat and land animal habitat opportunities, such as hollows and overhangs.

Response

Mamre Road is an existing road with limited connectivity of fauna habitat on both sides of the road. Fauna are therefore unlikely to frequently cross the road. Fauna strikes along Mamre Road have not been a significant issue to date.

Despite this, Transport considered opportunities to provide fauna connectivity and habitat during development of the proposal. There are limited opportunities to provide any proven effective connectivity measures for the Cumberland Plain Land Snail as part of the proposal. A bridge to connect the two identified populations of Cumberland Plain Land Snail is not considered to be feasible due to flooding and other engineering concerns.

Transport will consider opportunities for fauna connectivity and habitat enhancement as part of further upgrades of Mamre Road in the future.

Measures to discourage illegal dumping and antisocial behaviour

Issue description

Penrith City Council suggested consideration of appropriate measures (such as CCTV, signage and guardrail fencing) to prevent vehicles stopping, illegal dumping or other antisocial behaviour. In particular, this was recommended to be considered at the new Mamre House access driveway and Banks Drive western stub.

Response

The proposal as described in the REF would increase the number of CCTV cameras installed along this section of Mamre Road from one to four. The new CCTV cameras are proposed to be installed at the Banks Drive, Solander Drive, Luddenham Road and Erskine Park Road intersections. This would increase the visibility of obstructions or incidents along the road section and would assist the Transport Management Centre to efficiently manage the operation of the road.

The proposal also includes lighting of the U-turn stubs, road safety barriers and pedestrian/cyclist fencing along the shared path. These design features may deliver minor indirect benefits and prevent illegal behaviour in these locations. During detailed design, further consideration would be given to any known illegal dumping areas and any appropriate mitigation measures that should be adopted into the design. This has been added as additional mitigation measure O10 (refer to Section 6.2).

Installation of additional CCTV, signage or guardrails in the future, such as at the new Mamre House access driveway or Banks Road western stub, is not precluded by the design, but are outside the scope of the proposal. Penrith City Council can install additional measures based on their own safety risk assessment if it is determined that it is required in the future based on observations of vehicles stopping, illegal dumping or other antisocial behaviour.

Water sensitive urban design

Issue description

Penrith City Council provided the following comments relating to the water sensitive urban design for the proposal:

- the provided treatment does not comply with Council's WSUD Policy, however is an improvement on the current infrastructure, which has minimal treatment devices
- request for the full MUSIC model with catchment break ups and detailed engineering plans for the proposed water quality basins and Gross Pollutant Trap (GPT) upgrade to be provided to Council.

Response

The proposal has aimed to improve the current water quality infrastructure by providing upgrades and new WSUD infrastructure. However, the ability for the proposed water quality treatment to meet Penrith City Council's WSUD Policy has been limited by several environmental and engineering constraints surrounding Mamre Road. As a result, the proposal would result in minor (less than three per cent) pollutant load increases to South Creek and unnamed tributaries compared to the existing pollutant load from the local urbanised catchment within the proposal area.

Transport will provide the full MUSIC model for the proposal and detailed plans of WSUD infrastructure to Penrith City Council. The design and modelling will also be updated and shared with Council during detailed design.

Property acquisition

Issue description

Penrith City Council confirmed that the Council owned land along the eastern side of Mamre Road that is classified as community land would require acquisition for the proposal and that Council and Transport will continue to discuss the legal requirements associated with acquisition of this land.

Response

Transport acknowledges that discussions regarding the potential acquisition of Council owned land for the proposal are ongoing.

Northern tie-in

Issue description

Penrith City Council commented that it appears that the first stage of the Mamre Road upgrade and M4 Smart Motorways projects do not directly connect on Mamre Road and queried why this is the case.

Response

The connection between this proposal and the M4 Smart Motorways project is outside of the scope of the proposal. This is because the northern limit of the proposal ties into an existing section of Mamre Road, which has two through lanes in each direction.

Safety barrier design

Issue description

Penrith City Council raised concern regarding the design of the W-beam safety barrier in the turf strip between the road kerb and shared path, as it is considered unsafe for cyclists and high maintenance, and requested consideration of alternatives.

Response

Transport notes Council's concern about the safety barrier design and the design process has considered alternatives including solid concrete road barriers. However, Transport has determined that the W-Beam safety barrier is the preferred safety barrier type. This is because it complies with Australian road design standards, is not considered unsafe for nearby cyclists and would result in less impact on utilities and drainage than solid concrete road barriers.

Utilities adjustments

Issue description

Penrith City Council requested clarification on the proposed undergrounding of overhead wires.

Response

As outlined in Section 4.4, since public display of the REF, one of the changes to the proposal design relates to the Endeavour Energy overhead electricity wires. Instead of being relocated underground (as per the REF), the powerline would now be relocated above ground along the western side of the northbound carriageway.

3.2.2 Hydrology and flooding

Assessment methodology

Issue description

Penrith City Council provided the following comments relating to the methodology carried out for preparation of the Hydrology and Hydraulics Assessment for the REF and its contents:

- Figure 3.1 does not show the flow contributing from the unnamed creek that is located between Cosgrove Creek and Blaxland Creek and so it needs to be clarified whether this was considered in the modelling for South Creek mainstream flooding
- the model topography was based on Airborne Laser Scanning (ALS) survey data flown in 2011. Council suggests that modelling be carried out using more recent 2019 LiDAR data
- the assumed initial loss value of 41mm for pervious area in urban environment is considered too high and it is not clear if the initial loss values listed in Table 3-1 will be used
- the report does not include, which is requested to be provided to Council:
 - a table showing the inflow hydrographs from South Creek and associated tributaries together with their locations
 - a comparison to South Creek 2015 inflows values
 - a graph with a table showing the downstream boundary stage-hydrograph
 - a long section comparing the existing and proposed elevation of Mamre Road
 - the validation of the TUFLOW model results for mainstream flooding
 - the flood impact of the proposed noise wall on South Creek PMF.

Response

The flow from the unnamed tributary catchment between Cosgrove Creek and Blaxland Creek has been applied in the mainstream flood modelling.

The latest ALS data from 2019 was not used for this assessment because:

- A detailed survey was used to inform the modelling in the vicinity of the road corridor instead of ALS.
- The modelled South Creek main stream flood levels are consistent with the calibrated Updated South Creek Flood Study (WP, 2015) flood levels used for planning purposes. Updating the ALS from 2011 to 2019 may change the flood levels to be no longer consistent with Council's adopted Flood Study.

The 41-millimetre figure quoted by Penrith City Council is identified in Section 3.2.2 of Appendix H to the REF as the pervious area initial storm loss, which includes pre-burst and burst losses. The resultant losses applied to the model (burst only) are the Probability Neutral Burst Losses, shown in Table 3-1 in Section 3.2.2 of Appendix H to the REF.

Transport acknowledges Penrith City Council's request for additional information about the hydrology and flooding assessment methodology and notes that:

- Transport issued the 100% concept design to Penrith City Council, which included the long section of the design in the roadwork drawing.
- Due to the rare nature of a PMF flood, the design specifications for the proposal do not require the design to meet these requirements. However, due to the potential for the local catchment PMF event to impact a large number of private properties, the hydrology and flooding assessment checked the design against the local catchment PMF event. The South Creek PMF flood event has not been checked. This exceeds the design requirements for the proposal.
- Transport will continue consulting with Penrith City Council during detailed design of the proposal, and will provide further updates and information on the flood modelling carried out.

Existing environment

Issue description

Penrith City Council commented that there was inconsistency between Figure 2-2 and Figure 2-3 in the Hydrology and Hydraulics Assessment regarding the locations of the existing transverse drainage.

Response

Figure 2-2 and Figure 2-3 referred to by Penrith City Council are available in Section 2.2 of Appendix H to the REF. These figures are not inconsistent, however Transport notes that they label different aspects of the local catchment and drainage infrastructure with the same drainage structure identifiers. Figure 2-3 shows the location of the existing transverse drainage structures. Figure 2-2 shows the upstream catchment areas which drain to each transverse drainage structure via overland flow paths. These areas make up the local catchment area.

Operational impacts

Issue description

Penrith City Council provided the following comments relating to the operational impacts of the proposal on private properties during the PMF flood event reported in the Hydrology and Hydraulics Assessment (provided as Appendix H to the REF):

- the flood results presented show that the proposed noise wall in its current design poses a significant risk to flooding for properties located upstream of Mamre Road from local catchment, particularly in the PMF flood event
- the results acknowledge that the flow impact from mainstream flooding on two properties along McIntyre Avenue St Clair (No. 43 and 44) is beyond the acceptable limit and further investigation is required during the detailed design.

Response

Transport notes that Penrith City Council's observations are consistent with the findings of the REF. Refer to Section 6.5.3 of the REF for further details.

Additional flood modelling has been carried out for the proposed changes to the proposal since public display of the REF, which showed that the impacts of the revised proposal on flood risk during operation would be relatively consistent with the impacts as outlined in the REF (refer to Section 5.5). However, as outlined in Section 2.3.1, the noise wall design and alignment is subject to confirmation during detailed design and will be refined in consideration of the potential impacts of the noise wall on PMF flood risk. The hydrology and flooding impacts of the final design would also be confirmed during detailed design, which would be informed by an allotment and floor level survey of 43 and 44 McIntyre Avenue, St Clair to confirm flood inundation risk for these properties as per mitigation measure HF2.

Issue description

Penrith City Council queried whether Table 4-3 in the Hydrology and Hydraulics Assessment shows the one per cent AEP results for local catchment flooding based on five per cent AEP South Creek tailwater.

Response

Table 4-3 (refer to Section 4.1.2 of Appendix H to the REF) shows the one per cent AEP results for local catchment flooding based on the five per cent AEP South Creek tailwater as assumed by Council.

Issue description

Penrith City Council queried why the results from the Council adopted Penrith Overland Flow Flood "Overview Study" 2006 are higher on the upstream side of Mamre Road compared to the modelled results for the proposal.

Response

As stated in Section 5.1.2 of Appendix H to the REF, only XD03, XD04, XD07 and XD14 were modelled in the Penrith Overland Flow Overview Study (Cardno, 2006). No stormwater network pit and pipes were modelled, implying that depth of ponding at the intersections was being overestimated. Smaller losses used in the 2006 study are expected to have resulted in higher flows compared to the flooding assessment carried out for the proposal.

The 1987 Intensity-Frequency-Duration (IFD) rainfall depths are also higher than 2016 IFD rainfall depths used in the Mamre Road upgrade project flooding investigation for the 100-year ARI 2 hour rainfall event. These factors may have contributed to the flood levels in the 2006 study being higher upstream of the road than stated in the Mamre Road upgrade hydrology and hydraulics assessment.

Issue description

Penrith City Council raised concern that the proposed change at XD14 where the flow area is increased more than double compared to existing case may lead to increase flood level in both directions (downstream as well as backwater from South Creek).

Response

A key objective for the design of the proposal is to achieve one per cent AEP flood immunity for the upgraded section of Mamre Road. At XD14, the existing road flood immunity is much less than one per cent AEP. As such, a larger cross drainage structure is proposed to improve conveyance under the road.

The proposal has also provided a large cross-drainage structure to avoid adverse flood impacts to the adjacent warehouse. The box culverts are proposed to be at least 1.5 metres high for safe maintenance requirements. Upstream and downstream impacts have been assessed in Section 6.5.3 of the REF and Section 7 of Appendix H to the REF as well as in Section 5.5 for the revised proposal. The potential impacts are within the acceptable flood impact limits.

Issue description

Penrith City Council commented that the flow results presented in Table 3-3 in the Hydrology and Hydraulics Assessment are of a concern as the difference is beyond the acceptable range of 10 per cent.

Response

For the local catchment modelling, the Australian Rainfall and Runoff (AR&R) 1987 guidelines were adopted for hydrologic modelling during the strategic design phase. This was revised during the concept design stage due to the adoption of the AR&R 2019 guidelines. This resulted in changes to IFD rainfall data, rainfall losses, temporal patterns and land-use areas, which would explain the difference. The flow estimate for the XD12 catchment increased by about 40 per cent. AR&R 2019 guidelines note that the Rational Method is no longer recommended for flow estimation.

3.2.3 Biodiversity

Operational Impacts

Issue description

Penrith City Council commented that the impacts of the surrounding changes to the environment on the retained trees should be considered and mitigated, including as a result of:

- changes in water availability
- altered nutrient levels from surface run off
- loss of support from removed adjacent vegetation leaving trees exposed.

Response

There may be indirect impacts to vegetation during operation of the proposal, such as through changes in hydrology and flooding patterns and creation of a new edge on vegetation communities as noted by Penrith City Council. These impacts have been assessed in Section 6.1.3 of the REF. They would be managed through the proposal design and operational mitigation measure B2 to ensure minimal impacts to surrounding vegetation.

Issue description

Penrith City Council commented that the Biodiversity Assessment Methodology (BAM) Credit Summary Report provided in Appendix F documents that 4.52 of Cumberland Plain Woodland and 4.3 ha of River-flat Eucalypt Forest, which differ from the main document that states the proposal would result in the removal

of 4.55 ha of Cumberland Plain Woodland and 4.36 ha of River-flat Eucalypt Forest. They queried which figures are correct.

Response

The areas of vegetation removal expected for Cumberland Plain Woodland and River-flat Eucalypt Forest that were entered into the BAM calculator were consistent with the areas stated in the REF. However, the difference between the areas of vegetation removal stated in the REF compared to the areas shown in the BAM Credit Summary Report are due to the automatic rounding that occurs within the BAM Credit Summary Report (see Table 3-1). As such, the figures stated within the REF are less rounded and considered more accurate.

Table 3-1 Comparison of areas of vegetation removal stated in BDAR and BAM Credit Summary Report

PCT	Condition	Area shown in BDAR (ha)	Area shown in BAM Credit Summary Report (ha)
Cumberland Plain Woodland (PCT849)	Moderate	3.63	3.6
	Low	0.92	0.92
	Total	4.55	4.52
Riverflat Eucalypt Forest (PCT835)	Moderate	2.84	2.8
	Low	1.52	1.5
	Total	4.36	4.3

Since public display of the REF, the vegetation clearance boundary for the proposal has been revised. This has resulted in a revised estimate of 4.61 hectares of Cumberland Plain Woodland (PCT849) and 4.22 hectares of Riverflat Eucalypt Forest (PCT835) being removed for construction of the proposal. The biodiversity offset obligation for the project has also been revised accordingly (refer to Section 5.1 and Appendix B).

Mitigation measures

Issue description

Penrith City Council provided comments and suggestions relating to mitigation of biodiversity impacts:

- suggestion to install nesting boxes of different sizes to cater for birds and marsupials to replace habitat trees lost
- comment that two threatened fauna species were recorded: Southern Myotis and Cumberland Plain Land Snail and the Ecology Assessment Officer is satisfied the report has identified suitable mitigation measures to mitigate the impact to these species
- suggestion to investigate options of securing offsets within the Penrith Local Government Area (LGA) to ensure the continued presence of Cumberland Plain Woodland within the Penrith LGA and mitigate the impact of native vegetation removal
- suggestion to identify opportunities to improve the patches of vegetation that would remain by undertaking weed removal and supplementary planting in addition to the proposed landscaping.

Response

Transport acknowledges Council's support for the mitigation measures identified for the threatened fauna species within the proposal area. The need for nesting boxes or artificial hollows to be installed as part of the proposal to provide alternate habitat for birds and marsupials, and whether these are feasible to be

implemented, would be considered further during detailed design (reflected in additional mitigation measure B11 in Section 6.2).

Biodiversity offset obligation of the proposal is proposed to be met by paying into the Biodiversity Conservation Fund managed by the Biodiversity Conservation Trust. This option is preferred compared to securing offsets within the Penrith LGA due to the tight timeframes for the delivery of the proposal. Further refinement of the vegetation clearance boundary would be carried out during detailed design to reflect any further design refinements and minimise impacts on biodiversity where possible.

A substantial planting strategy has been proposed (refer to Section 3.2.1) which would include opportunities to improve remnant patches of native vegetation alongside the Mamre Road corridor. This strategy would be refined during detailed design.

Issue description

Penrith City Council stated that tree protection measures need to be implemented to protect trees proposed to be retained during construction, which should include consideration of:

- Tree protection zones, which should be identified for any tree that is located in '12 x tree trunk diameter' of any construction zone in consideration Council's Street and Park Tree Management Plan. Within these zones there would be restricted access for construction staff, vehicles, equipment and storage of material.
- Appropriate fencing and signage, with a material screen wrapped around the fence.
- Ground protection measures such as mulch, watering, geofabrics.

Response

As per standard mitigation measure 'B1', the proposal would be constructed in accordance with Transport's *Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects* (RMS, 2011), which includes protocols relating to the clearing of vegetation. In response to Penrith City Council's submission, additional mitigation measure 'B11' has been amended (refer to Section 6.2) to note that 'Vegetation removal would occur in accordance with *Vegetation Management (Protection and Removal) Guideline* (Transport, 2021).' These guidelines set out the requirements for vegetation clearing, including tree protection zones, fencing and signage and ground protection measures during construction.

The vegetation clearance boundary would continue to be refined in accordance with the design changes outlined in Chapter 4. Standard mitigation measure 'B2' has been amended to note that 'The limit of clearing will be confirmed in a revised vegetation clearance boundary, within which construction work would not be permitted to occur.'

3.2.4 Non-Aboriginal heritage

Existing environment

Issue description

Penrith City Council commented that there is little information provided explaining heritage themes, their interpretation in the landscape and how they have been determined and requests further detail.

Response

The Statement of Heritage Impact (SOHI; provided as Appendix F of the REF) provided an overview of the history of the proposal area, including relevant heritage themes. Opportunities for heritage interpretation identified in the urban design concept would be further developed during detailed design. This may involve:

- applying interpretive treatment to noise walls, including at pedestrian portals where there is pedestrian access between Mamre Road and local roads of St Clair

- further development of the interface with the proposal and Mamre House
- provision of interpretive signage at portals and/or near identified heritage items.

Operational impacts

Issue description

Penrith City Council provided comments relating to the assessment of the impacts of the proposal on heritage during operation, including that:

- a SOHI should be prepared for each site that outlines the heritage value
- further information is required on why particular design options were chosen and considered to result in the best heritage outcome
- view impacts to and from Mamre House are to be considered in any final SOHI to inform any response in relation to landscaping of the area, verges and site.

Response

The final SOHI for the proposal was attached as Appendix F to the REF, which provides an assessment of impacts on each heritage site within and close to proposal. This assessment considered both direct impacts and indirect impacts on heritage sites, such as changes to views to and from Mamre House. Design options to respond to the heritage setting will continue to be developed during detailed design in consultation with specialist heritage advice.

The SOHI was carried out in line with Transport processes for assessment of heritage impacts. It adopted the approach and terminology outlined in the Australia ICOMOS Charter for Places of Cultural Significance (Australia ICOMOS, 2013) (*the Burra Charter*). In addition, the SOHI was prepared in accordance with the following heritage guidelines and policy documents:

- Heritage Council of NSW Statements of Heritage Impact (updated 2002)
- Heritage Council of NSW Assessing Heritage Significance: NSW Heritage Manual (updated 2002)
- Heritage Branch, Assessing Significance for Historical Archaeological Sites and 'Relics', 2009.

As such, it is considered that there is no need to prepare further heritage options analyses or any additional SOHIs for the proposal.

Mitigation measures

Issue description

Penrith City Council provided comments relating to mitigation measures proposed for heritage impacts including that:

- All artists should be considered for developing artistic responses to the heritage themes identified (both Aboriginal and non-Aboriginal).
- John and Gregory Blaxland were associated with the Luddenham Road, which may be appropriate to address in the Interpretation Plan.
- Further details of the proposed conservation of the Memorial Cairns and their setting, detailing any proposed interpretive signage, should be provided.
- Mamre House is a high-profile heritage listed property and important to warrant a reconsideration of design to enable an appropriately landscaped interface. In particular, Council commented that the design of the heritage interpretation area and new entry drive is not supported and the option for interpretation on the eastern noise wall is questionable and requires more specialist heritage advice and consultation with Council.

Response

Heritage interpretation opportunities on the noise wall and near the Memorial Cairns has not been confirmed. This would be considered further during detailed design.

The following additional mitigation measures provide guidance for how opportunities for interpretation of heritage would be considered further during detailed design (refer to Section 6.2):

- NAH4 – design near Marsden Memorial Cairn
- NAH5 – design near Mamre House driveway
- NAH6 – heritage interpretation opportunities.

Transport notes that the proposal design was discussed with Heritage NSW and Catholic Care (the operator at Mamre House). Heritage NSW was generally supportive of the proposal during consultation prior to the display of the REF. The proposal would be ultimately subject to approval through a section 60 application to Heritage NSW under the *Heritage Act 1977*.

Since public display of the REF, further consultation has been undertaken with Penrith City Council regarding the management of non-Aboriginal heritage within Mamre House. Transport notes that Council have expressed support for the proposed management of heritage values via archival recording and have requested a copy of any archival recording documentation prepared. The provision of archival recording documentation to Council has been added to mitigation measure NAH7 (refer to Section 6.2).

3.2.5 Traffic and transport

Assessment methodology

Issue description

Penrith City Council commented that the forecast traffic models assumed that the proposed four lane Southern Link Road (south of the water pipeline) will be delivered by year 2026, however noted this is not a currently committed timeframe by the NSW Government. As such, Council recommended a sensitivity analysis be carried out to understand the forecast traffic impact along Mamre Road and any associated mitigation measures required.

Response

A sensitivity analysis will be carried out during detailed design to understand the influence of the Southern Link Road construction on the expected traffic performance of the proposal as suggested by Council. An additional mitigation measure TT13 has been proposed to reflect this commitment (refer to Section 6.2).

Existing environment

Issue description

Penrith City Council commented that there are approximately five pedestrian laneways that provide direct pedestrian links to Mamre Road from adjoining streets/cul de sacs in St Clair, which should be considered and are:

- Alpine Lane (from Alpine Circuit to Mamre Road)
- Biwa Lane (from Rotorua Road to Mamre Road)
- Mamre Lane (from Alpine Circuit to Mamre Road)
- Palena Lane (from Rotorua Road to Mamre Road)
- Rotorua Lane (from Rotorua Road to Mamre Road).

In addition, Council noted that pedestrian laneways support connectivity, encourage safe and active uses of pedestrian and cycleways and are particularly important given the close proximity and connection to local schools and community services such as childcare centres and local shops.

Response

Transport notes that the laneways identified by Penrith City Council provide connectivity to pedestrians and cyclists near Mamre Road. The proposed shared path on the eastern side of Mamre Road would tie in to some of the existing laneways which connect Mamre Road with the residential streets of St Clair. This would enhance the use of these laneways by improving pedestrian and cyclist connectivity near the proposal.

Construction and operational impacts

Issue description

Penrith City Council raised concern about the potential for increased congestion around major road exits and entrances during construction and operation at:

- the M4 onramp westbound (north of Banks Drive).
- the left turn off Mamre Road southbound onto Banks Drive.
- streets used to access local schools, such as Banks Public School, which are already affected by long traffic commutes and congestion that can increase driver frustration.

Response

Temporary congestion during construction of the proposal is generally unavoidable during road upgrades. This would be minimised through the staging strategy for the proposal, which would generally facilitate one lane of traffic in each direction to allow Mamre Road to remain operational throughout construction. For specific construction activities where this is not practical, construction work would be undertaken out of peak traffic periods using temporary traffic management arrangements, such as night time and weekend lane closures, and traffic controls to divert or detour vehicles onto the surrounding road network around the worksite for short periods. After each night or weekend shift, traffic conditions would return to normal to minimise the impact to road users.

Since public display of the REF, several improvements to the road design around the Banks Drive intersection have been proposed to improve traffic flow and the performance of this intersection (refer to Sections 4.5 and 5.4).

Mitigation measures

Issue description

Penrith City Council provided comments and suggestions to mitigate the traffic and transport impacts of the proposal, including that:

- pedestrian laneways should remain open, accessible and well-maintained during construction, where possible, to provide safe pedestrian links for residents accessing local services, schools and bus stops
- Transport must outline measures to be implemented to ensure a safe environment for laneway users during construction such as letterbox drops, notification of residents/schools of closures and clear signage for pedestrian detours
- vehicle mitigation measures, such as bollards, signage and lighting, must be provided during construction
- Transport is to ensure affected properties retain pedestrian and vehicle access during construction.

Response

Where possible, property access and pedestrian access would be maintained during construction. However, temporary closures of laneways may be required during the construction of the noise wall to protect the safety of pedestrians when work is occurring in the near vicinity. If these were required, detours would be provided to safely maintain access for pedestrians. Safety barriers would separate users from the construction zone, to provide safe passage during construction.

Relevant mitigation measures to manage any changes in access proposed during construction include (refer to Section 6.2):

- GEN2, 'All businesses, residential properties and other key stakeholders (eg schools, local councils) affected by the activity will be notified at least five days prior to commencement of the activity.'
- TT8, 'Detours during temporary access changes will be implemented with directional signage along alternate routes, including advice to pedestrians and cyclists of any path closures.'
- TT10, 'Property access will be maintained where feasible and reasonable and property owners (including Erskine Park Rural Fire Service and Mamre House) will be consulted before starting any work that may restrict or control access.'
- TT11, 'Council will be consulted with prior to any local road or shared path closures to identify suitable mitigation measures such as detour routes.'

Some existing bus stops on Mamre Road would be relocated during construction to a safe location away from construction activities, so it is anticipated that there may be reduced pedestrian movements through the laneways to Mamre Road. This would further minimise the impact on pedestrians due to temporary laneway closures.

3.2.6 Landscape character and visual

Assessment methodology

Issue description

Penrith City Council provided comments relating to the landscape character and visual assessment for the proposal including that:

- the 'Movement and Place' role of the road should be determined based on the NSW Government Architect guidelines and how this has been addressed should be clearly articulated in the Urban Design Report
- the Urban Design report should be amended to ensure the proposal meets the objectives and principles outlined in Chapter 1
- the landscape character chapter only assesses the level of impact based on existing character and does not consider improvements to landscape character required or provide an understanding of the historical landscape character of the area to inform character enhancement strategies.

Response

The urban design strategy and landscape character and visual impact assessment for the proposal has been prepared in accordance with the objectives and principles outlined in Chapter 1 of Appendix K to the REF and relevant Transport guidelines (*Environmental Impact Assessment Practice Note - Guidelines for Landscape Character and Visual Impact Assessment (EIA-N04) Version 2.2* (Transport, 2020d) and *Beyond the Pavement* (Transport, 2020)).

The urban design report prepared for the REF is not proposed to be updated, as this is considered a final document. However, the urban design response has considered the Movement and Place guideline and will continue to be developed during detailed design in consideration of relevant guidelines, objectives and

principles. The further development of the urban design strategy will also aim to improve the amenity of the road corridor, and thus the enhance the existing landscape character, as suggested by Council.

Mitigation measures

Issue description

Penrith City Council provided suggestions for mitigation measures relating to the landscape character and visual impacts of the proposal, including that:

- the tree size along the road corridor should be considered to minimise visual impact and impact on landscape character due to the proposed new road works, longevity of the trees planted, heat mitigation and amenity for pedestrians and cyclists
- the existing 'leafy' character of Mamre Road should be preserved and achieved through carefully considered tree planting, species and sizes
- measures to minimise urban heat should be considered during detailed design in line with the Cooling the City Strategy, including consideration of water either on the surface or stored in the soil profile, ground cover that is permeable and grassed and tree cover.

Response

Penrith City Council's suggestions will be considered further during detailed design, which is reflected in the additions to mitigation measure LV3 (refer to Section 6.2).

Further detail regarding how Penrith City Council's suggestions have been considered regarding the landscape design for the proposal (including suggestions related to tree size, planting and urban heat minimisation) is provided in Section 3.2.1 of this report. An urban design concept has been developed for the proposal that considers maximising opportunities for tree planting close to the shared path to protect pedestrian areas from heat (refer to Section 3.2.3 and Appendix K to the REF). The final landscape design would be confirmed during detailed design and would seek to implement Cooling the City Strategies, where possible, to provide shade and protection from heat.

3.2.7 Socio-economic, property and land use

Operational impacts

Issue description

Penrith City Council commented that the installation of a noise wall in the proposed location is not consistent with the applicable Plan of Management for the land, as such continued discussions with Council's Property department is required.

Response

Discussions between Transport and Penrith City Council are ongoing in consideration of the Plan of Management for the land on which the noise wall is currently proposed. As noted in Section 2.4.4, the noise wall design is subject to ongoing refinement and would be confirmed during detailed design.

3.2.8 Aboriginal heritage

Mitigation measures

Issue description

Penrith City Council queried what recommendations the local Aboriginal Community has proposed not only for Aboriginal archaeology but also current and future associations with Aboriginal living heritage. Council also commented that the recommendations of the Aboriginal cultural heritage and Aboriginal archaeological studies shall be implemented in consultation with the identified local Aboriginal people and stakeholders.

Response

The consultation with the local Aboriginal community carried out during development of the proposal and draft Aboriginal Cultural Heritage Assessment Report (CHAR) is summarised in Section 5.3 of the REF. The responses received from the Aboriginal community on the draft CHAR were generally in support of the recommendations outlined in the CHAR and no additional issues were raised.

Following approval of the AHIP, Aboriginal stakeholders will continue to be involved through the salvage process and long-term management of Aboriginal artefacts.

3.2.9 Water quality and soil

Mitigation measures

Issue description

Penrith City Council queried what specific measures are proposed to protect the receiving waterways from the increased pollutant loads during construction (e.g. gross pollutants).

Response

A water quality and soil impact assessment has been carried out for the proposal in accordance with relevant guidelines and is attached as Appendix I to the REF. Mitigation measures recommended to be implemented during detailed design and construction are outlined in Section 6.2.

A Soil and Water Management Plan (SWMP) would be prepared and implemented as part of the CEMP to manage water quality impacts during construction of the proposal (refer to standard mitigation measure SQ1 in Section 6.2). The SWMP would identify all reasonably foreseeable risks relating to soil erosion and sedimentation, dewatering and water pollution and describe how these risks will be addressed during construction. This would include the preparation and implementation of:

- a site-specific Erosion and Sediment Control Plan (ESCP) (refer to standard mitigation measure SQ2 in Section 6.2)
- a construction water quality monitoring plan (refer to additional mitigation measure SQ3 in Section 6.2).

Transport will provide a copy of the ESCP to Penrith City Council.

During construction, temporary sediment basins would be installed in accordance with the *Draft Guideline for Assessing the Impacts of Treated Water Discharge from Water Quality Treatment Controls* (Transport, 2020) (refer to additional mitigation measure SQ16 in Section 6.2). These basins would minimise water quality impacts by capturing and treating sediment laden runoff from the proposal area prior to discharging the water to existing stormwater drains. This would manage the expected change in runoff, and the associated erosion and sediment risk during construction. Further consideration of how to manage stockpiles, material laydown and chemical storage with respect to floodwater run-off would be carried out during detailed design.

3.2.10 Cumulative impacts

Mitigation measures

Issue description

Penrith City Council commented that Transport must undertake a complete review of all infrastructure projects, both planned and underway, public and private, across the region to establish a co-ordinated delivery strategy, adjust delivery timeframes where necessary and ensure the impact on existing communities is minimised and managed. In addition, they commented that this must consider the impacts of long-term construction activities on road congestion, safety and urban amenity.

Response

Transport notes that the additional mitigation measures CU1, CU2 and CU3 (refer to Section 6.2) recommended to address cumulative impacts would satisfy Penrith City Council's request for ongoing management of cumulative impacts of the proposal. These measures would involve ongoing consultation and consideration of concurrent projects on surrounding communities and allow a coordinated delivery strategy to be developed.

The Community Stakeholder and Engagement Plan outlines commitments to identify and implement appropriate safeguards and management measures to minimise cumulative impacts of the proposal on the surrounding community (refer to additional mitigation measure CU1 in Section 6.2). This would include management of the interfaces of the proposal's staging and programming in combination with the other projects occurring in the area.

Transport would coordinate with the project teams for nearby infrastructure projects and the Transport Management Centre about the proposed timing of the road and lane closures (refer to additional mitigation measure CU2 in Section 6.2). This would allow alternate routes or additional safeguards and management measures to be identified as required to minimise impact on the surrounding communities.

The CEMP would consider potential cumulative construction impacts from known surrounding development activities as well as new planned development activities near the proposal, as they become known (refer to additional mitigation measure CU3 in Section 6.2). This would include a process to regularly review and update mitigation measures as new works are identified that may lead to cumulative impacts or if complaints are received due to cumulative impacts.

3.2.11 Consultation

Request for further updates and consultation

Issue description

Penrith City Council requested further updates and consultation associated with several aspects of the proposal including the detailed design of roadside furniture, street lighting, canopy tree planting, plant species, ground treatments, fauna connectivity measures, noise wall design, heritage interpretation, bus stops, rest areas and median planting as well as maintenance and access needs for Council assets.

Response

Transport has noted Penrith City Council's interest in ongoing consultation during detailed design of the proposal. Transport will continue to consult with Council about the proposal and provide design updates for the matters identified.

Request for social impact assessment

Issue description

Penrith City Council queried whether the proposal triggers the need to prepare a social impact assessment and if so, whether this could be provided to Council's Social Strategy Officer.

Response

A socio-economic impact assessment was carried out for the proposal in accordance with Transport's *Environmental Impact Assessment Practice Note – Socio-economic Assessment (EIA-N05)* (Transport, 2020c). It was attached as Appendix M to the REF and was summarised in Section 6.10 of the REF. Transport will follow up with Penrith City Council regarding any further comments related to social impact during the development of the detailed design of the proposal.

3.2.12 Environmental management

Environmental management framework

Issue description

Penrith City Council commented that the REF satisfactorily identifies the key impacts and issues associated with the proposal. They noted that as outlined in the REF, the proposal would be carried out in accordance with relevant Transport guidelines, legislation, standards and policies that apply to all industries, applicants, and developers and would be subject to an Environment Protection License (EPL) issued by the NSW Environment Protection Authority (EPA).

Response

Transport acknowledges Penrith City Council's support for the assessment carried out and the environmental management framework proposed in the REF.

3.3 Sydney Water

3.3.1 Impacts on utilities

Existing environment

Issue description

Sydney Water provided several comments related to Sydney Water assets within the proposal area, including that:

- Sydney Water owns and operates drinking water and wastewater trunk and reticulation infrastructure along Mamre Road between the M4 Motorway and Erskine Park Road, which provide potable water and wastewater services to customers in St Clair and Erskine Park
- there are three new assets (two wastewater pressure mains and a drinking watermain) proposed by Sydney Water along Mamre Road that are due for completion in 2022 or 2023, which should be considered in the design
- some of Sydney Water's existing assets near the proposal are considered critical and in need of protection
- under Sydney Water's Operating Licence and Customer Contract, its existing assets are required to be fully operational at all times, including during and after construction of the proposal.

Response

As outlined in Section 3.5.4 of the REF, the proposal is expected to require the relocation of existing watermains owned by Sydney Water within the proposal area.

The strategy for the protection or relocation of existing utilities would be confirmed in consultation with Sydney Water during detailed design to minimise the risk of damaging utilities. Access to utilities along Mamre Road would be maintained for Sydney Water during and after construction, where possible.

The requirements to adjust and/or relocate existing Sydney Water assets along Mamre Road will continue to be refined during detailed design. This would also include further consideration of the planned future utilities noted by Sydney Water within the proposal area to avoid potential design conflicts and allow for growth in the area, where possible.

Mitigation measures

Issue description

Sydney Water provided several recommendations and requirements for mitigation measures to minimise the risk of impacts on their utility assets, including:

- requirement for early notice of construction staging and timing to allow sufficient time for Sydney Water to schedule shutdowns and reconnect its assets
- requirement for Sydney Water to have the right to assess the condition of impacted assets before, during and after construction
- request that access to Sydney Water assets should be maintained for operational and maintenance purposes
- requirement for safe, unrestricted access to Sydney Water assets throughout construction of the proposal
- recommendation to avoid transferring loading onto Sydney Water assets as changes to ground levels may impact buried assets
- requirement for Sydney Water's Asset Adjustment process to be followed for the relocation, adjustment and/or protection of Sydney Water assets
- recommendation that if assets are required to be changed, the environmental approval needs to cover all work that would be a result of the proposal
- request for Sydney Water to be able to consider the need for amplification of assets to facilitate future growth along the development corridor during detailed design
- requirement for the proposed stormwater management network is well designed to manage the quantity and quality of stormwater runoff from the road upgrade and consider integrated waterway outcomes during detailed design.

Response

The recommendations and requirements for mitigation measures suggested by Sydney Water to minimise impacts on existing or future planned Sydney Water assets have been considered and addressed in existing mitigation measures O6 and O7 as well as additional mitigation measures O11 and O12 (refer to Section 6.2).

New and upgraded stormwater drainage and WSUD infrastructure will be designed to be appropriate for the expected quantity and quality of stormwater runoff from the proposal and consider integrated waterway outcomes. The final drainage and WSUD design will be confirmed during detailed design in consideration of the changes to the proposal outlined in Chapter 4.

3.3.2 Waste

Issue description

Sydney Waters' requirements for any trade waste licence request (such as removal of leachate) and environmental approvals for the discharge of chlorinated water (due to watermain shutdown and reconnection of live Sydney Water assets), need to be considered during construction of the proposal.

Response

These requirements have been added into mitigation measure O3 (refer to Section 6.2) to make sure they are considered during preparation of the Waste Management Plan for construction of the proposal.

3.3.3 Cumulative impacts

Mitigation measures

Issue description

Sydney Water commented that they would be delivering infrastructure in 2023 along Mamre Road between James Erskine Drive and Elizabeth Drive which would result in lane closures and traffic flow impacts and may have an impact on the construction of the proposal. Sydney Water requests continued discussion and coordination between Transport, Sydney Water and the Western Sydney Utilities Technical Group.

Response

It is acknowledged that there is potential for cumulative traffic impacts with surrounding projects during construction of the proposal, including those proposed to be delivered by Sydney Water in 2023. Transport will continue consultation and coordination with Sydney Water and the Western Sydney Utilities Technical Group to minimise cumulative impacts as much as possible (refer to mitigation measure CU2 in Section 6.2).

3.3.4 Support for REF

Issue description

Sydney Water commends Transport on the consultation across agencies in development of this REF, including acknowledgement of the Dharug, traditional custodians of the land along Mamre Road.

Response

Transport appreciates Sydney Waters' support regarding the consultation carried out across agencies during preparation of the REF and the acknowledgement of the traditional custodians of the land within the REF.

3.3.5 Consultation

Request for further updates/consultation

Issue description

Sydney Water provided comments relating to further updates and consultation, including that it:

- requests continued consultation with its Infrastructure Development team to ensure protection of its assets and early identification of potential asset amplifications
- strongly encourages Transport to obtain endorsement and/or approval from Sydney Water to ensure that the proposed road upgrade does not adversely impact on existing and future Sydney Water assets, including properties and easements
- encourages continued cross agency consultation and coordination, including through the Western Sydney Utilities Technical Group
- requests a meeting with Transport to agree on the best location for the one of these assets (a wastewater pressure main).

Response

Transport acknowledges the need for the strategy for the protection or relocation of existing utilities to be confirmed in consultation with utility owners during detailed design to minimise the risk of damaging utilities and achieve the best outcomes. Transport welcomes further cross agency consultation and coordination including with Sydney Water and the Western Sydney Utilities Collaboration – Technical Working Group during further development and delivery of the proposal.

3.4 Western Sydney Utilities Collaboration – Technical Working Group

3.4.1 Proposal design and construction

Stormwater management

Issue description

Western Sydney Utilities Collaboration – Technical Working Group notes there is work currently being developed for South Creek which would impact stormwater management for that catchment. This work should be considered by Transport to ensure stormwater floodplains are not compromised and the health of the existing creeks is protected during operation of the proposal.

Response

Additional detail has been added to mitigation measure SW11 (refer to Section 6.2) to make sure that the existing work being carried out for South Creek is considered during finalisation of the drainage infrastructure and stormwater management during detailed design.

3.4.2 Support for REF

Adequacy of REF

Issue description

Western Sydney Utilities Collaboration – Technical Working Group noted that it believes the REF is well written and covers technical aspects to be considered in design. It commends Transport for acknowledging the traditional custodians of the land.

Response

Transport acknowledges Western Sydney Utilities Collaboration – Technical Working Group’s support for the assessment carried out in the REF and the acknowledgement of the traditional custodians of the land.

3.4.3 Consultation

Request for further updates/consultation

Issue description

Western Sydney Utilities Collaboration – Technical Working Group provided comments relating to further consultation related to the utility strategy for the proposal, including that it:

- encourages early consultation with each utility provider to align with their operating requirements and processes
- recommends strong collaboration and coordination with all utility providers from design through to operation of the proposal
- would like to work further with Transport to coordinate utility co-location in the next phases of the proposal.

Response

Transport has noted Western Sydney Utilities Collaboration – Technical Working Group’s interest in continuing their involvement in the next phases of the proposal and welcomes further collaboration and coordination with all utility providers from design through to operation. This consultation would include confirmation of operating requirements and processes with each utility provider and coordination of utility co-location.

3.5 Western Sydney Airport

3.5.1 Proposal design and construction

Public transport provision

Issue description

Western Sydney Airport provided comments relating to public transport provision, including that:

- the proposal currently makes provision for replacement of existing bus stops and provision of space for future bus priority lanes at some intersections
- existing bus services through the proposal area are minimal, with limited bus routes which operate at 30- to 60-minute intervals
- the proposal focuses on allowing the continuation of existing bus services, rather than account for future growth of bus services throughout the Western Parkland City
- in the future, Mamre Road between the M4 Motorway and Erskine Park Road is likely to be used as a key movement corridor by both Transport regular public transport services and Sydney Metro Rail replacement services, which would generate demand for additional bus priority measures.

Response

The proposal has been designed to allow for the continuation of existing bus services along Mamre Road through the replacement of bus stops as well as the future growth of bus services by including space for future bus priority lanes. As noted in Section 3.2.1, the future bus priority left turn lanes would be

constructed as part of the proposal, however would not be line marked or provided dedicated traffic signals. As such, this would allow for bus priority to be easily implemented in the future, as required.

Queries about surrounding roads

Issue description

Western Sydney Airport noted that the proposal would upgrade a short 250 to 300 metre section of Luddenham Road to allow for the intersection upgrade with Mamre Road. Given Luddenham Road has been identified as a strategy corridor within the Western Sydney Aerotropolis Plan, they recommended further considering how the proposal would integrate with the Luddenham Road strategic corridor and whether an extension of the proposal to duplicate Luddenham Road as far south as the Water NSW Pipeline would be beneficial.

Response

As discussed in Section 2.10.3, Luddenham Road is a local road managed by Penrith City Council. As such, the upgrade of Luddenham Road as far south as the Water NSW pipeline is outside of the scope of this proposal and any planning for the future upgrade of this road would be confirmed by Penrith City Council.

The proposal has generally allowed for future proofing of the Luddenham Road intersection to allow it to be suitable for a future upgrade of Luddenham Road to three lanes in each direction, as requested by Penrith City Council. However, since the public display of the REF, the space for a future second left turn lane from the northbound carriageway of Mamre Road onto Luddenham Road has been removed from the design (refer to Section 4.3). Despite this, the design does not preclude this second left-turn lane being built in the future separately to this proposal, if determined to be required based on increase in traffic volumes.

Separate to this proposal, the Department of Planning and Environment (DPE) has identified the potential for Luddenham Road to be upgraded to a 60-metre road corridor in the future as part of the Western Sydney Aerotropolis project, subject to planning approval and funding availability. Sydney Metro is also carrying out work on Luddenham Road associated with the future Luddenham station as part of the Sydney Metro – Western Sydney Airport project.

Wildlife attraction and aviation risk

Issue description

Western Sydney Airport noted that the proposal is partially located within wildlife buffer zones as prescribed by State Environmental Planning Policy (Western Sydney Aerotropolis) 2020 (now consolidated as part of State Environmental Planning Policy (Precincts – Western Parkland City) 2021 (Western Parkland City SEPP)). Due to the provision of substantial planting in the proposed design, Western Sydney Airport recommends that a review of species in the context of wildlife attraction and aviation risk is carried out. Given similar work has recently been carried out by the M12 Motorway project team, further discussions with the M12 Motorway project team is recommended.

Response

The potential wildlife attraction and aviation risk, and how this may be influenced by the landscape design and species selection for the proposal, will be considered further during detailed design. This will be informed by discussions with the M12 Motorway project team as suggested by Western Sydney Airport. Additional mitigation measure LV3 has been amended to reflect this commitment (refer to Section 6.2). It is noted that the section of Mamre Road within the proposal area is further away from the Western Sydney Aerotropolis than the proposed M12 Motorway and therefore any wildlife attracted by planting surrounding Mamre Road may pose a lower aviation risk.

3.5.2 Proposal need and options

Support need

Issue description

Western Sydney Airport acknowledged that there are strategic benefits of upgrading the full length of Mamre Road between the M4 Motorway and Elizabeth Drive. Western Sydney Airport wishes to see this upgrade realised as there would be strategic benefits of the full upgrade, including:

- enabling Mamre Road to perform as an integrated north-south movement corridor within the Western Parkland City
- alignment of the Mamre Road upgrade with the Stage 1 development of Western Sydney Airport to be completed in 2026 as well as the Initial Precincts of the Western Sydney Aerotropolis
- compounding economic benefits throughout the region
- provision of an interchange at Devonshire Road, which would improve connectivity.

Response

The NSW Government has identified the need to upgrade Mamre Road to provide an improved link between the M4 Motorway in the north and Elizabeth Drive in the south (referred to as the Mamre Road upgrade project). Transport has noted the support for upgrading the full length of Mamre Road, including to support economic and residential growth in the surrounding area and the Western Sydney Aerotropolis.

Following the exhibition of the strategic design for the Mamre Road upgrade project in 2017, community concern about the safety of Mamre Road for residents within St Clair and Erskine Park and availability of funding has led to the prioritising of the section of Mamre Road between the M4 Motorway and Erskine Park Road for upgrade.

Subject to further funding being secured, the section of Mamre Road between Erskine Park Road and Kerrs Road may still be upgraded separately to this proposal in the future. Funding is made available following a state-wide assessment of priority. For example, the M12 Motorway also includes provision for a future interchange and link between Devonshire Road and Mamre Road, however this is dependent on additional funding being available.

Transport also notes that some work along Mamre Road may be delivered by developers adjacent to the road corridor.

Timing of future upgrades

Issue description

Western Sydney Airport noted that the proposal is the first stage of the upgrade of Mamre Road, with later stages at varying phases of strategic design, detailed design or funding. It was identified that the proposal would resolve some short-term issues (notably congestion between the Western Sydney Employment Area and the M4 Motorway). However, further certainty is required about funding, detailed design and timing of the later stages of the upgrade of Mamre Road.

Response

The NSW Government initially committed \$220 million to the upgrade of Mamre Road between the M4 Motorway and Erskine Park Road (the first stage of the Mamre Road upgrade). In September 2020, the proposal was fast-tracked as a part of the Jobs and Infrastructure Acceleration Fund and an additional \$28.2 million in funding for the proposal has been committed to the proposal.

As described in Section 2.1.1, the construction staging of the proposal has been further refined since public display of the REF, so that:

- the northern section of Mamre Road generally between the M4 Motorway and Chad Place has been prioritised for upgrade
- the southern section of Mamre Road generally between Chad Place and Erskine Park Road may start to be built later than the northern section, depending on funding availability.

The exact timing of the commencement of construction for the upgrades to the northern and southern sections of Mamre Road (as outlined above) would be confirmed during detailed design.

The later stages of the Mamre Road upgrade (involving upgrades south of Erskine Park Road) are subject to availability of additional funding, which has yet to be secured. As such, the timing of these further upgrades is currently unknown.

3.5.3 Consultation

Request for further updates/consultation

Issue description

Western Sydney Airport commented that it has been working collaboratively with Transport and the Western Sydney Planning Partnership on the strategic transport planning of the Western Sydney Aerotropolis and other roads surrounding the airport and looks forward to continue working with Transport in relation to future stages of the Mamre Road upgrade.

Response

Transport acknowledges Western Sydney Airport's collaboration in the development of the proposal and commits to ongoing consultation during detailed design and construction of the proposal.

Issue description

Western Sydney Airport recommended that the Transport and Sydney Metro teams responsible for bus planning in Western Sydney should be consulted to ensure that the proposed design is suitable to enable long term performance of the future Western City bus network.

Response

Discussions are ongoing with the Transport and Sydney Metro teams responsible for bus planning in Western Sydney.

3.6 Department of Planning and Environment

3.6.1 Proposal design and construction

Issue description

DPE queried whether the area within the Luddenham Road BioBank site (near the Luddenham Road intersection) can be avoided by the proposal. They commented that elsewhere in the vegetation clearance boundary, swales have been located to avoid disturbance to Cumberland Plain Woodland and River-Flat Eucalypt Forest threatened ecological communities (TECs), threatened fauna species and their habitat.

Response

The design for the proposal has been specifically refined to minimise removal of vegetation, particularly in areas where there are TECs and at the Luddenham Road BioBank site. This involved substantial refinement and optioneering of the tail-out channel work and proposed locations of water quality basins and swales.

A very small area (0.14 hectares) of the Luddenham Road BioBank site near the Luddenham Road intersection could not be avoided by the proposal. This is because swales were identified as important design features in this location to minimise water quality impacts from road runoff migrating into South Creek, which is Class 1 Major Key Fish Habitat. Swales would result in a smaller area of disturbance than water quality basins, which were originally considered for water quality treatment in this location. Alternate locations for the swales were investigated, however they were unable to provide adequate water quality treatment for this runoff from the Luddenham Road intersection.

Issue description

DPE commented that some local scale fauna connectivity impacts exist, which could be considered further. These relate to several species (including Cumberland Plain Land Snail, frogs, reptiles and woodland birds) using roadside vegetation west of Mamre Road to access South Creek and the Luddenham Road BioBank site. They suggested that culverts with both drainage and fauna connectivity functions could help facilitate improved under-road fauna connectivity.

Response

The proposal involves the replacement of several existing culvert structures with new upgraded reinforced concrete box culvert structures to achieve improved drainage and flood immunity. The potential for these culverts to also function for fauna connectivity, particularly for amphibians during wet periods, has been considered, which would be enhanced by:

- weed control within areas occupied by native vegetation next to culverts to enhance this habitat
- consideration of the potential to plant native tubestock along the road verge and banks near the culverts as part of the landscaping and species selection strategy for the proposal to enhance native canopy/mid-storey in the area
- regular maintenance and clearing of culverts.

These measures have been incorporated into additional mitigation measures B15 and LV3 (outlined in Section 6.2), where relevant.

3.6.2 Biodiversity

Issue description

DPE queried whether biodiversity credit obligations have been identified for impacts to the Luddenham Road BioBank site and noted this was unclear in the BDAR.

Response

All vegetation that occurs within the 'vegetation clearance boundary', which includes a small 0.14 hectare area within the Luddenham Road BioBank site, has been assessed as a direct impact in the BDAR and offset accordingly. This included identification of biodiversity credit obligations for:

- the removal of 0.14 hectares of PCT835 (River-Flat Eucalypt Forest) that occurs within the Luddenham Road BioBank site
- potential impacts to 0.14 hectares of potential Cumberland Plain Land Snail and Southern Myotis habitat within the Luddenham Road BioBank site.

Issue description

DPE noted that an assessment of serious and irreversible impacts (SAII) was carried out for Cumberland Plain Woodland (Table 7-4 in that BDAR) and suggested this assessment could be enhanced by a concluding statement of the likely direct, indirect, and cumulative impacts. DPE also noted that no commentary has been provided in the BDAR on why SAII assessments were not completed for River-Flat Eucalypt Forest, Swamp Oak Floodplain Forest, Cumberland Plain Land Snail and Southern Myotis.

Transport would compensate the Biodiversity Conservation Trust and the Office of Strategic Lands for any existing credits within the Luddenham Road BioBank site affected by the proposal, as required. This would form part of the retirement of biodiversity offset credits and property acquisition process for the proposal. This has been reflected in additional mitigation measure 'B16'.

Response

Serious and irreversible impacts are impacts that are likely to contribute significantly to the risk of a threatened species or ecological community becoming extinct in accordance with the principles set out in clause 6.7(2) of the Biodiversity Conservation Regulation 2017 (BC Regulation). To assist the decision-maker to evaluate the extent and severity of the impact on an entity at risk of SAII, the BDAR must contain details of the assessment of SAIIs, in accordance with the criteria set out in Subsection 9.1.1 for impacts on each TEC and in Subsection 9.1.2 for each threatened species.

An SAII assessment for Cumberland Plain Woodland, which is listed as a Critically Endangered Ecological Community (CEEC) under both State and Commonwealth legislation, has been carried out as it is considered an entity that is at risk of SAII and likely to be impacted by the proposal. This SAII is provided in section 7.4 of the BDAR.

The assessment concluded the following:

- The proposal would result in direct impacts to up to 4.36 hectares of Cumberland Plain Woodland, which represents around 0.06 per cent of the estimated current extent of the TEC in NSW and five per cent of the TEC within the locality.
- Indirect impacts from the proposal would create edge effects on the local occurrence of the TEC. Fragmentation of the TEC currently exists as scattered patches within the proposal area and about 21.09 hectares of TEC within the locality occurs as scattered patches ranging in size of about 0.02 hectares to greater than 5 hectares. The proposal would increase the distance between the already fragmented patches, particularly to those immediately next to the proposal area (see Figure 11 of BDAR).
- Cumulative impacts from surrounding activities (ie. agriculture, grazing and illegal land clearing) are likely to contribute to the decline the Cumberland Plain Woodland in the short-term, however the impacts as a result are unlikely to result in extinction of the local occurrence.
- Long-term cumulative impacts to Cumberland Plain Woodland within the locality may occur as a result of clearing for urban development. At this stage, the land immediately next to the proposal area, which encompasses the local occurrence of Cumberland Plain Woodland, has not been proposed as 'urban capable' land use category as mapped in the *Draft Cumberland Conservation Plan 2020* (DPIE 2020 Draft Cumberland Plain Conservation Plan 2020). However, future urban development could be sought through local government approval processes, which if were to occur, may further impact upon the already fragmented local occurrence of Cumberland Plain Woodland.
- The proposal for the most part, is proposed within a highly fragmented and impacted environment. The Cumberland Plain Woodland in its current form would likely further decline without sufficient remediation work due to the ongoing edge effects.

It is noted that since public display of the REF, the vegetation clearance boundary has been refined due to design changes, which has resulted in a revised estimate for the direct impacts to Cumberland Plain Woodland of 4.61 hectares (refer to Chapter 4 and Section 5.1). This change is not considered to affect the conclusions of the SAII assessment outlined in the BDAR for the REF.

No other threatened biodiversity at risk of SAIL were identified for consideration in the BDAR. River-Flat Eucalypt Forest, Swamp Oak Floodplain Forest, Cumberland Plain Land Snail and Southern Myotis are currently not regarded as a SAIL entities (as at 28th of February 2022 as supported by the NSW BioNet Threatened Biodiversity Database Collection (TBDC)).

Issue description

DPE suggested that given 16 records of Green and Golden Bell Frogs were identified within 10 kilometres of the proposal area, additional surveys could be undertaken to determine their presence, particularly at South Creek near Luddenham Road. They noted that the statement implying that this species does not occur in the proposal area due to the predatory fish, Eastern Gambusia, could be verified through further surveys, given the presence of other water bodies and grassy woodland habitat next to the proposal.

Response

Green and Golden Bell Frog surveys have been completed within the proposal area as detailed in Table 4-4 of the BDAR. The surveys were carried out during the correct survey time recommended by the TBDC, and did not determine the presence of the species in the proposal area. As such, the species has been assessed as being absent from the proposal area based on the survey results.

Issue description

DPE noted that surveys conducted for Little Bent-winged Bat, Large Bent-winged Bat and Southern Myotis were carried out outside of recommended Biodiversity Assessment Methodology (BAM) survey periods. Ideally, further surveys within the recommended BAM periods would ensure that a complete assessment of the potential impacts of the proposal on these species is carried out.

Response

As discussed in section 4.2 of the BDAR, targeted surveys during the correct survey months were not able to be completed for the Little Bent-winged Bat, Large Bent-winged Bat and Southern Myotis, however:

- the acoustic survey in April and May was just outside the recommended survey period for the species (October to March) and climatic conditions at the time of the survey were still mild (daily average temperature of 22°C)
- microbats were still recorded on anabat recording units regardless of the recommended months
- the acoustic detection was placed for a greater number of nights than guidelines propose
- the survey was supplemented with a greater number of trap nights than specified in the guidelines.

As a result, both the Little Bent-wing Bat and the Large Bent-wing Bat have been assessed in the BDAR as ecosystem credit species. The Southern Myotis was detected during the survey and generated an offset requirement. A Microbat Management Plan would be implemented during construction to further minimise potential impacts to microbats.

Issue description

DPE noted primary and secondary Koala food tree species were recorded in the proposal area and within the vegetation clearance boundary and that the Luddenham BioBank Site may also provide suitable foraging habitat for Koala. They suggested this could be confirmed given its proximity to the southern section of the proposal area.

Response

The Luddenham BioBank site is highly unlikely to be Koala habitat based on the following:

- No Koalas have been recorded within the locality and no evidence of Koala occupation was detected during field surveys for the proposal.
- If a viable Koala population was within the area, it is highly likely that Koalas would be encountered by the public, motorists or restoration ecologists working on South Creek and the BioBank site.

- The nearest historic records are about 10 kilometres to the south near Kemps Creek. These records are from 2002.
- The BioBank site is separated via roads and urban development, such that it is unlikely that the BioBank site would be used by Koalas.

In addition, the Luddenham BioBank site would not be able to generate Koala offset credits purely on the presence of feed trees. A Koala would need to be recorded within the site, or use of the BioBank site by Koalas would need to be demonstrated.

Issue description

DPE noted proposed drainage and flooding infrastructure work have the potential to impact adversely on aquatic species and their habitats in South Creek and two of its tributaries that bisect the proposal area. South Creek is classified as a Class 1 Major Key Fish Habitat. They also noted the aquatic habitat assessment was undertaken in September 2020, a time of drought in eastern Australia, which may have affected the presence of aquatic species in South Creek and other water bodies in or near the proposal.

DPE suggested consultation should be carried out with DPI Fisheries (if not already done) to confirm if South Creek contains habitat within the proposal area to support a freshwater fish community.

Response

Transport carried out consultation with DPI Fisheries during preparation of the REF (refer to Section 5.5 of the REF). DPI Fisheries recommended best practice measures to be adopted for design refinement, particularly for culvert outlet structures near South Creek, and noted no permit is likely to be required under the *Fisheries Management Act 1994* (FM Act), however this would be confirmed during detailed design. As per mitigation measure B10, Transport will continue consulting with DPI Fisheries during detailed design to identify any additional measures required to minimise potential impacts to aquatic habitat within South Creek.

In addition, it is unlikely that an additional aquatic ecology assessment completed following a period of rain or different season would substantially change the conclusions presented within the BDAR such that significant impacts to threatened aquatic ecology would likely occur. This is because the portion of South Creek to be impacted by the proposal is located in a highly modified landscape, which contains barriers from existing culverts, rubbish dumping and areas of sediment build up that would limit fish movement in times of low flow. Furthermore, based on an assessment of threatened aquatic species, a significant impact on any threatened species, communities or populations listed on the FM Act is unlikely given the temporary nature of construction work and the mitigation measures that would be employed.

Issue description

DPE commented that flora survey plots and transects were not located within the indirect impact buffer or adjacent habitat that occurs in Luddenham Road Biobank site. This is recommended given the moderate condition of this vegetation and the presence of suitable habitat, potentially for terrestrial orchids and *Pimelea spicata* (which was recorded during the nearby M12 Motorway project).

Response

The area of native vegetation to be impacted within the Luddenham BioBank site has been aligned to PCT835, which has been assigned a moderate condition vegetation zone. The 0.14 hectares of PCT835 to be directly impacted consists of a mix of native and introduced shrubs and ground-cover.

The native canopy and mid layer within the directly impacted area of the Luddenham BioBank site is dominated by Forest Red Gum (*Eucalyptus tereticornis*), Wattle (*Acacia parramattensis*), Blackthorn (*Bursaria spinulosa*), which is similar to the other BAM plots completed within the vegetation zone. Moreover, the introduced canopy and mid layer is dominated by Smalled-leaved privet (*Ligustrum sinense*), Large-leaved Privet (*Ligustrum lucidum*) and African olive (*Olea europaea*), which is similar to the other BAM plots completed within the vegetation zone. The ground cover was dominated by non-native grasses,

including Rhodes grass (*Chloris gayana*), Pigeon grass (*Setaria gracilis*), African love grass (*Eragrostis cuvula*), and Paspalum (*Paspalum dilatatum*).

A BAM plot has not been completed within the 0.14 hectare area of the Luddenham BioBank site to be directly impacted because:

- The required number of BAM plots per vegetation zone/area had been completed in accordance with the BAM. The condition of vegetation within the BioBank site did not differ in condition compared to the rest of the PCT835 moderate vegetation zone.
- The representative BAM plot is part of the same vegetation zone that has a vegetation integrity score of 72.4. It is highly likely that the vegetation within the BioBank site would be within this vegetation integrity range.
- There are no large trees or hollows.
- The shrub layer of Large and small-leaved privet, *Bursaria spinulosa* and *Acacia parramattensis* was relatively thick in areas, which would limit ground-truthing efforts in this area.

In regard to threatened flora, surveys were carried out within the 0.14 hectare portion of the Luddenham BioBank site to be directly impacted (as shown on Figure 5.2 of the BDAR). The surveys were carried out for candidate species listed in September, February, April and May as per Table 4-1 of the BDAR.

Threatened orchids, *Pimelea spicata* and all other candidate threatened flora have been surveyed and assessed in section 4.1 of the BDAR. No candidate species were detected during the surveys.

Pimelea spicata was assessed during the recommended timing as stated in the TBDC (which is anytime in the year). The field team consisted of Yogesh Nair and Luke Baker who are very familiar with this species as they have been involved in long-term monitoring for a *Pimelea spicata* monitoring program.

Issue description

DPE suggested additional actions for consideration to avoid, minimise and mitigate construction and operation impacts on biodiversity from the proposal as follows:

- Use tubestock for site revegetation comprising, wherever possible, tree, shrub and groundcover species that are members of Cumberland Plain Woodland, River-Flat Eucalypt Forest and Swamp Oak Floodplain Forest TECs.
- Temporary ancillary facilities to support construction including compound sites, stockpile and laydown locations, temporary access tracks, temporary waterway crossings and concrete batching plants should be located away from areas of native vegetation, i.e. in existing cleared areas.
- Design, install and maintain fauna fencing to minimise the risk of vehicle strike on fauna along the western impacted edge of Mamre Road and at new intersections, where practicable.
- Review the performance of the Microbat Management Plan as part of the CEMP to ensure adequate protection and mitigation of disturbance to culvert-roosting microbats during culvert construction, e.g., Large Bent-winged Bat and Little Bent-winged Bat.
- Review existing proposed clearance areas of Cumberland Plain Woodland as part of the BAM SAI process. Some areas that have been identified for removal within the vegetation clearance boundary in Section 7.4 (such as opposite Solander Drive intersection with Mamre Road) could be set aside for protection during construction and operation.

Response

The suggestions for mitigation measures raised by DPE have been considered and would be adopted, where practicable, as follows:

- The use of tubestock for revegetation as recommended by DPE would be considered further as part of the landscaping and species selection strategy for the proposal that will be developed during detailed design (refer to LV3 in Section 6.2).
- As discussed in Section 3.4 of the REF, the location of temporary ancillary facilities for the proposal has generally been selected in existing cleared areas away from areas of native vegetation.

- As per mitigation measure B7 (refer to Section 6.2), Transport will monitor road kills along Mamre Road to identify any additional measures required to minimise the risk of vehicle strike on fauna, as well as installing a replacement fence along the Luddenham Road BioBank site boundary.
- As discussed in section 7.5.4 of the BDAR, the likelihood of fauna interactions within the proposal area is low and therefore, the implementation of fauna proof fencing may not be necessary as:
 - It is estimated that vehicle strike rates would be low, which is supported by only a few historic records of vehicle collision along Mamre Road within the proposal area, and within five kilometres to the south of the proposal area (mainly to kangaroos/wallabies) as reported on Bionet.
 - The fauna survey did not detect a high abundance of fauna using the proposal area.
- As per mitigation measure B4 (refer to Section 6.2), the Microbat Management Plan to be implemented as part of the CEMP will include a protocol to routinely review and update the plan to ensure its effectiveness.
- As per mitigation measure B2 (refer to Section 6.2), the vegetation clearance boundary will continue to be refined with an aim to avoid and minimise further native vegetation or habitat removal during detailed design, particularly in areas of TECs including Cumberland Plain Woodland.

4. Changes to the proposal

Following exhibition of the REF, the proposal design has been refined (referred to as 'the revised design') in response to stakeholder feedback and further progression of the design.

Figure 4-1 indicates the locations where design changes are proposed in the revised design compared to the design outlined in the REF.

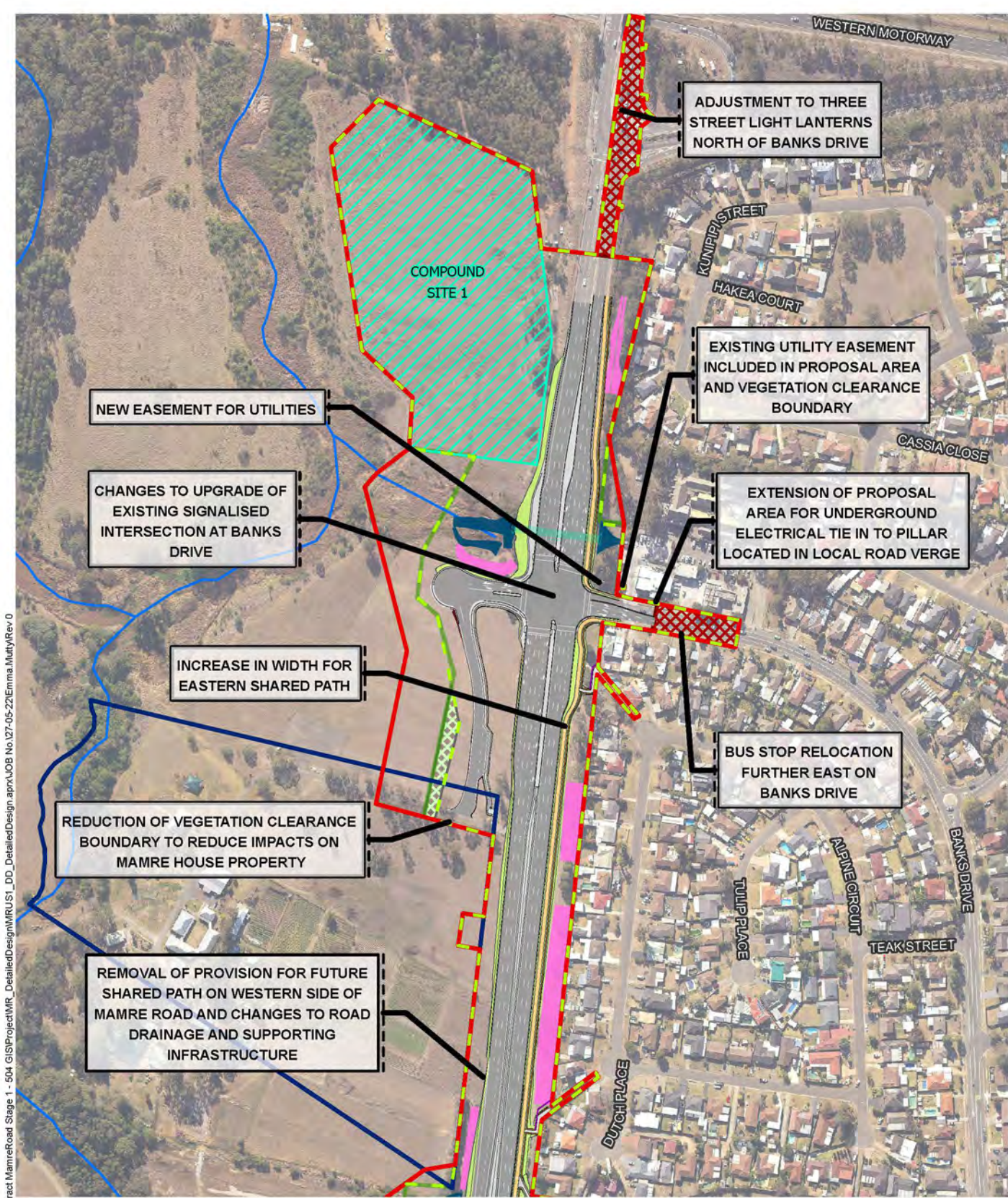
The design changes in the revised design include:

- replacement of the space provision for a future shared path on the western side of Mamre Road between Mandalong Close and Banks Drive with a paved shoulder and road verge
- an increase in width of the shared path on the eastern side of Mamre Road from three metres (as per the REF) to 3.5 metres. This would be confirmed during detailed design.
- changes to road drainage and supporting infrastructure along the western side of Mamre Road, including removal of most proposed pits and pipes from the REF design and introduction of swales and channels for the collection of stormwater
- removal of future provision for an additional left-turn lane from Mamre Road onto Luddenham Road
- changes to relocation of an existing 11 kilovolt overhead powerline owned by Endeavour Energy to be relocated overhead instead of underground (as per the REF)
- changes to the lane configuration at the Banks Drive intersection compared to the REF, including:
 - an increase in the number of through lanes proposed on Mamre Road at this intersection from two to three in each direction
 - changes to the northbound inside lane north of the Banks Drive intersection to become an exclusive right turn lane onto the M4 Motorway westbound on-ramp
 - a change along the westbound carriageway of Banks Drive from one right turn lane and one shared straight, right turn and left turn lane (as per the REF) to be two right turn lanes and a shared straight and left turn lane.
- adjustment to three street light lanterns to the north of the original proposal area outlined in the REF
- bus stop relocation further east on Banks Drive compared to the REF
- combining of proposed drainage near the Erskine Park Road intersection from two lines into one
- minor adjustments to the original proposal area and vegetation clearance boundary to allow for the connection of utilities to the surrounding network and incorporation of utility easements at Banks Drive
- slight reduction of land to be leased for construction near Mamre House to reduce property impacts.

The construction staging of the proposal has also been further refined since public display of the REF, so that:

- The northern section of Mamre Road generally between the M4 Motorway and Chad Place has been prioritised for upgrade.
- The southern section of Mamre Road generally between Chad Place and Erskine Park Road may start to be built later than the northern section, depending on funding availability.

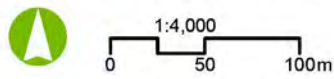
The exact timing of the commencement of construction for the upgrades to the northern and southern sections of Mamre Road (as outlined above) would be confirmed during detailed design.



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<ul style="list-style-type: none"> — Waterways — Culverts — Indicative noise wall ▨ Compound site options 	<ul style="list-style-type: none"> ▨ Revised REF proposal area ▨ Original REF proposal area ▨ Difference between original and revised REF proposal area ▨ Revised Vegetation Clearance Boundary ▨ Original Vegetation Clearance Boundary ▨ Difference between original and revised Vegetation Clearance Boundary 	<p>Revised Design</p> <ul style="list-style-type: none"> ■ Basin ■ Shared user path ■ Channel work ■ Concrete ■ Cut ■ Bank ■ Median ■ Road ■ Swale ■ Verge 	
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Source: Aurecon, Spatial Services, Nearmap, Esri



Date: 27/05/2022 Version: 1

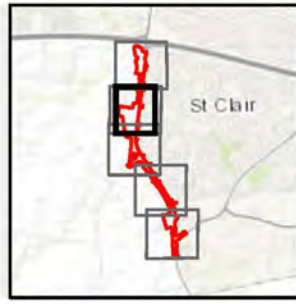
Mamre Road upgrade between the M4 Motorway and Erskine Park Road

Projection: GDA2020 MGA Zone 56 Figure 4-1: Design changes to the proposal following exhibition of the REF

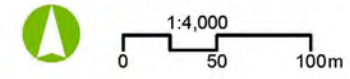


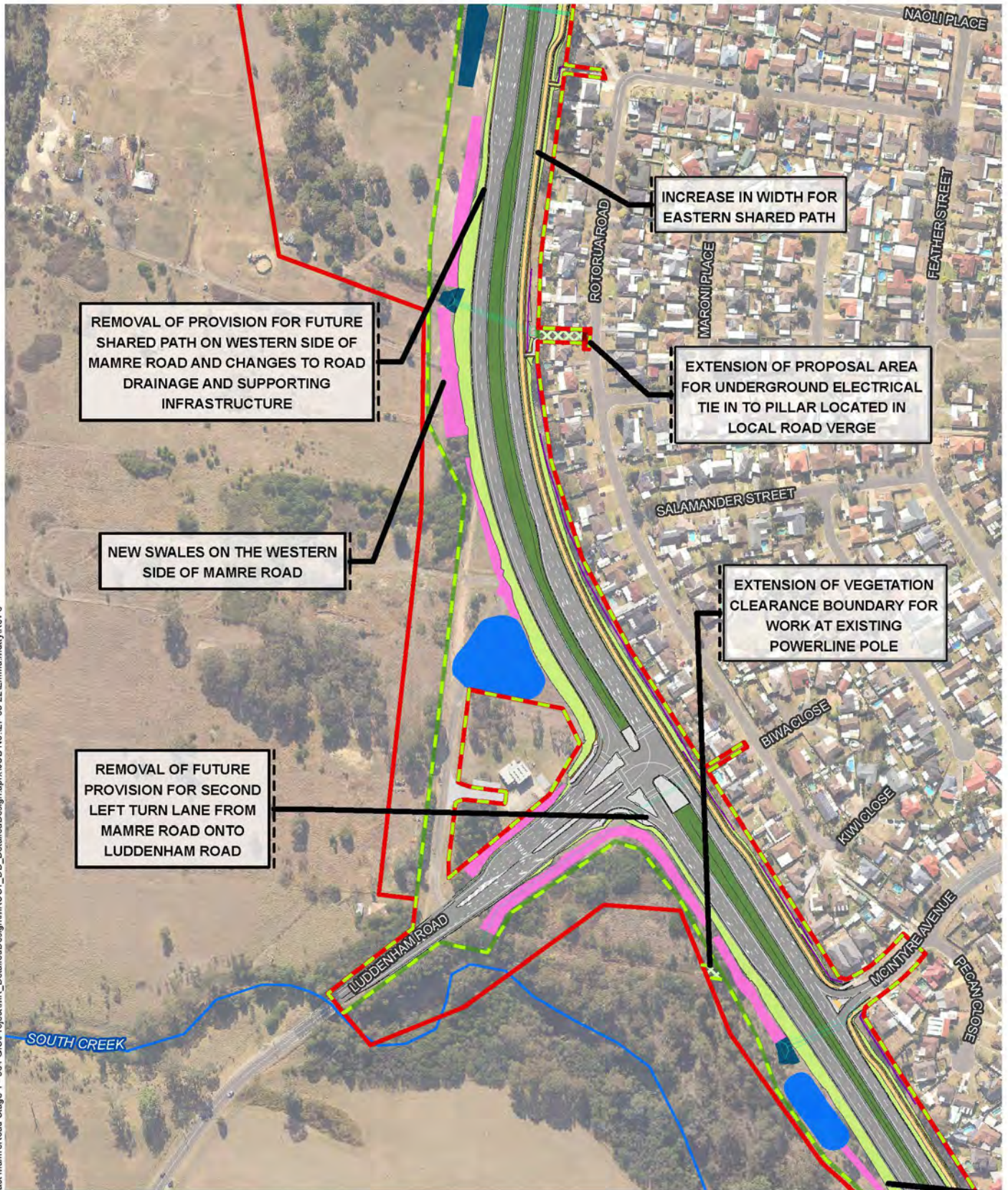
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Waterways	Revised REF proposal area	Revised Design Basin
Culverts	Original REF proposal area	Shared user path
Indicative noise wall	Difference between original and revised REF proposal area	Channel work
Compound site options	Revised Vegetation Clearance Boundary	Concrete
	Original Vegetation Clearance Boundary	Cut
	Difference between original and revised Vegetation Clearance Boundary	Bank
		Median
		Swale
		Verge



Source: Aurecon, Spatial Services, Nearmap, Esri





REMOVAL OF PROVISION FOR FUTURE SHARED PATH ON WESTERN SIDE OF MAMRE ROAD AND CHANGES TO ROAD DRAINAGE AND SUPPORTING INFRASTRUCTURE

INCREASE IN WIDTH FOR EASTERN SHARED PATH

EXTENSION OF PROPOSAL AREA FOR UNDERGROUND ELECTRICAL TIE IN TO PILLAR LOCATED IN LOCAL ROAD VERGE

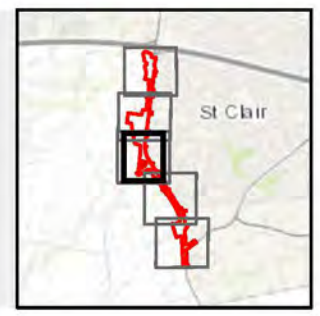
NEW SWALES ON THE WESTERN SIDE OF MAMRE ROAD

EXTENSION OF VEGETATION CLEARANCE BOUNDARY FOR WORK AT EXISTING POWERLINE POLE

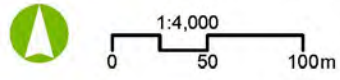
REMOVAL OF FUTURE PROVISION FOR SECOND LEFT TURN LANE FROM MAMRE ROAD ONTO LUDDENHAM ROAD

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| <ul style="list-style-type: none"> — Waterways — Culverts — Indicative noise wall — Compound site options | <ul style="list-style-type: none"> Revised REF proposal area Original REF proposal area Difference between original and revised REF proposal area Revised Vegetation Clearance Boundary Original Vegetation Clearance Boundary Difference between original and revised Vegetation Clearance Boundary | <ul style="list-style-type: none"> ■ Basin ■ Shared user path ■ Channel work ■ Concrete ■ Cut ■ Bank ■ Median ■ Road ■ Swale ■ Verge |
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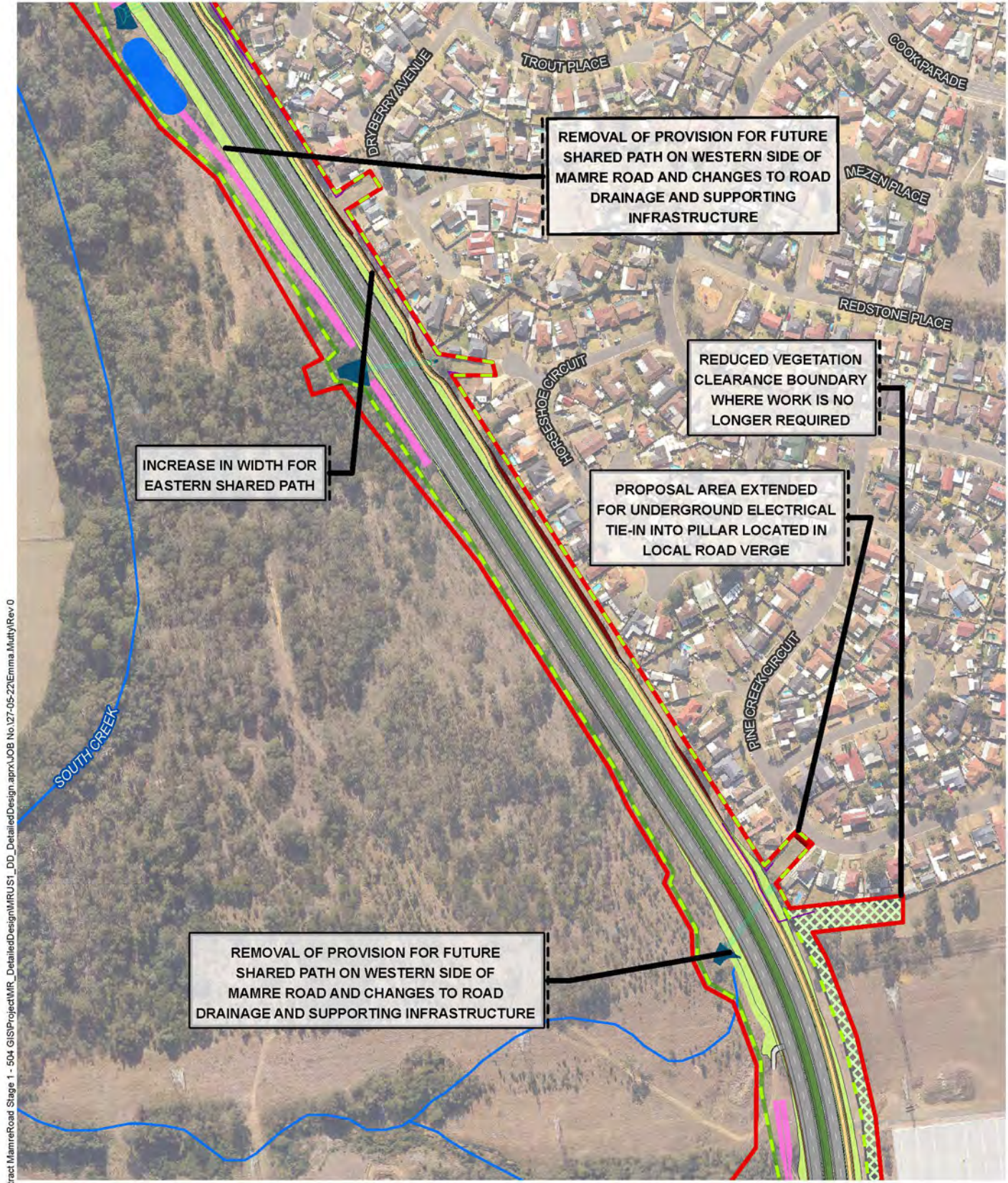
Source: Aurecon, Spatial Services, Nearmap, Esri



Date: 27/05/2022 Version: 1
 Projection: GDA2020 MGA Zone 56

Mamre Road upgrade between the M4 Motorway and Erskine Park Road

Figure 4-3: Design changes to the proposal following exhibition of the REF



INCREASE IN WIDTH FOR EASTERN SHARED PATH

REMOVAL OF PROVISION FOR FUTURE SHARED PATH ON WESTERN SIDE OF MAMRE ROAD AND CHANGES TO ROAD DRAINAGE AND SUPPORTING INFRASTRUCTURE

REDUCED VEGETATION CLEARANCE BOUNDARY WHERE WORK IS NO LONGER REQUIRED

PROPOSAL AREA EXTENDED FOR UNDERGROUND ELECTRICAL TIE-INTO PILLAR LOCATED IN LOCAL ROAD VERGE

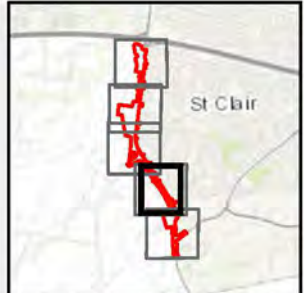
REMOVAL OF PROVISION FOR FUTURE SHARED PATH ON WESTERN SIDE OF MAMRE ROAD AND CHANGES TO ROAD DRAINAGE AND SUPPORTING INFRASTRUCTURE

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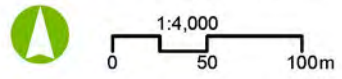
- Waterways
- Culverts
- Indicative noise wall
- ▭ Compound site options

- Revised REF proposal area
- Original REF proposal area
- Difference between original and revised REF proposal area
- Revised Vegetation Clearance Boundary
- Original Vegetation Clearance Boundary
- Difference between original and revised Vegetation Clearance Boundary

- Revised Design
- ▭ Basin
 - ▭ Shared user path
 - ▭ Channel work
 - ▭ Concrete
 - ▭ Cut
 - ▭ Bank
 - ▭ Median
 - ▭ Road
 - ▭ Swale
 - ▭ Verge



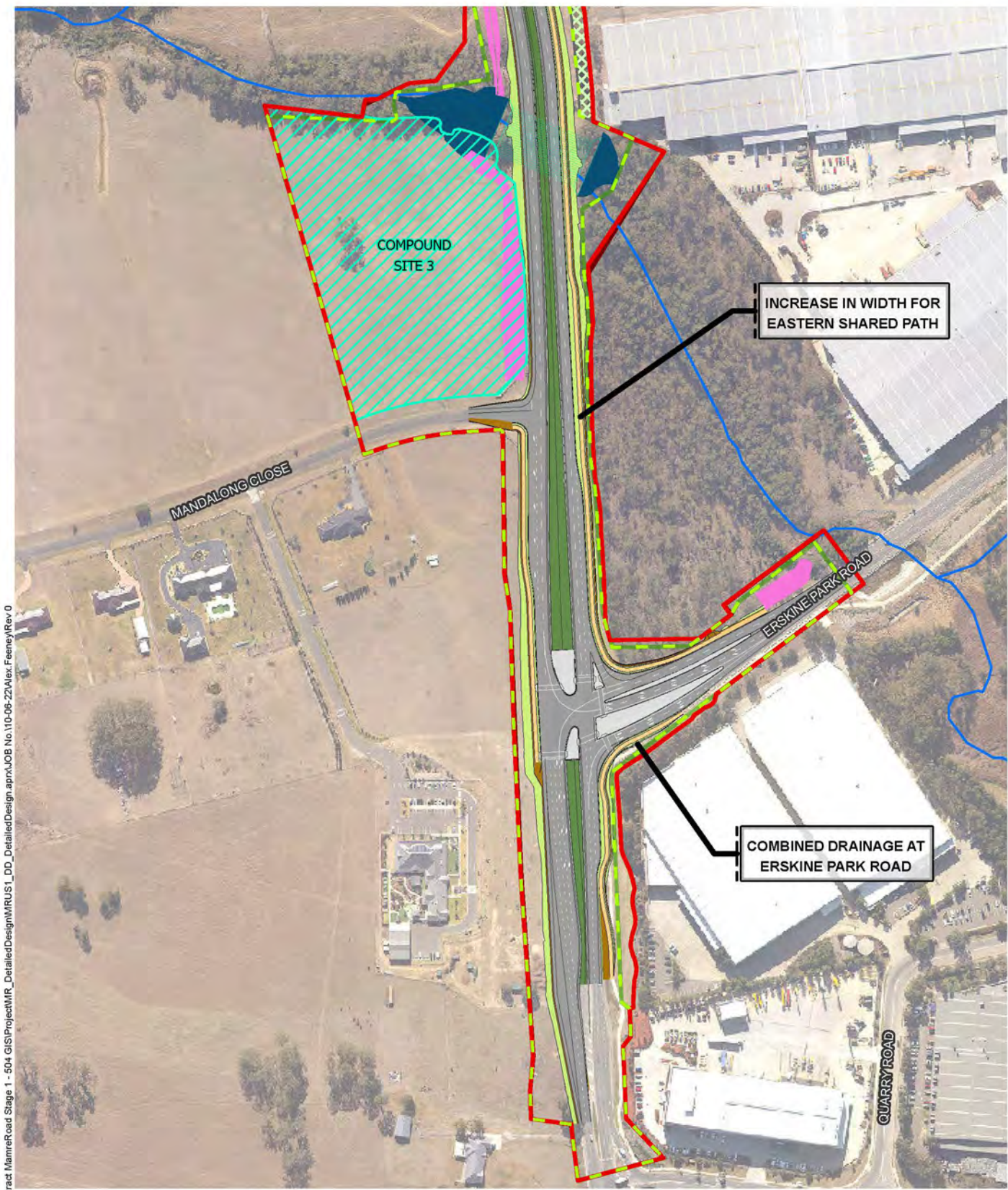
Source: Aurecon, Spatial Services, Nearmap, Esri



Date: 27/05/2022 Version: 1

Mamre Road upgrade between the M4 Motorway and Erskine Park Road

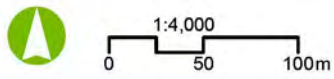
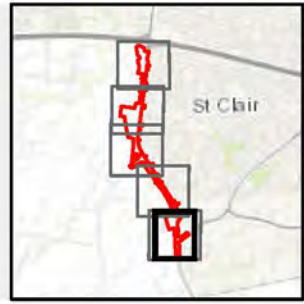
Projection: GDA2020 MGA Zone 56 Figure 4-4: Design changes to the proposal following exhibition of the REF



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Source: Aurecon, Spatial Services, Nearmap, Esri

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| <ul style="list-style-type: none"> — Waterways — Culverts — Indicative noise wall ▨ Compound site options | <ul style="list-style-type: none"> Revised REF proposal area Original REF proposal area Difference between original and revised REF proposal area Revised Vegetation Clearance Boundary Original Vegetation Clearance Boundary Difference between original and revised Vegetation Clearance Boundary | <p>Revised Design</p> <ul style="list-style-type: none"> ■ Basin ■ Shared user path ■ Channel work ■ Concrete ■ Cut ■ Bank ■ Median ■ Road ■ Swale ■ Verge |
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4.1 Changes to shared paths

The revised design removes the space provision for a future shared path on the western side of Mamre Road between Mandalong Close and Banks Drive, which was proposed in the REF. This has been replaced with a paved shoulder and road verge along the length of the proposal in the revised design. However, this design would not preclude a shared path being built along the western side of Mamre Road in the future separate to this proposal.

It is also noted that the section of shared path on the western side of Mamre Road between Erskine Park Road and Mandalong Close and the 1.5 metre wide footpaths between intersection pram ramps would remain in the proposal for pedestrian safety (as outlined in Section 2.5 of the REF).

The shared path on the eastern side of Mamre Road has also been revised in response to community feedback. The proposed width of this path has increased from three metres (as per the REF) to 3.5 metres. This would be confirmed during detailed design and would improve safety and comfort of pedestrians sharing the path with cyclists.

4.2 Changes to road drainage and supporting infrastructure

Due to the change in proposed shared path design (refer to Section 4.1), there have been some changes to road drainage and supporting infrastructure. These changes include the removal of the pits and pipes, which were previously proposed within the space provision for the future western shared path, and the introduction of new swales and channels on the western side of the road corridor.

Along the western side of Mamre Road, stormwater is now proposed to be collected in swales and channels. This would include provision of:

- seven vegetated swales, with 4H:1V side slopes and one metre base width
- nine channels, with 2H:1V side slopes and one metre base width.

The channels and swales have been designed for a one per cent AEP flood event. All the drainage systems have been designed to discharge into the existing watercourse system, with appropriate scour protection. Transverse culverts have also been shortened to align with the revised design.

However, there would be some locations on the western side of Mamre Road where swales and channels have not been adopted, including:

- between Chad Place and the northern end of Horseshoe Circuit, where the existing pit and pipe network has been retained in the revised design due to flood risk
- between Dutch Place and the Banks Drive intersection with Mamre Road, where an access track was provided alongside the kerb (with drainage pits and pipes) in the REF due to space limitations.

Other changes to the road drainage design proposed in the REF include:

- localised changes to kerb type to improve surface runoff
- realignment of drainage lines near changes to kerbs and access tracks
- incorporation of three additional swales on the eastern side of Mamre Road
- combining two drainage lines into one at Erskine Park Road to provide space for the proposed Jemena gas main.

4.3 Removal of future provision for additional left-turn lane from Mamre Road onto Luddenham Road

The upgrade to the existing Luddenham Road intersection proposed in the REF included the space provision for a future second left turn lane from the Mamre Road northbound carriageway onto Luddenham Road westbound. This left-turn lane may be required due to growth in traffic volumes and an upgrade of Luddenham Road to a six-lane road in the future separately to this proposal.

The revised design for the proposal has removed this future provision to reduce the footprint and impacts of the Luddenham Road intersection. This would not change the capacity of the proposal upon opening as both the design proposed in the REF and the revised concept design only provided for the activation of one left turn lane. The second lane would have only been opened in the future, should Luddenham Road be upgraded to be a six-lane road and this additional left-turn lane is identified to be required due to increase in traffic volumes in the future. However, with the removal of the future provision, more substantial work would be required to introduce a second left turn lane in the future.

4.4 Changes to relocation of high voltage powerline

As noted in Section 3.5.1 of the REF, the proposal would require relocation of an existing 11 kilovolt overhead powerline owned by Endeavour Energy. In the REF, it was proposed that this asset would be relocated underground.

However, the powerline would now be relocated above ground along the western side of Mamre Road to reduce costs due to limited funding availability.

A potential additional access track may be required within the proposal area to provide safe access to the high voltage powerline and other utilities along the western side of Mamre Road. The design of this track and any additional associated environmental assessment, if required, would be carried out during detailed design.

4.5 Changes to the Banks Drive intersection

There have been changes made to lane configuration on Mamre Road and Banks Drive at the Banks Drive intersection compared to the REF to improve the traffic performance of this section (refer to Figure 4-2). These changes are in response to community and government agency issues raised during REF display expressing concern about congestion near the Banks Drive intersection (refer to Sections 2.2.1, 2.3.7, 2.5.3 and 3.2.5).

The number of through lanes proposed on Mamre Road at this intersection has been increased from two to three in each direction so that there would be:

- an additional third through lane from about 120 metres south of the Mamre Road / Banks Drive intersection on the northbound carriageway
- an additional third through lane from about 185 metres north of the Mamre Road / Banks Drive intersection on the southbound carriageway.

This design change would allow for free flow traffic on the through lanes without the need for lane merges between the Banks Drive intersection and M4 Motorway interchange.

The proposed design speed between the Banks Drive intersection and the M4 Motorway interchange would be reduced from 90 kilometres per hour (as per the REF proposal) to 70 kilometres per hour due to engineering constraints of the road. However, this part of Mamre Road currently has a posted speed limit of 60 kilometres per hour.

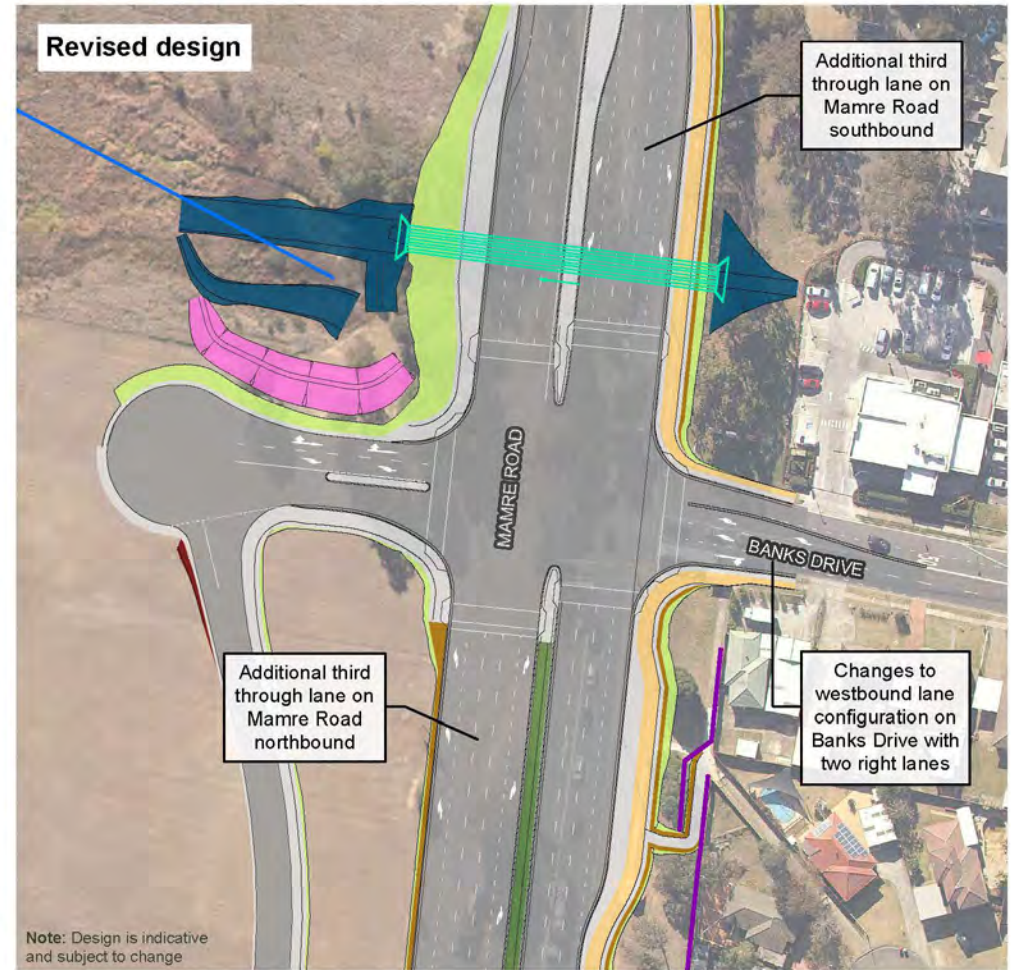
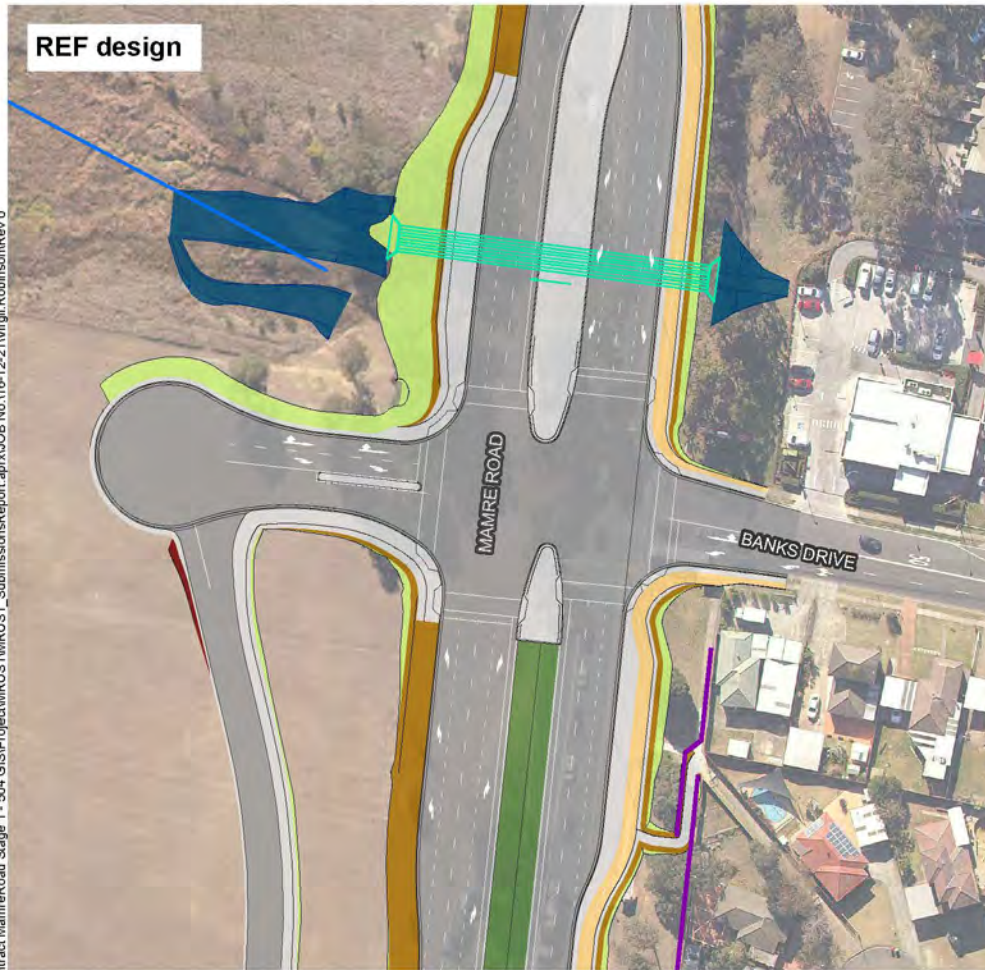
The median width has also been reduced, but the reduction has been minimised by removing the road shoulder adjacent to the right turn lanes on Mamre Road near the Banks Drive intersection. Despite this, a

staggered pedestrian crossing was able to be maintained in the revised design. The pedestrian crossing arrangement shown on Figure 4-2 is indicative and would be confirmed during detailed design.















North of the Banks Drive intersection, the northbound inside lane would become an exclusive right turn lane onto the M4 Motorway westbound on-ramp. To provide sufficient warning to motorists, appropriate signage and line marking would be provided south of the Banks Drive intersection.

On Banks Drive, the proposed lane configuration along the westbound carriageway was changed from one right turn lane and one shared straight, right turn and left turn lane to be two right turn lanes and a shared straight and left turn lane. A 0.5-metre-wide separation island was added along this section of Banks Drive for improved safety. The upgraded right turn lanes from Banks Drive towards the M4 Motorway were designed to accommodate a 12.5 metre Single Unit design vehicle on the inside lane with a passenger vehicle on the outside lane. This would reduce unsafe weaving conditions on Mamre Road between the Banks Drive intersection and M4 Motorway interchange.

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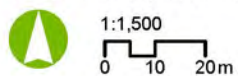


Note: Design is indicative and subject to change

- | | | |
|---|--|---|
|  Indicative noise wall |  Shared path |  Road |
|  Waterways |  Channel work |  Swale |
|  Culverts |  Concrete |  Cut |
|  Compound site options |  Fill |  Verge |
|  Basin |  Median | |



Source: Aurecon, Spatial Services, Nearmap, Esri



Date: 16/12/2021 Version: 2
Projection: GDA2020 MGA Zone 56

Mamre Road upgrade between the M4 Motorway and Erskine Park Road

Figure 4-2: Changes to Mamre Road / Banks Drive intersection

4.6 Minor adjustments to proposal area associated with utilities

Since the public display of the REF, the utility relocation and adjustment strategy for the proposal has been refined. This has identified minor adjustments to the proposal area and vegetation clearance boundary to allow for proposed utilities to tie-in to the surrounding existing utility assets. This includes (refer to Figure 4-1):

- a minor extension of the vegetation clearance boundary to provide access to the existing Endeavour Energy power pole about 120 metres south of the Luddenham Road intersection, which is proposed to be shackled
- a minor extension of the proposal area at four locations to allow for connecting the proposed underground electrical system into existing pillars located in the local road verge at Banks Drive, Meru Place, Rotorua Road and Pine Creek Circuit
- a reduction in the vegetation clearance boundary on the eastern side of Mamre Road between Chad Place and large culvert near compound site 3, as utility adjustments are no longer required in this area
- a minor extension of the proposal area and vegetation clearance boundary to incorporate a new three metre wide easement at 1 Banks Drive, St Clair and an existing easement at 249 Banks Drive, St Clair, within which a new electrical cable would be installed.

The areas where the vegetation clearance boundary has been extended would allow for any vegetation clearance required to provide safe access for the work as well as any trenching or other direct land disturbance required to install the utility connections. Where the proposal area has been extended but not the vegetation clearance boundary, no additional vegetation clearance would be permitted in these areas.

4.7 Adjustments to street light lanterns

Adjustment to three street light lanterns is proposed to the north of Banks Drive, which are located beyond the original proposal area as shown in the REF. As a result, the proposal area has been extended about 175 metres to the north of the original boundary to capture this additional work.

These adjustments would be required to upgrade the existing street lighting from time-based controls, to lights that would automatically turn on and off based on external light levels. The work to adjust the lanterns would involve replacing the photo-electric cell on the three street light lanterns and replacing the bulb of the southern-most lantern with a 196 Watt LED bulb. This would require a truck with an elevated platform to temporarily park alongside the road. Temporary traffic control would be implemented to manage this work safely.

4.8 Reduction of land to be leased near Mamre House

The land to be leased for construction of the proposal near Mamre House on the western side of Mamre Road has been reduced slightly, as requested by Catholic Care (the current operators of Mamre House), to minimise property impacts. This would slightly reduce the extent of the proposal area and associated vegetation clearance boundary that encroaches into the curtilage of the State Heritage Register listed Mamre House.

4.9 Relocation of bus stop on Banks Drive

The existing bus stop on Banks Drive westbound (for bus route 775 towards Penrith) is proposed to be replaced with a new bus stop further to the east than was originally proposed in the REF. The relocated bus stop would be about 60 metres east of the existing bus stop, near 250 Banks Drive, St Clair. The new bus stop would feature a new signpost and hardstand as well as a new bus shelter (subject to installation by Penrith City Council). The existing bus shelter for the Banks Drive westbound bus stop would be removed.

5. Environmental assessment

As a result of the changes to the proposal outlined in Chapter 4, additional environmental assessment was required. This chapter describes the additional assessment carried out for the revised proposal since the exhibition of the REF and identifies changes in potential impacts of the proposal compared to those identified in Chapter 6 of the REF. The following sections assess changes due to the revised design against each environmental assessment discipline. As the revised proposal is generally located within or immediately adjacent to the proposal area outlined in the REF, there would be negligible change to the existing environment as outlined in the REF.

5.1 Biodiversity

5.1.1 Methodology

A *Biodiversity Development Assessment Report (BDAR)* was prepared by Niche for the REF (refer to Section 6.1 of the REF and Appendix D to the REF) to assess the potential biodiversity impacts during construction and operation of the proposal. This assessment included a desktop review of biodiversity databases and site inspections in accordance with the Biodiversity Assessment Methodology and threatened biodiversity survey guidelines of the proposal area.

Due to the minor adjustments proposed to the vegetation clearance boundary (refer to Chapter 4), a revised BDAR was prepared by Niche to assess any changes to the potential impacts and biodiversity offset obligation of the proposal (provided in Appendix B).

No additional database searches or site inspections were required to assess the revised proposal beyond those carried out for the REF.

5.1.2 Potential impacts

The design changes described in Chapter 4 have resulted in minor adjustments to the vegetation clearance boundary compared to the boundary assessed in the REF. Table 5-1 summarises the changes in the magnitude of impacts in hectares (ha) expected as a result of the revised vegetation clearance boundary.

Table 5-1 Summary of changes in biodiversity impacts expected from revised vegetation clearance boundary

Biodiversity impact	Original impact (ha)	Revised impact (ha)	Difference (ha)
Removal of vegetation			
Removal of native vegetation , which comprises:	9.38	9.30	- 0.08
• PCT 849 Cumberland Plain Woodland (Medium condition)	3.63	3.68	0.05
• PCT 849 Cumberland Plain Woodland (Low condition)	0.92	0.93	0.01
• PCT 835 River-flat Eucalypt Forest (Medium condition)	2.84	2.97	0.13
• PCT 835 River-flat Eucalypt Forest (Low condition)	1.52	1.25	-0.27
• PCT 1800 Swamp Oak Floodplain Forest (Medium condition)	0.47	0.47	0.00
Removal of non-native vegetation	35.46	34.90	- 0.56
Impact on threatened species habitat			
Cumberland Plain Land Snail	3.40	3.46	0.06

Biodiversity impact	Original impact (ha)	Revised impact (ha)	Difference (ha)
Southern Myotis	6.12	5.94	- 0.18

However, the final vegetation clearance boundary subject to impacts during construction would be confirmed during detailed design, with the aim to continue minimising impacts on biodiversity where possible. No other changes to the biodiversity impacts compared to those outlined in the REF have been identified.

5.1.3 Revised safeguards and management measures

The BAM Calculator was rerun for the revised proposal in accordance with the revisions to the biodiversity impacts outlined in revised BDAR as summarised in Table 5-1. This determined that the following revised biodiversity credit offsets are required to offset the unavoidable impacts of the proposal:

- 125 credits (previously 124 credits) for PCT 835
- 112 credits (previously 110 credits) for PCT 849
- 8 credits (unchanged) for PCT 1800
- 157 credits (previously 160 credits) for Southern Myotis
- 87 credits (previously 86 credits) for Cumberland Plain Land Snail.

Additional mitigation measures have been proposed to address the potential for further refinement of the design and construction staging during detailed design as follows:

- 'B13' has been added to state that 'The proposal's biodiversity offset obligation for impacts on biodiversity values using the BAM-Calculator will be recalculated prior to construction if any further amendments to the vegetation clearance boundary are proposed.'
- 'B17' has been added to state that in accordance with Clause 7.15(5) of the BC Act 'Biodiversity credits will be retired prior to construction or the stage of the construction activity that would impact on biodiversity values.'

5.2 Aboriginal cultural heritage

5.2.1 Methodology

An *Aboriginal cultural heritage assessment report* (ACHAR) was prepared by Kelleher Nightingale Consulting for the REF (refer to Section 6.2 of the REF and Appendix E to the REF) to assess the potential Aboriginal cultural heritage impacts during construction and operation of the proposal. This assessment was prepared in accordance with Transport's Procedure for Aboriginal Cultural Heritage Consultation and Investigation (PACHCI). It included a desktop review of the Aboriginal Heritage Information Management System (AHIMS) database, archaeological test investigations and consultation with registered Aboriginal parties.

No additional database searches, investigations or consultation were required to assess the revised proposal beyond those carried out for the REF.

5.2.2 Potential impacts

The changes to the proposal outlined in Chapter 4 have resulted in minor changes to the proposal area boundary compared to the area assessed in the REF.

The minor extension of the vegetation clearance boundary to shackle an existing power pole adjacent to PAD site Mamre Road AFT 3 would have negligible additional impacts on Aboriginal heritage compared to those outlined in the REF. This is because the work would remain within the original proposal area boundary at this location, which was conservatively used as the boundary for assessment of direct Aboriginal impacts in the ACHAR. There would also be no direct ground disturbance within the PAD site to carry out this work as it involves connections to an existing power pole beside the PAD site. Therefore, there is no change to the degree of harm to the site compared to that assessed in REF Section 6.2.3.

The other minor extensions to the proposal area as outlined in Chapter 4 are not expected to result in any additional impacts on Aboriginal heritage. This is because they are away from known PADs and Aboriginal sites and in areas that have generally previously been disturbed for roadways, utility corridors and local path connections.

Overall, it is anticipated that the revised proposal would result in negligible changes in potential Aboriginal cultural heritage impacts compared to those outlined in Section 6.2 of the REF.

The final area subject to direct impacts during construction would be confirmed during detailed design, with the aim to continue minimising impacts on Aboriginal cultural heritage where possible. During detailed design, the Aboriginal Heritage Impact Permit boundary would also be confirmed so that it is in line with the final areas of Aboriginal cultural sites subject to direct impacts from the proposal.

In line with this, the need for compound site 3 will be confirmed during detailed design in consideration of the design changes outlined in Chapter 4, the final construction staging of the proposal and community submissions. If this compound site was to be no longer used, the revised proposal would avoid impacts to the following Aboriginal archaeological sites:

- MWP-AD5 AHIMS 45-5-4815
- MWP-AD6 AHIMS 45-5-4813.

5.2.3 Revised safeguards and management measures

No additional safeguards and management measures would be required due to the revised proposal.

5.3 Non-Aboriginal heritage

5.3.1 Methodology

A *Non-Aboriginal Heritage Statement of Heritage Impact – Mamre Road Upgrade Stage 1* (referred to as 'the SOHI') was prepared by Aurecon for the REF (refer to Section 6.3 of the REF and Appendix F to the REF) to assess the potential non-Aboriginal impacts during construction and operation of the proposal. This assessment included a review of statutory heritage lists and past heritage studies and a site inspection of the proposal area.

No additional database searches or site inspections were required to assess the revised proposal beyond those carried out for the REF.

5.3.2 Potential impacts

The revised proposal would result in the relocation of electrical poles and wires along Mamre Road near Mamre House, with no additional electrical infrastructure proposed (refer to Section 4.4). This would intensify the visible infrastructure within the curtilage of the Mamre House listed heritage item, leading to additional indirect heritage impacts compared to the proposal. However, it would result in a negligible change to the existing heritage setting of Mamre House as there are existing overhead wires located along

the western side of Mamre Road close to the new proposed location. The heritage impacts to the site would be minimised, where possible, through consideration of the location of the new poles during detailed design to minimise visual impacts in this area (refer to additional safeguard LV6 in Section 6.2).

The widening of the Banks Drive intersection would also slightly increase the loss of Mamre House's rural setting (refer to Section 4.5). This would lead to minor additional indirect non-Aboriginal heritage impacts compared to the REF proposal and existing scenario.

The revised proposal includes a slight reduction of the proposal area and vegetation clearance boundary at Mamre House from design refinements following consultation with Catholic Care (refer to Section 4.8). This would marginally reduce non-Aboriginal heritage impacts by decreasing the direct impact area and property acquisition within the Mamre House curtilage and the surrounding Marsden Memorial Cairn curtilage area compared to the REF.

The removal of the future provision for an additional left-turn lane at the Mamre Road intersection with Luddenham Road (refer to Section 4.3) would not change any impacts to non-Aboriginal heritage items. This includes the Blaxland Memorial Cairn, Leeholme Horse Stud Rotunda and Luddenham Road Alignment local heritage items located along Luddenham Road.

The other changes to the proposal outlined in Chapter 4 would result in negligible additional impacts to non-Aboriginal heritage.

5.3.3 Revised safeguards and management measures

Section 8.2.1 of the SOHI for the proposal stated that 'a Section 140 excavation permit and a Section 139(4) exception notification under the *Heritage Act 1977* may be required for works within the State listed Mamre House grounds, and the locally listed Luddenham Road alignment, where work would take place outside of the SHR (State Heritage Register) curtilage'.

Since public display of the REF, further specialist heritage advice has confirmed no permits are required to be obtained for the proposal under section 139 and 140 of the *Heritage Act 1977*. As such, the summary of licensing and approvals for the proposal outlined in Section 6.3 does not outline these permits as required for the proposal.

As outlined in Section 3.2.4, mitigation measure NAH7 has been amended in relation to the archival recording proposed to be carried out at Mamre House to include 'The archival recording documentation is to be provided to Penrith City Council for their records.'

5.4 Traffic and transport

5.4.1 Methodology

A *Traffic and Transport Impact Assessment* was prepared by SMEC for the REF (refer to Section 6.4 of the REF and Appendix G to the REF) to assess the potential traffic and transport impacts during construction and operation of the proposal. This assessment included traffic modelling for operation of the proposal for AM and PM peak period scenarios in 2026 (at opening) and 2036 (10 years after opening).

No additional traffic modelling was carried out to assess the changes to the Banks Drive intersection, as the changes adopted were identified as recommended design improvements during the assessment carried out for the REF.

5.4.2 Potential impacts

The changes to the Banks Drive intersection in the revised design were identified in response to traffic modelling carried out for the REF, which identified that the Banks Drive intersection would experience a level of service (LOS) of D in the 2036 AM peak period. The improvements at the Banks Drive intersection in the revised design were recommended to improve the LOS and reduced delays predicted in the AM Peak period compared to the design proposed in the REF. This is because the revised design would allow for free flow traffic on the through lanes without the need for lane merges between the Banks Drive and M4 Motorway intersections along Mamre Road.

The revised design also involves increasing the shared path width along the eastern side of Mamre Road from three to 3.5 metres wide. This would be confirmed during detailed design. This increase in width would improve the amenity, safety and comfort for pedestrians and cyclists using the shared path as there would be additional space for users to pass by each other and stay away from the road.

The removal of space provision for a future shared path along the western side of Mamre Road (as outlined in Section 4.1) would have a negligible impact on access for pedestrians, as it wasn't proposed to be built for use as part of the proposal and is not precluded from being built in the future.

The removal of the space provision for an additional left-turn lane from Mamre Road onto Luddenham Road would not impact the traffic performance of the proposal as this lane was not proposed to be opened for use and is not precluded from being built if required in the future.

The impacts of the additional utility adjustment work involved in the revised design on traffic and transport would be minor and localised during construction. This includes extensions in the proposal area for tie-ins to pillars located in the local road verge for underground electrical cables. These extensions would occur at the road verge of Banks Drive, Meru Place, Rotorua Road and Pine Creek Circuit. This underground electrical work at the road verge is not expected to impact traffic flow or require traffic control. However, short-term impacts on pedestrian access may occur while the work is being carried out due to the nearby pedestrian pathways between Mamre Road and these local roads. The potential impacts of this work would be managed by REF mitigation measure TT8 which outlines that detours would be implemented to minimise impacts associated with temporary access changes for pedestrians.

The adjustments to three street light lanterns beside the existing road at the northern extent of Mamre Road would extend construction traffic impacts beyond the original proposal area outlined in the REF (refer to Section 4.7). These adjustments would require traffic control for safety while a truck with an elevated platform would park alongside the road to carry out the work. This would have a short-term additional impact, which may result from a temporary lane closure slowing the traffic in a localised area around where the adjustments would occur. These impacts would be appropriately managed in accordance with REF traffic management safeguards TT8, TT9, and SE8, which describe measures such as signage and advice for road diversions, closures and temporary traffic arrangements.

There is potential that the northern section of Mamre Road between the M4 Motorway and Chad Place (as described in Section 2.2.1) may need to establish a temporary traffic arrangement at the southern tie-in to Mamre Road, depending on the construction timing of the southern section between Chad Place and Erskine Park Road. The exact timing of construction for the northern and southern sections of Mamre Road within the proposal area would be confirmed during detailed design. The potential traffic impacts of any temporary arrangement associated with this revised construction staging would need to be assessed during detailed design once the timing and form of this is further known, to identify any additional mitigation measures required (reflected in additional mitigation measure 'TT14'). No other changes to the traffic impacts compared to those outlined in the REF have been identified.

5.4.3 Revised safeguards and management measures

The timing of implementation of mitigation measure:

- 'TT2' has been amended to occur during 'pre-construction' and 'construction' in addition to 'detailed design' (as per the REF).
- 'TT12' has been amended to occur during 'pre-construction' and 'early work' in addition to 'main construction work' (as per the REF).

Additional mitigation measure 'TT14' has been proposed as follows: 'The potential traffic impacts of any temporary arrangement along Mamre Road associated with revised construction staging of the proposal will be assessed during detailed design to identify any additional mitigation measures required.'

5.5 Hydrology and flooding

5.5.1 Methodology

A *Hydrology and Hydraulic Assessment* was prepared by Aurecon for the REF (refer to Section 6.5 of the REF and Appendix H to the REF) to assess the potential hydrology and flooding impacts during operation of the proposal. This assessment included hydraulic modelling using DRAINS and TUFLOW software to assess the impacts of the proposal on South Creek and local catchment flood behaviour.

Additional hydraulic modelling was carried out for the revised design to investigate any potential changes to flood behaviour associated the design changes. This modelling particularly focused on the potential impacts on flood levels along Mamre Road expected during a South Creek flood event associated with the removal of the space provision for the future western shared path and changes to the road drainage (as outlined in Sections 4.1 and 4.2).

5.5.2 Potential impacts

The results of the additional modelling carried out for the revised design confirmed that removal of space for the future shared path along the western side and changes to road drainage would not cause any additional adverse flood impacts and would be relatively consistent with those presented in the REF. In particular, while Mamre Road would experience shallow flooding on the sections of the northbound carriageway during a one per cent AEP South Creek flood event, the road would remain trafficable for both travel lanes. As such, the design requirement for the Mamre Road to achieve flood immunity in a one per cent AEP flood event would be maintained.

Flood impacts within the South Creek and local catchments would continue to be reviewed during detailed design to consider the impact of any further design refinements to flood risk. This would involve carrying out detailed flood modelling on the final drainage design (including preparation of additional flood maps) during detailed design to confirm the potential flooding impacts that are expected to occur due to operation of the proposal. Following this, Transport would consult with any identified affected landowners regarding the potential flooding impacts on private properties to identify if any additional mitigation measures are required.

5.5.3 Revised safeguards and management measures

No additional safeguards and management measures would be required due to the revised proposal.

5.6 Soil and water quality

5.6.1 Methodology

A *Water quality and soil impact assessment* and a combined *Preliminary Site Investigation* and *Detailed Site Investigation* were prepared by Aurecon for the REF (refer to Section 6.6 of the REF and Appendix I to the REF) to assess the potential soil and water quality impacts during construction and operation of the proposal. This assessment included a desktop review of the existing environment, a site investigation and a review of MUSIC modelling and proposed drainage design and water quality treatment strategy.

A high-level MUSIC model was developed for the REF to estimate the change in pollutant load and annual runoff volume as a result of the proposal with consideration to the proposed stormwater treatment strategy (refer to Section 6.6.4 of the REF). The revised proposal would not impact the results of the MUSIC modelling carried out for the REF. As such, no additional MUSIC modelling was carried out for the revised proposal.

5.6.2 Potential impacts

The revised proposal would marginally reduce the residual impacts on the surface water environment compared to those identified in Section 6.6.4 of the REF.

The REF identified that load increases from the REF proposal to South Creek and unnamed tributaries are likely to be minor (less than three per cent) compared to the existing pollutant load from the local urbanised catchment within the proposal area.

The revised design includes channels on the western side to replace the former pit and pipe network within the space provided for the western shared path. The material used to line the channels (i.e. concrete or vegetation) will be confirmed during detailed design. Vegetated channels would result in a beneficial outcome that would better reflect the existing conditions compared to concrete channels, which would not provide any water quality treatment.

The proposed changes to the road drainage would include combining the clean water (from external catchment runoff) drainage and dirty water (from road runoff) drainage into one drainage pipe near the Erskine Park Road intersection to accommodate the space needed for the Jemena gas main (refer to Section 4.2). This would mean that a small section of the road runoff at this intersection would not be channelled into a water treatment measure (i.e. water quality basin or swale). This catchment was identified as higher risk for surface water impacts due to the presence of road intersections and its proximity to an unnamed tributary that connects to South Creek. The untreated road footprint as a result of this change would be less than five per cent of the existing road footprint that is currently being treated across the proposal area via a swale. This is likely to result in a slight increase in pollutants that may migrate to South Creek from that predicted in the REF, however the overall pollutant load impact would remain negligible in the context of the wider catchment. Therefore, this change to the drainage is not expected to result in a significant change in water quality within South Creek and water quality would be monitored and managed appropriately in line with mitigation measures SW3, SW11 and SW12 (refer to Section 6.2). The widening of the Banks Drive intersection with Mamre Road (refer to Section 4.5) would lead to a minor increase in the pollutant load being released from Mamre Road due to the minor additional increase in pavement. However, these impacts would be minimised by the changes to drainage design (refer to Section 4.2). As such, there would be negligible changes to potential water quality impacts compared to the REF.

The footings for the relocated high-voltage powerlines are not likely to be deep enough to intercept groundwater. Therefore, no additional impacts on groundwater from those identified in the REF are expected due to this change.

The slightly increased areas of disturbance associated with the additional work for the utility connections and relocation of the bus stop on Banks Drive are expected to result in negligible changes to potential soil and water quality impacts compared to the REF.

5.6.3 Revised safeguards and management measures

Additional mitigation measure SW12 has been updated following display of the REF to note that 'Stormwater outlets to local drainage lines and waterways are to be designed with consideration to the *Guidelines for outlet structures on waterfront land* (DPI, 2012c) and relevant Transport specifications and guidelines. This will include consideration of vegetated channels with plants suitable for 1V2H batter slopes that do not require mowing and short lengths of linear biofiltration where possible during detailed design.' It is anticipated that consideration of these design features is likely to improve stormwater treatment and better replicate current conditions.

Additional mitigation measure SW10 has also been updated to occur during 'pre-construction' and 'construction' as well as during 'detailed design' (as per the REF).

5.7 Noise and vibration

5.7.1 Methodology

A *Noise and Vibration Assessment* was prepared by SLR for the REF (refer to Section 6.7 of the REF and Appendix J to the REF) to assess the potential noise and vibration impacts during construction and operation of the proposal. This assessment included identification of noise sensitive receivers near the proposal, monitoring of existing background noise levels (including concurrent traffic counts) and noise modelling using SoundPLAN V8 software.

No additional noise monitoring or modelling was required to assess the revised proposal beyond that carried out for the REF.

5.7.2 Potential impacts

The widening of the Banks Drive intersection as part of the revised design would increase the capacity of the intersection. By providing for an additional through lane at this intersection, more vehicles would be able to use the intersection at a given time. This may slightly increase the operational noise levels near this intersection compared to the results presented in the REF, however any increase is unlikely to be big enough to be noticeable by nearby sensitive receivers.

The removal of the future provision for an additional left-turn lane at the Luddenham Road intersection as part of the revised design is not expected to lead to any changes in noise and vibration impact as this lane was not expected to be operational as part of the REF proposal.

The minor additional work outside the REF proposal area involving tie-in of underground electrical utilities at existing pillars and the adjustments of street light lanterns at the northern extent of the proposal would not cause a noticeable increase in noise or vibration impacts compared to those assessed in the REF. This is because this additional work would be relatively short-term and minor in scale compared to the construction scenarios assessed in the REF, and nearby sensitive receivers would already experience relatively high background traffic noise from surrounding roads. Mitigation measures in the REF including notifying businesses affected by work (GEN2), scheduling works for daytime hours where possible and providing respite periods (NV5) would appropriately manage any additional noise impacts of the work.

The other proposed design changes are not expected to result in any change to noise impacts expected during construction or operation of the proposal.

Further assessment of operational noise impacts would be carried out during detailed design to consider any further design refinements and confirm the effect of the Banks Drive intersection design changes. Following this, operational noise mitigation requirements including the noise wall design and any at-property treatments to manage residual noise levels will be reviewed and confirmed in consultation with property owners.

5.7.3 Revised safeguards and management measures

No additional safeguards and management measures would be required due to the revised proposal. As per additional mitigation measures 'NV1' and 'NV9', detailed assessment of noise and vibration impacts would be carried out during detailed design to verify potential noise impacts and confirm any necessary treatment options during construction and operation of the revised proposal.

Additional mitigation measure 'NV6' has also been updated to occur during 'pre-construction' as well as during 'construction' (as per the REF).

5.8 Landscape character and visual impacts

5.8.1 Methodology

An Urban design report including landscape character and visual impact assessment was prepared by Scape Design for the REF (refer to Section 6.8 of the REF and Appendix K to the REF) to assess the potential landscape character and visual impacts during construction and operation of the proposal. This assessment included identification of the visual catchment and landscape character zones (LCZ) for the proposal, a site inspection of the proposal area and assessment in accordance with Transport guidelines.

No additional viewpoints or LCZ were needed to assess the revised proposal beyond those carried out for the REF. No additional site inspections were required.

5.8.2 Potential impacts

Construction

The revised proposal would result in negligible changes to the potential impacts identified in Section 6.8.3 of the REF. Transport will review the continued need for compound site 3 during detailed design and minimise its use, where possible, which would reduce the risk of construction noise impacts on sensitive receivers near Mandalong Close.

Operation

Landscape character

The introduction of overhead powerlines to the revised design would be visible within LCZ-3 (the existing road corridor). However, this LCZ already contains existing overhead powerlines. As such, there would be a negligible change in impact to this LCZ compared to Section 6.8.3 of the REF and the impact rating would remain as 'Moderate'.

The addition of new infrastructure compared to the REF proposal (including overhead power lines that were previously proposed to be relocated underground and the widening of the Banks Drive intersection) would have a negative impact on landscape character in the heritage/pastoral zone (LCZ-4). This LCZ is located to the west of Mamre Road between the northern limit of the proposal and Luddenham Road. The revised design would slightly worsen the impacts to the pastoral outlook from the heritage buildings and gardens,

increasing the level of infrastructure development close to the working landscape, compared to the REF proposal. As such, the impact rating would increase from 'High-Moderate' (as per the assessment in Section 6.8.3 of the REF) to 'High'. This potential impact would be minimised through implementation of additional mitigation measure 'LV6', as outlined below.

In general, easements beneath overhead powerlines are maintained to be clear of tall vegetation for safety. However, the proposed easement for the overhead powerlines along the western side of Mamre Road as part of the revised design is expected to have minimal impact on planting opportunities for the proposal due to lack of trees proposed in this area to maintain open views to the west and Mamre House.

The revised design would result in a minor change along the western side of the proposal from a landscaped area that would provide space for a future shared path to a narrower asphalt shoulder. This would be a minor change in comparison to the road widening itself and the new sections of road barriers to be installed along the western side of the road. The visual impact of this change would mostly affect road users, who would be transient through the proposal area. In addition, the overall footprint of the new road infrastructure in the revised design would be slightly narrower than the REF proposal. As a result, any additional impacts to landscape character compared to those assessed in the REF proposal would be relatively negligible. This potential impact would generally be mitigated by the tree planting that is proposed below the embankment on the western side of Mamre Road, where this planting is practicable, consistent with the existing landscape character and not in conflict with the location of swales or other design features. In addition, it is recommended that detailed design should consider inclusion of jute netting at the interface between the asphalt shoulder and softer landscape surfaces to avoid scouring. During operation of the revised proposal, the potential landscape character impacts are not expected to change for the remaining LCZs compared to those outlined in Section 6.8.3 of the REF.

Visual impacts

The potential visual impacts due to operation of the revised proposal have been assessed using the ten viewpoints identified in Section 6.8.2 of the REF.

The overhead relocation of high voltage powerlines as part of the revised proposal is expected to have the greatest visual impacts. The powerlines are proposed to be more visible due to the removal of vegetation on the western side of Mamre Road and because they would be closer to the road than the existing powerlines.

Viewpoints 1-6 are expected to potentially be impacted by the revised proposal. Predicted impacts compared to the visual impacts identified in the REF (refer to Section 6.8.3 of the REF) include an increase from 'Moderate' to 'High-Moderate' for:

- road users in VP1 due to the overhead relocation of powerlines and proposed widening of the Banks Drive intersection (which would reduce the median width, proposed median planting, screening and aesthetics and increase the area of hard surfaces)
- visitors to Mamre House in VP2 due to the overhead relocation of powerlines interrupting views to/from Mamre House and the ranges to the west
- road users in VP3 and VP5 due to the overhead relocation of powerlines.

Predicted impacts would not change compared to those outlined in Section 6.8.3 of the REF for:

- pedestrians and residents in VP4 due to there being a limited view of the overhead relocation of powerlines in the background of this viewpoint
- road users on Luddenham Road VP6 due to the overhead relocation of powerlines being partially visible (as they would tie in to existing powerlines and would be partially concealed by vegetation along Old Luddenham Road).

The other utility connections associated with the revised proposal (refer to Section 4.6) would largely be underground and result in negligible visual changes.

During operation of the revised proposal, the potential visual impacts are not expected to change for VP8, VP9 and VP10 compared to those outlined in Section 6.8.3 of the REF.

5.8.3 Revised safeguards and management measures

Standard mitigation measure 'LV1' has been amended to commit to continued development of the urban design concept rather than preparation of an urban design and landscape plan, as this is not considered to be required for the proposal.

Additional mitigation measures:

- 'LV3' has been updated to note that 'planting in lieu of seeding on 4:1 batters to avoid maintenance complications' would be considered during detailed design
- 'LV6' has been added due to the proposed overhead relocation of powerlines along the western side of Mamre Road as part of the revised proposal: 'The location of overhead powerlines and power poles would be confirmed during detailed design to minimise visual impacts on Mamre House, where possible.'
- 'LV7' has been added to consider installation of jute netting at the interface between the asphalt shoulder and softer landscape surfaces to avoid scouring

No other additional safeguards and management measures would be required due to the revised proposal.

5.9 Air quality

5.9.1 Methodology

An *Air Impact Quality Assessment* was prepared by SLR for the REF (refer to Section 6.9 of the REF and Appendix L to the REF) to assess the potential air quality impacts during construction and operation of the proposal. This assessment used Transport's Tool for Roadside Air Quality to assess potential emission impacts of the proposal.

No additional air quality modelling was required to assess the revised proposal beyond that carried out for the REF.

5.9.2 Potential impacts

Transport will review the continued need for compound site 3 during detailed design and minimise its use, where possible, which would reduce the risk of construction air quality impacts on sensitive receivers nearby.

The minor areas of additional disturbance associated with the revised proposal, such as the trenching along the new easement at Banks Drive, may increase the temporary and localised suspension of dust during construction. However, any increase would be negligible and no additional mitigation measures would be needed.

The changes to the proposal outlined in Chapter 4 would not result in any changes in potential operational air quality impacts compared to those outlined in Section 6.9.4 of the REF.

5.9.3 Revised safeguards and management measures

No additional safeguards and management measures would be required due to the revised proposal.

5.10 Socio-economic, property and land use

5.10.1 Methodology

A *Socio-economic impact assessment* was prepared by Aurecon for the REF (refer to Section 6.10 of the REF and Appendix M to the REF) to assess the potential socio-economic, property and land use impacts during construction and operation of the proposal. This assessment included a review of statutory planning and legislative requirements and a desktop review of the socio-economic context of the proposal.

No changes to this methodology were required to assess the revised proposal beyond those carried out for the REF.

5.10.2 Potential impacts

The need for temporary use of properties during construction has been refined in the revised design, resulting in a small decrease in the lease boundary of the proposal, which would slightly decrease the impact of the proposal on certain landholders. The final property acquisition and lease boundaries would be confirmed during detailed design.

The impacts on access and connectivity for local residents may be temporarily increased during construction due to the need for traffic control to adjust the street light lanterns north of Banks Drive, and potential impacts on pedestrian access for works in the road verge next to existing pedestrian pathways. These impacts would be managed in accordance with REF measure SE8 which states alternative routes for active transport users will be clearly identified by signage and the use of traffic controllers where required.

The temporary relocation of bus stops on Banks Drive outside the proposal area during construction was assessed in the REF. The permanent relocation of this bus stop is now proposed to be further east on Banks Drive (refer to Section 4.9). This would commence during construction and remain during operation. The relocation further east may have minor impacts such as slightly altering the walking distance to the relocated bus stop, depending on which direction the commuters are travelling to and from. However, the bus stop would be relocated to a location which may be safer for commuters since it would be further from the intersection. Therefore, any additional impacts associated with the relocation of the bus stop at Banks Drive would be negligible.

The changes to the proposal outlined in Chapter 4 would not result in any other changes in potential construction socio-economic impacts compared to those outlined in Section 6.10.4 of the REF.

The removal of the provision of a shared path on the western side of Mamre Road as part of the revised design has the potential to negatively impact access and connectivity and amenity and community values. At present, there are low numbers of residential receivers on the western side of Mamre Road and there is not currently a shared path on the western side of Mamre Road so there is likely to be a negligible impact associated with this design change. As such, while the revised design may make it harder to realise opportunities to enhance connectivity in the future on the western side of Mamre Road, it would be no worse than the existing scenario.

The revised design doesn't preclude the future development of a shared path on the western side of Mamre Road. This means that the revised design would not be in contradiction to the Greater Sydney Commission's Green Grid (refer to Section 2.1.2 of the REF), which seeks to develop opportunities for future pedestrian and cyclist connections. However, the loss of opportunity to easily build a future shared path on western side of Mamre Road compared to the REF proposal means there would be fewer future mobility choices for residents, potentially impacting the liveability of the area.

The changes to the Banks Drive intersection would reduce impacts to business operations at the Blue Cattle Dog Hotel compared to the existing scenario and REF proposal. This would be caused by the

potential reduction in congestion and improvements in accessibility and amenity from the improved functioning of the Banks Drive intersection (refer to Section 5.4).

The relocation of the overhead powerlines would result in power poles being located along the western side of Mamre Road. In areas where there is pedestrian access (for example, near the pedestrian crossings at the Banks Drive intersection), the poles would be placed so that impacts to people walking or people with mobility devices, such as prams or wheelchairs, are minimised. This would result in negligible additional access and connectivity impacts due to the revised proposal.

The acquisition boundary has been further refined in the revised design, which would reduce permanent impacts associated with property acquisition. This would have the largest reduction in impact within the Mamre House curtilage, and to the back of houses on Pine Creek Circuit, where work is no longer required. This change would have a positive impact by slightly reducing the partial acquisitions of residential properties.

5.10.3 Revised safeguards and management measures

No additional safeguards and management measures would be required due to the revised proposal. However, standard safeguard 'SE3' has been amended following the display of the REF to note that property acquisition would occur during 'detailed design' as well as 'pre-construction' (as per the REF).

5.11 Other impacts

Other impacts of the proposal were assessed qualitatively in Section 6.11 of the REF, which included consideration of impacts of the proposal on:

- waste and resources
- greenhouse gases and climate change
- utilities
- hazards and risk management.

5.11.1 Potential impacts

As discussed in Section 4.4, there is potential that an additional access track is required to be established within the proposal area to provide safe access to the high voltage powerline and other utilities along the western side of Mamre Road. The design of this track and any additional associated environmental assessment, if required, would be carried out during detailed design.

The changes to the proposal outlined in Chapter 4 would not result in any changes in potential other impacts compared to those outlined in Section 6.11.2 of the REF.

5.11.2 Revised safeguards and management measures

Additional safeguard 'O13' has been added as follows: 'During detailed design, arrangements for safe access to utilities for ongoing maintenance within the proposal area will be confirmed. Any additional access track that is required will be designed to minimise environmental impacts (including on biodiversity, heritage, visual and surface water) as far as practicable.'

5.12 Cumulative impacts

Cumulative impacts of the proposal were assessed qualitatively in Section 6.12 of the REF.

5.12.1 Potential impacts

The changes to the proposal outlined in Chapter 4 would not result in any changes in potential cumulative impacts compared to those outlined in Section 6.12.4 of the REF.

5.12.2 Revised safeguards and management measures

No additional safeguards and management measures would be required due to the revised proposal.

5.13 Additional factors to consider

Since public display of the REF, the Environmental Planning and Assessment Regulation 2021 has commenced, and the Environmental Planning and Assessment Regulation 2000 has been repealed.

Appendix A of the REF included a Clause 228(2) checklist, which outlined the factors that Transport are required to consider when considering the likely impact of an activity on the environment in accordance with the Environmental Planning and Assessment Regulation 2000. These factors are still included in the Environmental Planning and Assessment Regulation 2021, and the assessment provided in the REF is still applicable and would not change.

In addition to the Clause 228(2) factors considered in the REF, two additional factors were introduced with Section 171 of the Environmental Planning and Assessment Regulation 2021 and are required to be considered when assessing the likely impacts of the proposal. Table 5-2 outlines these additional factors.

Table 5-2 Consideration of additional factors in accordance with Section 171 of the Environmental Planning and Assessment Regulation 2021

Factor	Impact
<p>q) Applicable local strategic planning statements, regional strategic plans or district strategic plans made under the Act, Division 3.1</p> <p>The proposal is aligned with several strategic plans including (refer to Sections 2.1.2 and 2.1.3 of the REF for more information):</p> <ul style="list-style-type: none"> • <i>Greater Sydney Region Plan: A Metropolis of Three Cities</i> (Greater Sydney Commission, 2018), including directions to achieve: <ul style="list-style-type: none"> – A city supported by infrastructure – A city for people – A well connected city – A city in its landscape • <i>Western City District Plan</i> (Greater Sydney Commission, 2018), including planning priorities: <ul style="list-style-type: none"> – W1: planning for a city supported by infrastructure – W3: providing services and social infrastructure to meet people's changing needs – W7: establishing land use and transport structure to deliver a liveable, productive and sustainable Western Parkland City • <i>Penrith Local Strategic Planning Statement</i> (Penrith City Council, 2020), particularly planning priority 10: 'provide a safe, connected and efficient local network supported by frequent public transport options'. 	<p>Long-term moderate positive impact</p> <p>Long-term moderate positive impact</p> <p>Long-term moderate positive impact</p>

Factor	Impact
r) Other relevant environmental factors	All relevant environmental factors have been considered for this proposal, refer to Chapter 5 of this report and Chapter 6 of the REF.

6. Environmental management

The REF for the upgrade of Mamre Road between the M4 Motorway and Erskine Park Road identified the framework for environmental management, including safeguards and management measures that would be adopted to avoid or reduce environmental impacts (Chapter 7 of the REF).

After consideration of the issues raised in the submissions and assessment carried out for the proposal, the safeguards and management measures have been revised. This includes revisions to the mitigation measures relating to:

- biodiversity, including more detail regarding commitments to manage vegetation clearance, removal of habitat, potential termite presence and confirm biodiversity offsets based on the revised proposal
- traffic and transport, including a commitment to carry out a sensitivity analysis during detailed design and assess the impacts of a temporary arrangement along Mamre Road associated with revised construction staging
- soil and water, including more detail about management of stormwater impacts
- noise and vibration, including more detail regarding commitments to review noise wall construction timing and vibration impacts for properties located on unstable soils
- landscape character and visual impact, including more detail on aspects to consider during detailed design for planting, bus stops, construction light spill and overhead powerlines
- air quality, including a commitment to manage potential odours from toilet facilities during construction
- socio-economic impacts, including commitments on impacts to properties, Council-owned assets and access and connectivity near overhead powerlines
- other impacts, including more detail on considerations related to utilities, waste and illegal dumping during detailed design
- cumulative impacts, including further identification of nearby projects for consultation and coordination of construction staging.

Should the proposal proceed, environmental management would be guided by the framework and measures outlined below.

6.1 Environmental management plans (or system)

A number of safeguards and management measures have been identified 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 management measures would be incorporated into the detailed design and applied during the construction and operation of the proposal.

A Construction Environmental Management Plan (CEMP) will be prepared to describe safeguards and management measures identified. The CEMP will provide a framework for establishing how these measures will be implemented and who would be responsible for their implementation.

The CEMP will be prepared prior to construction of the proposal and must be reviewed and certified by environment staff, prior to the commencement of any on-site works. The CEMP will be a working document, subject to ongoing change and updated as necessary to respond to specific requirements. The CEMP would be developed in accordance with the specifications set out in the QA Specification G36 – *Environmental Protection (Management System)*, QA Specification G38 – *Soil and Water Management (Soil and Water Plan)*, QA Specification G39 *Soil and Water Management (Erosion and Sediment Control Plan)*, QA Specification G40 – *Clearing and Grubbing* and QA Specification G10 – *Traffic Management*.

6.2 Summary of safeguards and management measures

The REF for the first stage of the Mamre Road upgrade identified a range of environmental outcomes and management measures that would be required to avoid or reduce the environmental impacts.

After consideration of the issues raised in the public submissions, the environmental management measures for the proposal (refer to Chapter 7 of the REF) have been revised. Should the proposal proceed, the environmental management measures in Table 6-1 would guide the subsequent phases of the proposal.

Additional and/or modified environmental safeguards and management measures to those presented in the REF have been **underlined** and deleted measures, or parts of measures, have been **~~struck out~~**.

Table 6-1: Summary of environmental safeguards and management measures

No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
GEN1	General - minimise environmental impacts during construction	<p>A CEMP will be prepared and submitted for review and endorsement of the Transport Environment Manager prior to commencement of the activity.</p> <p>As a minimum, the CEMP will address the following:</p> <ul style="list-style-type: none"> any requirements associated with statutory approvals details of how the project will implement the identified safeguards outlined in the REF issue-specific environmental management plans 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. <p>The endorsed CEMP will be implemented during the undertaking of the activity.</p>	Contractor / Transport	Detailed design / pre-construction / construction	Early work / main construction work	Standard safeguard
GEN2	General - notification	All businesses, residential properties and other key stakeholders (eg schools, local councils) affected by the activity will be notified at least five days prior to commencement of the activity.	Contractor / Transport	Pre-construction / construction	Early work / main construction work	Standard safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
GEN3	General – environmental awareness	<p>All personnel working on site will receive training to ensure awareness of environment protection requirements to be implemented during the project. This will include up-front site induction and regular "toolbox" style briefings.</p> <p>Site-specific training will be provided to personnel engaged in activities or areas of higher risk. These include:</p> <ul style="list-style-type: none"> • areas of Aboriginal heritage sensitivity and known Aboriginal sites • non-Aboriginal heritage site locations • threatened species habitat, Biobank site location and 'no-go' zones • locations of potential asbestos • areas where work is proposed within or very close to South Creek • <u>areas very close to sensitive receivers, such as when constructing the noise wall along the eastern side.</u> 	Contractor	Pre-construction / construction	Early work / main construction work	Standard safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
B1	Biodiversity	<p>A Flora and Fauna Management Plan will be prepared in accordance with Transport's <i>Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects</i> (RMS, 2011) and implemented as part of the CEMP. Refer to Section 8.1 of the BDAR (Appendix D) for the individual guideline reference numbers. It will include, but not be limited to:</p> <ul style="list-style-type: none"> • plans showing areas to be cleared and areas to be protected, including exclusion zones, protected habitat features and revegetation areas • requirements set out in the <i>Landscape Design Guideline</i> (RMS, 2018RTA, 2008b) • pre-clearing survey requirements by suitably qualified ecologists • procedures and requirements for vegetation and habitat removal • procedures for unexpected threatened species finds and fauna handling • procedures addressing relevant matters specified in the Policy and guidelines for fish habitat conservation and management (DPI Fisheries, 2013) • procedures for native vegetation rehabilitation and re-establishment in consideration of the landscaping plan urban design concept • procedures for educating construction staff on how to implement controls to avoid or minimise potential environmental impacts • protocols to manage weeds and pathogens. 	Transport / Contractor	Detailed design / pre-construction / construction	Early work / main construction work	Section 4.8 of QA G36 <i>Environment Protection</i>

No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
B2	Biodiversity	Measures to further avoid and minimise the construction footprint, and native vegetation or habitat removal <u>and fragmentation of vegetation (particularly in areas of TECs)</u> will be investigated during detailed design and implemented where practicable and feasible. <u>The limit of clearing will be confirmed in a revised vegetation clearance boundary, within which construction work would not be permitted to occur.</u>	Transport	Detailed design	N/A	Standard safeguard
B3	Shading and artificial light	Shading and artificial light impacts will be minimised where practicable, particularly adjacent to the BA408 Luddenham BioBank site, taking into account minimum luminescence requirements for: <ul style="list-style-type: none"> • safety when constructing during the night-time period • an urban road as outlined in the Australian Standards. 	Transport / Contractor	Detailed design/ construction	Early work / main construction work	Additional safeguard
B4	Impacts to habitat in human made structures	Where microbats are present and impacted within a structure, a Microbat Management Plan is to be developed by a suitably qualified microbat expert in consultation with Transport Biodiversity Officer. The Microbat Management Plan would be incorporated into the Flora and Fauna Management Plan. As a minimum, the plan is to include: <ul style="list-style-type: none"> • demonstrated consideration of the roosting and breeding season requirements of the target species • pre-clearing requirements for artificial habitat during pre-construction • a detailed methodology for pre-clearing surveys to identify microbats within the bridge structure 	Contractor	Detailed design / construction	Early work / main construction work	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
		<ul style="list-style-type: none"> • a protocol for identification, capture, and relocation of microbats • reporting requirements including species identification, number, relocation actions, exclusion methods • a protocol to routinely review and update the plan. 				
B5	Aquatic impacts	<p>Aquatic habitat will be protected in accordance with:</p> <ul style="list-style-type: none"> • <i>Guide 10: Aquatic habitats and riparian zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA Projects</i> (RMS, 2011) • <i>Section 3.3.2 Standard precautions and mitigation measures of the Policy and guidelines for fish habitat conservation and management Update 2013</i> (Department of Primary Industries (Fisheries NSW), 2013). <p>Culverts will be installed in accordance with the DPI (2013) guidelines.</p> <p>Implement and regularly maintain erosion and sediment controls for the duration of construction and landscaping works as per Landcom (2004), which will be detailed in a Soil and Water Management Plan.</p>	Transport / Contractor	Detailed design/ construction	Early work / main construction work	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
B6	Unexpected biodiversity impacts	Fencing and/or the use of highly visible rope or tape boundaries will be used to delineate the boundary of vegetation clearing at the edge of the proposal area. Signposting will be used to inform project personnel and site visitors of areas of conservation value to restrict entry or inform behaviour that will reduce incidental interactions with fauna.	Contractor	Construction	Early work / main construction work	Additional safeguard
B7	Vehicle strike	Transport will monitor road kills along Mamre Road during operation to identify the need for any additional safeguards. The northern portion of the Luddenham BioBank site would require the existing fence to be removed to account for the proposal area. A new replacement fence is to be installed at the northern portion of Luddenham BioBank site to assist in minimising fauna movement across Mamre Road.	Transport	Operation	N/A	Additional safeguard
B8	Invasion and spread of weeds	Weed species will be managed in accordance with <i>Guide 6: Weed management of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	Contractor	Construction	Early work / main construction work	Additional safeguard
B9	Changes to hydrology	Changes to existing surface water flows will be minimised through detailed design.	Transport	Detailed design	N/A	Additional safeguard
B10	Potential impact on key fish habitat	Transport will continue consultation with DPI Fisheries during detailed design to identify any additional measures required to minimise potential impacts to aquatic habitat within South Creek.	Transport	Detailed design	N/A	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
B11	Removal of threatened species habitat and habitat features	<p>Habitat removal minimised through detailed design. Develop and implement a Flora and Fauna Management Plan as part of the CEMP. Fauna will be managed in accordance with <i>Guide 9: Fauna handling of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA, 2011).</p> <p>Habitat removal will be undertaken in accordance with <i>Guide 4: Clearing of vegetation and removal of bushrock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA, 2011).</p> <p>Habitat will be replaced or re-instated in accordance with <i>Guide 5: Re-use of woody debris and bushrock</i> and <i>Guide 8: Nest boxes of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA, 2011).</p> <p><u>Vegetation removal would occur in accordance with <i>Vegetation Management (Protection and Removal) Guideline (Transport, 2021)</i>.</u></p> <p>The unexpected species find procedure is to be followed under <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA, 2011) if threatened fauna, not assessed in the biodiversity assessment, are identified in the proposal site.</p> <p><u>The need for nesting boxes or artificial hollows to be installed as part of the proposal to provide alternate habitat for birds and marsupials, and whether these are feasible to be implemented, will be considered further during detailed design.</u></p>	Transport / Contractor	Detailed design / Construction	Early work / main construction work	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
B12	<u>Potential disturbance of termites</u>	<p><u>An investigation will be carried out prior to the commencement of clearing and grubbing to confirm the potential for termites in the trees along Mamre Road that may be directly affected by construction of the proposal.</u></p> <p><u>If termites are identified during the inspection, affected trees that will be directly impacted by the proposal will be treated to minimise the potential for termites to impact surrounding properties as a result of disturbance due to the proposal.</u></p>	<u>Transport / Contractor</u>	<u>Pre-construction / construction</u>	<u>Early work / main construction work</u>	<u>Additional safeguard</u>
B13	<u>Biodiversity offsets</u>	<u>The proposal's biodiversity offset obligation for impacts on biodiversity values using the BAM-C will be recalculated prior to construction if any further amendments to the vegetation clearance boundary are proposed.</u>	<u>Transport</u>	<u>Pre-construction</u>	<u>N/A</u>	<u>Additional safeguard</u>
B14	<u>Tree risk</u>	<u>A preliminary tree assessment, Arborist Impact Assessment and tree risk assessment will be carried out for all existing trees prior to removal of vegetation to identify any specific concerns regarding the options to retain or remove vegetation.</u>	<u>Contractor</u>	<u>Detailed design / pre-construction</u>	<u>N/A</u>	<u>Additional safeguard</u>
B15	<u>Maintenance of culverts for fauna connectivity</u>	<u>Culverts within the proposal area will be regularly maintained and cleared (including weed control in adjacent native vegetation) to maintain potential use of these structures for fauna connectivity.</u>	<u>Transport</u>	<u>Operation</u>	<u>N/A</u>	<u>Additional safeguard</u>

No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
B16	<u>Impact on BioBank site</u>	<u>Compensation will be provided to the Biodiversity Conservation Trust and the Office of Strategic Lands as required for impacts to existing biodiversity offset credits generated within the Luddenham Road BioBank site.</u>	<u>Transport</u>	<u>Pre-construction</u>	<u>N/A</u>	<u>Additional safeguard</u>
B17	<u>Staged retirement of biodiversity offset credits</u>	<u>Biodiversity credits will be retired prior to construction or the stage of the construction activity that would impact on biodiversity values.</u>	<u>Transport</u>	<u>Pre-construction</u>	<u>N/A</u>	<u>Additional safeguard</u>
AH1	Aboriginal heritage	The design and construction methodology for the proposal will be reviewed during detailed design to identify any further areas where direct impacts on Aboriginal sites could be avoided or minimised.	Transport	Detailed design	N/A	Additional safeguard
AH2	Aboriginal heritage	An Aboriginal Heritage Impact Permit (AHIP) will be sought under section 90A of the NPW Act for Aboriginal sites with expected direct impacts (excluding the area within the boundary of existing AHIP C0002113) prior to construction. This is likely to include (subject to design refinement): <ul style="list-style-type: none"> • Mamre Road 1 (AHIMS 45-5-3167) • Mamre Road AFT 1 (AHIMS 45-5-5337) • Mamre Road AFT 2 (AHIMS 45-5-5336) • Mamre Road AFT 3 (AHIMS 45-5-5335) • Mamre Road AFT 4 (AHIMS tbc) • Mamre Road AFT 5 (AHIMS tbc) • Mamre Road IF 1 (AHIMS 45-5-5338) • MWP-AD5/MWP-AD6 (AHIMS 45-5-4815/45-5-4813) 	Transport	Detailed design / pre-construction	N/A	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
AH3	Mamre Road 1 and Mamre Road IF 1	Mamre Road 1 and Mamre Road IF 1 will be subject to community collection prior to any construction that may impact these sites. Community collection activities will be undertaken in accordance with the methodology attached as Appendix D in the <i>Aboriginal cultural heritage assessment report</i> (KNC, 2021b).	Transport	Detailed design / pre-construction / construction	Early work / main construction work	Additional safeguard
AH4	Salvage excavation	Salvage excavations will be undertaken on the impacted portions of the following sites prior to construction works that would impact these sites: <ul style="list-style-type: none"> • Mamre Road AFT 1 • Mamre Road AFT 2 • Mamre Road AFT 3 • Mamre Road AFT 4 • Mamre Road AFT 5 • MWP-AD5/MWP-AD6. Salvage excavation activities will be undertaken in accordance with the methodology attached as Appendix D in the <i>Aboriginal cultural heritage assessment report</i> (KNC, 2021b).	Transport	Pre-construction / construction	Early work / main construction work	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
AH5	Aboriginal heritage	<p>Short-term management of collected Aboriginal objects:</p> <ul style="list-style-type: none"> Any Aboriginal objects that are removed from the land by actions authorised by an AHIP, would be moved as soon as practicable to the temporary storage location (Kelleher Nightingale Consulting Pty Ltd, Level 10, 25 Bligh Street, Sydney NSW 2000) pending any agreement reached about the long-term management of the Aboriginal objects. Any Aboriginal objects stored at the temporary storage location would not be further harmed, except in accordance with the conditions of the AHIP. 	Transport	Pre-construction / construction	Early work / main construction work	Additional safeguard
AH6	Aboriginal heritage	<p>The long-term management of collected Aboriginal objects would occur as follows:</p> <ul style="list-style-type: none"> Recovered objects would be lodged with the Australian Museum in the first instance in accordance with the <i>Australian Museum Archaeological Collection Deposition Policy</i> (Australian Museum, 2012) If required, a variation would be sought for recovered objects to be held by the Aboriginal community or reburied. If reburial is to take place, registered Aboriginal stakeholders would be notified and given the opportunity to attend. Requirement 26 "Stone artefact deposition and storage" in the <i>Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW</i> would be complied with. 	Transport	Construction	Early work / main construction work	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
AH7	Aboriginal heritage	An Aboriginal Heritage Management Plan (AHMP) will be prepared in accordance with the <i>Procedure for Aboriginal cultural heritage consultation and investigation</i> (Transport, 2012) and <i>Standard Management Procedure - Unexpected Heritage Items</i> (Transport, 2015) and implemented as part of the CEMP. It will provide specific guidance on measures and controls to be implemented for managing impacts on Aboriginal heritage. The AHMP will be prepared in consultation with all relevant Aboriginal groups.	Contractor	Detailed design / pre-construction / construction	Early work / main construction work	Section 4.9 of QA G36 <i>Environment Protection</i>
AH8	Aboriginal heritage	<i>The Standard Management Procedure - Unexpected Heritage Items</i> (Transport, 2015) will 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 will only recommence once the requirements of that Procedure have been satisfied.	Contractor	Construction	Early work / main construction work	Section 4.9 of QA G36 <i>Environment Protection</i>

No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
AH9	Aboriginal heritage	<p>Barrier fencing will be established on the AHIP boundary, where feasible, to make sure that no construction impact extends into areas of Aboriginal sites outside the AHIP boundary including:</p> <ul style="list-style-type: none"> • Mamre Road AFT 1 • Mamre Road AFT 3 • Mamre Road AFT 4 • Mamre Road AFT 5 • MWP-AD7 • MWP-AD8 • MWP-IF1. <p>Aboriginal sites outside of the AHIP boundary will be marked as environmentally sensitive “no-go zones” within the CEMP.</p>	Contractor	Pre-construction / construction	Early work / main construction work	Additional safeguard
AH10	Aboriginal heritage	Workers will be inducted on appropriate protection measures for Aboriginal heritage and to comply with conditions in the AHIP.	Contractor	Construction	Early work / main construction work	Additional safeguard
AH11	Aboriginal heritage	The proposed works overlap an area that has been previously assessed for Aboriginal cultural heritage values and is already covered under an existing Aboriginal heritage impact permit (AHIP C0002113). As Transport is the holder for AHIP C0002113, any works related to the proposal undertaken within the boundary of AHIP C0002113 would need to comply with the existing permit conditions.	Transport	Construction	Main construction work	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
NAH1	Non-Aboriginal heritage	<p>A Non-Aboriginal Heritage Management Plan (NAHMP) would be prepared and implemented as part of the CEMP. It would provide specific guidance on measures and controls to be implemented to avoid and mitigate impacts to Non-Aboriginal heritage including but not limited to the following:</p> <ul style="list-style-type: none"> • a map identifying locations of no-go areas, including listed item curtilages, which are to be avoided • identification of potential environmental risks/impacts due to the works/activities • site inductions and heritage awareness training • management measures to avoid or minimise potential impacts • outline of the content to be included in toolbox talks regarding management of Non-Aboriginal heritage, including identification of no-go areas, any relevant permits and any responsibilities specified under the <i>Heritage Act 1977</i>. 	Contractor	Detailed design / pre- construction / construction	Early work / main construction work	Section 4.10 of QA G36 <i>Environment Protection</i>
NAH2	Non-Aboriginal heritage	<p><i>The Standard Management Procedure - Unexpected Heritage Items</i> (Transport, 2015) would be followed if any unexpected heritage items, archaeological remains or potential relics of Non-Aboriginal origin are encountered.</p> <p>Work would only re-commence once the requirements of that Procedure have been satisfied.</p>	Contractor	Construction	Early work / main construction work	Section 4.10 of QA G36 <i>Environment Protection</i>

No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
NAH3	Mamre House	<p>Mamre House, including significant gardens and grounds, would be protected throughout construction. Mitigation measures would include:</p> <ul style="list-style-type: none"> • cordoning off the Mamre House building and other significant buildings and gardens, and defining these as a 'no works' zone to minimise impacts on the site and avoid any inadvertent damage to the property and significant grounds • work completed within the SHR curtilage of the site would be carried out in accordance with the relevant conservation policies included within the Mamre House CMP (Section 6). 	Contractor	Construction	Early work / main construction work	Additional safeguard
NAH4	Marsden Memorial Cairn	<p>Retain and conserve the Marsden Memorial Cairn in an appropriate location within the SHR curtilage of Mamre House adjacent to the new driveway.</p> <p>Minimise through design and detailing any impacts on its setting and visibility from Mamre Road.</p>	Contractor	Detailed design / construction	Main construction work	Additional safeguard
NAH5	Mamre House driveway	<p>A landscape solution for the redundant gated entrance and signage to Mamre Homestead off Mamre Road would be informed by specialist heritage advice and consider the significant pastoral setting and the heritage significance of the property beyond, and might include but not be limited to updated signage, an interpretation node for vehicles, and lighting.</p>	Contractor	Detailed design	N/A	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
NAH6	Heritage interpretation opportunities	<p>Post-contact and contemporary Aboriginal cultural heritage values interpretation opportunities would be considered through the proposal area, including locations such as:</p> <ul style="list-style-type: none"> the Mamre House grounds as part of the new driveway landscape treatment along new pedestrian pathways and portals on the St Clair side of the proposal area noise walls proposed along the length of the proposal area. near a scar tree identified near the Blaxland Memorial Cairn. 	Contractor	Detailed design	N/A	Additional safeguard
NAH7	Non-Aboriginal heritage – archival recording	<p>Undertake an external photographic archival recording of Mamre House, focusing on driveway changes and realignment as well as changes to the setting of the Memorial Cairn. <u>The archival recording documentation is to be provided to Penrith City Council for their records.</u></p>	Contractor / <u>Transport</u>	Detailed design / pre-construction	N/A	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
TT1	Traffic and transport	<p>A Traffic Management Plan (TMP) will be prepared and implemented as part of the CEMP. The TMP will be prepared in accordance with the Transport <i>Traffic Control at Work Sites Manual</i> (RTA, 2010) and <i>QA Specification G10 Control of Traffic</i> (Transport, 2008). The TMP will include:</p> <ul style="list-style-type: none"> • confirmation of haulage routes • measures to maintain access to local roads and properties • construction traffic control plans outlining 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 • 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	Detailed design / pre-construction / construction	Early work / main construction work	Section 4.8 of QA G36 <i>Environment Protection</i>

No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
TT2	Construction site access	<p>Construction site access will be designed and implemented in consideration of:</p> <ul style="list-style-type: none"> road design guidelines and turning paths for heavy vehicles appropriate sight distances and deceleration/acceleration lanes (where required near highly trafficked areas) to allow traffic to safely enter and exit conspicuous temporary regulatory, warning and guide 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 minimising the size of heavy vehicles that would use local roads to access construction zones safe arrangements for pedestrians and/or cyclists. 	Contractor	<u>Detailed design / pre-construction / construction</u>	Main construction work	Additional safeguard
TT3	Temporary traffic arrangement	<p>The temporary traffic arrangement for Mamre Road will be designed to provide at a minimum, where feasible and reasonable:</p> <ul style="list-style-type: none"> single through lane per direction maintain traffic movements at intersections lanes widths of at least 3.5m 0.5m shoulder. <p>The posted speed limit is also proposed to be reduced from 80 kilometres per hour to 60 kilometres per hour along Mamre Road during construction.</p>	Contractor	Detailed design / construction	Main construction work	Additional safeguard

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No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
TT4	Traffic impacts	Further traffic modelling will 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	N/A	Additional safeguard
TT5	Impact on bus stops or routes	If any potential direct impacts on bus stops or routes during construction are identified, Transport will consult with the relevant bus operator/s to identify alternate arrangements.	Transport	Pre-construction / construction	Main construction work	Additional safeguard
TT6	Damage to local roads	A Road Dilapidation Report will be prepared by a suitably qualified person for local roads proposed to be used by heavy vehicles, before the commencement of use of the roads during construction. Any damage to the local road network identified to be caused by construction vehicles for the proposal will be remediated rectified by the contractor to be similar to the existing road condition or compensation will be paid to the relevant road authority.	Transport / Contractor	Pre-construction / post-construction	N/A	Additional safeguard
TT7	Impacts on cycling	During detailed design, a cyclist detour strategy would be prepared and implemented during construction to minimise any temporary impacts on cycling during construction. Community consultation will be carried out to understand the travel patterns of cyclists and inform the cyclists of any alternate access arrangements.	Transport / Contractor	Detailed design / pre-construction / construction	Main construction work	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
TT8	Temporary access changes	Detours during temporary access changes will be implemented with directional signage along alternate routes, including advice to pedestrians and cyclists of any path closures.	Contractor	Construction	Early work / main construction work	Additional safeguard
TT9	Traffic management measures	Any temporary traffic diversions, clearways and road closures will be implemented in accordance with Transport Management Centre (TMC) requirements.	Contractor	Construction	Early work / main construction work	Additional safeguard
TT10	Property access	Property access will be maintained where feasible and reasonable and property owners (including Erskine Park Rural Fire Service and Mamre House) will be consulted before starting any work that may restrict or control access.	Contractor	Construction	Early work / main construction work	Additional safeguard
TT11	Local road or shared path closures	Council will be consulted with prior to any local road or shared path closures to identify suitable mitigation measures such as detour routes.	Contractor	Construction	Early work / main construction work	Additional safeguard
TT12	Parking	Off-road parking for construction vehicles will be provided within the compound sites and construction areas.	Contractor	<u>Pre-construction / construction</u>	<u>Early work / Main construction work</u>	Additional safeguard
<u>TT13</u>	<u>Sensitivity analysis of traffic assumptions</u>	<u>A sensitivity analysis will be carried out to understand the influence of the Southern Link Road construction on the expected traffic performance of the proposal.</u>	<u>Transport</u>	<u>Detailed design</u>	<u>N/A</u>	<u>Additional safeguard</u>

No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
<u>TT14</u>	<u>Temporary traffic arrangement</u>	<u>The potential traffic impacts of any temporary arrangement along Mamre Road associated with revised construction staging of the proposal will be assessed during detailed design to identify any additional mitigation measures required.</u>	<u>Transport</u>	<u>Detailed design</u>	<u>N/A</u>	<u>Additional safeguard</u>
HF1	Flood risk	Flood modelling will be carried out to confirm flood impacts during detailed design including consideration of the potential noise wall on PMF flood risk.	Transport	Detailed design	N/A	Additional safeguard
HF2	Flood risk	Conduct an allotment and flood level survey of 43 and 44 McIntyre Avenue, St Clair to confirm flood inundation risk for these properties.	Transport	Detailed design	N/A	Additional safeguard
HF3	Scour risk	The detailed design will consider the need to provide scour protection and energy dissipation measures to mitigate the localised increases in flow velocities at the outlets that are to be upgraded, relocated or new stormwater drainage systems.	Transport	Detailed design	N/A	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
HF4	Flooding	<p>Further consideration of measures to minimise flooding impacts on the compound sites and construction activities will be undertaken during detailed design. This will include identification of:</p> <ul style="list-style-type: none"> • areas where material storage and stockpiles could be located outside of land subject to flooding in a 20 year ARI flood event • feasible design measures or construction methods to minimise sedimentation and cross contamination risks where flood prone land cannot be avoided for material storage and stockpiles such as installing erosion and sediment controls around compound site boundaries. 	Transport / Contractor	Detailed design	N/A	Additional safeguard
HF5	Hydrology impacts	The detailed design of any temporary waterway crossings will be developed in consultation with the Transport Environmental Officer and include appropriate pipe outlets, scour protection and flood immunity to minimise impacts on hydrology and flooding.	Transport	Detailed design	N/A	Additional safeguard
HF6	Hydrology impacts	All work within waterways will be carried out in accordance with the <i>Code of practice for minor work in NSW waterways</i> (Roads and Maritime, 2014a).	Contractor	Construction	Early work / main construction work	Additional safeguard
HF7	Flooding	The CEMP will include a Construction Flood Management Plan, which will include details and procedures to minimise the potential for construction activities to adversely impact on flood behaviour.	Transport / Contractor	Detailed design / pre-construction / construction	Early work / main construction work	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
		<p>This Plan will define the flood immunity criteria (including consideration of inundation from minor rain events) for material storage and stockpile areas proposed to be located on land that is inundated during a 1% AEP event.</p> <p>Measures to manage residual flood impacts that will be outlined in the Plan will include:</p> <ul style="list-style-type: none"> • 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 should a weather warning be issued of impending flood producing rain • providing temporary flood protection to properties identified as being at risk of adverse flood impacts during any stage of construction of the proposal, where feasible and reasonable • limiting the extent of works located in floodway areas • monitoring 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 and actions required to make construction areas stable and safe • implementation of a flood evacuation plan. 				

No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
HF8	Flooding	<p>A flood evacuation plan for construction personnel, materials and equipment will be prepared to manage a potential flood event during construction and included as part of the CEMP. This plan will be implemented during construction and outline:</p> <ul style="list-style-type: none"> • procedures to monitor rainfall that may influence water levels • what flood event would trigger the plan • evacuation procedures including a map indicating the area that is flood prone and suitable evacuation locations • procedures to reduce risk during a flood event including removal of all plant/equipment and stabilising exposed areas. 	Contractor	Pre-construction / construction	Early work / main construction work	Additional safeguard
HF9	Flooding	<p>The storage of hazardous material will be confined to areas that are not subject to flooding during a one per cent AEP extent or either:</p> <ul style="list-style-type: none"> • stored in a manner that prevents their mobilisation during times of flood • be removed from the floodplain when minor rain events are predicted to inundate storage areas and at the onset of a flood. 	Contractor	Construction	Early work / main construction work	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
SW1	Soil and water	<p>A Soil and Water Management Plan (SWMP) will be prepared and implemented as part of the CEMP to manage water quality impacts during construction of the proposal. The SWMP will identify all reasonably foreseeable risks relating to soil erosion and sedimentation, dewatering and water pollution and describe how these risks will be addressed during construction.</p> <p>The SWMP will be reviewed by a soil conservationist on the Transport list of Registered Contractors for Erosion, Sedimentation and Soil Conservation Consultancy Services. The SWMP will then be revised to address the outcomes of the review.</p>	Contractor	Detailed design / pre-construction / construction	Early work / main construction work	Section 2.1 of QA G38 <i>Soil and Water Management</i>
SW2	Soil and water	<p>A site-specific Erosion and Sediment Control Plan/s (ESCP) will be prepared and implemented as part of the SWMP.</p> <p>The Plan will include arrangements for managing wet weather events, including monitoring of potential high-risk events (such as storms) and specific controls and follow-up measures to be applied in the event of wet weather.</p>	Contractor	Detailed design / pre-construction / construction	Early work / main construction work	Section 2.2 of QA G38 <i>Soil and Water Management</i>
SW3	Soil and water	<p>A construction water quality monitoring plan will be prepared and implemented as part of the SWMP. The plan will be prepared in accordance with the Transport Guideline for Construction Water Quality and EPA publication "Approved Methods for the Sampling and Analysis of Water Pollutants in NSW.</p>	Contractor	Detailed design / pre-construction / construction	Early work / main construction work	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
SW4	Soil and water	The design and construction of watercourse crossings, works within a watercourse or works on waterfront land as defined by the <i>Water Management Act 2000</i> are to be undertaken with consideration to the <i>Guidelines for instream works on waterfront land</i> (DPI, 2012a), <i>Guidelines for watercourse crossings on waterfront land</i> , (DPI, 2012b) and in accordance with relevant Transport specifications and guidelines.	Transport / Contractor	Detailed design / construction	Early work / main construction work	Additional safeguard
SW5	Contaminated land	<p>A Contaminated Land Management Plan will be prepared in accordance with the <i>Guideline for the Management of Contamination</i> (Transport, 2013) and implemented as part of the CEMP. The plan will include, but not be limited to:</p> <ul style="list-style-type: none"> 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. 	Contractor	Detailed design / pre-construction / construction	Early work / main construction work	Section 4.2 of QA G36 <i>Environment Protection</i>

No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
SW6	Contaminated land	A Remediation Action Plan (RAP) and an Unexpected Find Protocol (UFP) will be prepared and implemented to manage the potential for soil or water quality contamination during construction of the proposal. The RAP will evaluate potential remedial options and recommend a preferred option to manage the ACM during the construction of the road upgrades. The RAP should include a Long-Term Environmental Management Plan for the ACM material (should it remain in the proposal alignment). The RAP should include a preliminary plan to manage potential risks to human health and the environment during the remediation activities. The RAP will form a part of the overall CEMP.	Contractor	Detailed design / pre-construction / construction	Early work / main construction work	Additional safeguard
SW7	Asbestos	When working in areas impacted by asbestos, Work Health and Safety (WHS) and additional controls must be in place to minimise exposure risks. These may include physical removal of asbestos fragments from the soil surface, additional dust suppression and appropriate PPE.	Contractor	Construction	Early work / main construction work	Additional safeguard
SW8	Asbestos	Asbestos air monitoring by a licensed hygienist/LAA should be carried out for the duration of the earthworks to monitor for respirable asbestos fibres which may be released.	Contractor	Construction	Early work / main construction work	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
SW9	Accidental spill	A site-specific emergency spill plan will be developed and include spill and leak management measures in accordance with the <i>Transport Code of Practice for Water Management</i> (RTA, 1999) and relevant EPA guidelines. The plan will address measures to be implemented in the event of a spill, including initial response and containment, notification of emergency services and relevant authorities (including Transport and EPA officers).	Contractor	Pre-construction / construction	Early work / main construction work	Section 4.3 of QA G36 <i>Environment Protection</i>
SW10	Accidental spill	Spill containment to be provided within operational water quality basins located within road catchments considered to present a high risk to South Creek.	Contractor	Detailed design / <u>pre-construction / construction</u>	N/A	Additional safeguard
SW11	Stormwater	The layout and detail of the drainage system including drainage, water quality basins, spill containment, swales, discharge points and outlet scour protection measures will be refined during detailed design. <u>This should consider any recent work in South Creek that may influence stormwater flow and management.</u>	Transport	Detailed design	N/A	Additional safeguard
SW12	Stormwater	Stormwater outlets to local drainage lines and waterways are to be designed with consideration to the <i>Guidelines for outlet structures on waterfront land</i> (DPI, 2012c) and relevant Transport specifications and guidelines. <u>This will include consideration of vegetated channels with plants suitable for 1V:2H batter slopes that do not require mowing and short lengths of linear biofiltration where possible during detailed design.</u>	Transport	Detailed design	N/A	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
SW13	Stockpiles	Stockpiles sites will be managed in accordance with <i>Environmental Procedure Management of Wastes on Roads and Maritime Services Land</i> (RMS, 2014b)	Contractor	Construction	Early work / main construction work	Additional safeguard
SW14	Soil and water	Stockpiles site locations would be confirmed during detailed design and managed during construction in accordance with <i>Environmental Procedure Management of Wastes on Roads and Maritime Services Land</i> (RMS, 2014b) and the <i>Stockpile Site Management Guideline</i> (RMS, 2015b). This would consider measures to manage cross contamination within a stockpile area.	Contractor	Detailed design / construction	Early work / main construction work	Additional safeguard
SW15	Soil and water	Further consideration of how to manage stockpiles, material laydown and chemical storage with respect to floodwater would be undertaken during detailed design.	Contractor	Detailed design / pre-construction	N/A	Additional safeguard
SW16	Soil and water	An assessment of the impact of discharges from each temporary sediment basin would be undertaken during detailed design in accordance with the <i>Draft Guideline for Assessing the Impacts of Treated Water Discharge from Water Quality Treatment Controls</i> (Transport 2020b). The assessment would adopt relevant water quality objectives for South Creek and include a catchment analysis to confirm the flow characteristics of the receiving waterways.	Transport / Contractor	Detailed design / pre-construction	N/A	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
NV1	Noise and vibration	<p>A Construction Noise and Vibration Management Plan (CNVMP) will be prepared and implemented as part of the CEMP. The CNVMP will generally follow the approach in the <i>Interim Construction Noise Guideline</i> (ICNG) (DECC, 2009) and identify:</p> <ul style="list-style-type: none"> • nearby sensitive receivers • all potential significant noise and vibration generating activities associated with the activity • description of works, construction equipment and hours work would be completed in • results of location- and activity-specific noise and vibration impact assessments • feasible and reasonable mitigation measures to be implemented, taking into account Beyond the Pavement: urban design policy, process and principles (Transport, 2020a) • criteria for the proposal and relevant licence and approval conditions • a monitoring program to assess performance against relevant noise and vibration criteria • contingency measures to be implemented in the event of non-compliance with noise and vibration criteria • arrangements and details for consultation with the community, affected neighbours and sensitive receivers, including notification and complaint handling procedures • details on how respite would be applied where ongoing high impacts are seen at certain receivers. 	Contractor	Detailed design / construction	Early work / main construction work	Section 4.6 of QA G36 <i>Environment Protection</i>

No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
NV2	Noise and vibration	<p>All sensitive receivers (e.g. schools, local residents) likely to be affected will be notified at least seven days prior to commencement of any works associated with the activity that may have an adverse noise or vibration impact. The notification will provide details of:</p> <ul style="list-style-type: none"> the project the construction period and construction hours contact information for project management staff complaint and incident reporting how to obtain further information. 	Contractor	Detailed design / pre-construction / construction	Early work / main construction work	Standard safeguard
NV3	Noise and vibration	<p>Location- and activity-specific noise and vibration impact assessments should be carried out, as a minimum, prior to activities:</p> <ul style="list-style-type: none"> with the potential to result in noise levels above 75 dBA at any receiver required outside Standard Construction Hours likely to result in noise levels in greater than the relevant NMLs with the potential to exceed relevant criteria for vibration. <p>The assessments should confirm the predicted impacts at the relevant receivers in the vicinity of the activities to aid the selection of appropriate management measures, consistent with the requirements of the CNVG. The results of these assessments will be included as part of the CNVMP.</p>	Contractor	Pre-construction / construction	Early work / main construction work	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
NV4	Noise and vibration	Monitoring should be carried out at the start of noise 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	Early work / main construction work	Additional safeguard
NV5	Noise	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 they should be completed as early as possible in each work shift. Appropriate respite should also be provided to affected receivers in accordance with the CNVG.	Contractor	Pre-construction / construction	Early work / main construction work	Additional safeguard
NV6	Noise	Hoarding, or other shielding structures, should be considered for use where receivers are impacted near compounds or fixed work areas 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	<u>Pre-construction</u> / construction	Main construction work	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
NV7	Vibration	<p>The potential for vibration impacts and requirement for vibration intensive work and equipment will be reviewed during detailed design.</p> <p>Where work is within the minimum working distances and considered likely to exceed the cosmetic damage criteria:</p> <ul style="list-style-type: none"> • Different construction methods with lower source vibration levels will be investigated and implemented, where feasible • Attended vibration measurements will be undertaken at the start of the work to determine actual vibration levels at the item. Work should be ceased if the monitoring indicates vibration levels are likely to, or do, exceed the relevant criteria. 	Contractor	Detailed design / pre-construction / construction	Early work / main construction work	Additional safeguard
NV8	Vibration	Building condition surveys should be completed before and after the work where buildings or structures are within the minimum working distances and considered likely to exceed the cosmetic damage criteria during the use of vibration intensive equipment.	Contractor	Detailed design / pre-construction / construction	Early work / main construction work	Additional safeguard
NV9	Operational noise mitigation	Operational noise mitigation requirements including the noise wall design and any at-property treatments will be reviewed during detailed design. At-property treatments will be agreed upon and implemented during construction, where feasible and reasonable, in consultation with property owners. <u>Timing of noise wall construction will also be reviewed during detailed design with an aim to build noise walls as early as possible during the construction phase.</u>	Transport / Contractor	Detailed design	N/A	Additional safeguard

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No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
NV10	Noise from temporary detours	The proposal should review the requirement for detours during preparation of the CNVMP when sufficient information is available to allow the potential noise impacts to be determined.	Transport	Detailed design / pre-construction	N/A	Additional safeguard
<u>NV11</u>	<u>Vibration</u>	<u>The proposal will consider the risk of unstable soils where vibration impacts would be experienced during detailed design. Additional geotechnical investigations will also be carried out during detailed design to confirm the ground condition within and near the proposal area.</u>	<u>Transport</u>	<u>Detailed design</u>	<u>N/A</u>	<u>Additional safeguard</u>
LV1	Landscape character and visual impact	<p>An The Urban Design Concept and Landscape Plan will continue to be developed prepared to support the final detailed project design and implemented as part of the CEMP.</p> <p>The Urban Design and Landscape Plan will present an integrated urban design for the project, providing practical detail on the application of design principles and objectives identified in the environmental assessment. The Plan will include design treatments for:</p> <ul style="list-style-type: none"> • proposed landscaped areas, in consideration of advice from an ecologist, opportunities to improve riverine scenic quality and Bush Fire Prone Land • built elements including noise walls • pedestrian and cyclist elements including footpath location, paving types and pedestrian crossings • fixtures such as seating, lighting, fencing and signs 	Contractor / Transport	Detailed design / pre-construction / construction	Early work / main construction work	Standard safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
		<ul style="list-style-type: none"> details of the staging of landscape works taking account of related environmental controls such as erosion and sedimentation controls and drainage opportunities for heritage interpretation and minimisation of heritage impacts in consultation with specialist heritage advice procedures for monitoring and maintaining landscaped or rehabilitated areas. <p>It would be prepared in accordance with relevant guidelines, including:</p> <ul style="list-style-type: none"> <i>Beyond the Pavement urban design policy, process and principles</i> (Transport, 2020a) <i>Noise Wall Design Guidelines</i> (Transport, 2021). <u>Landscape Design Guideline (RMS, 2018)</u> 				
LV2	Road furniture	Consolidate signage structures and minimise visual clutter and obstructions, particularly in front of Mamre House.	Contractor	Detailed design	N/A	Additional safeguard
LV3	Planting	<p>The landscape plan for the proposal will be confirmed during detailed design and would consider:</p> <ul style="list-style-type: none"> arranging plants to maintain the long vistas to the Blue Mountains and views to Mamre House and other heritage sites choosing a variety of species for feature planting that is generally reflective of the existing landscape character and prioritises native vegetation, <u>including consideration of</u> 	Transport	Detailed design	N/A	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
		<p><u>tree sizes balancing long term performance with initial presentation</u></p> <ul style="list-style-type: none"> • selection of plant species and layouts in riparian areas <u>and near culverts</u> in consultation with ecologists • planting <u>low shrubs</u> in the median strip where it is more than three metres wide • planting to provide screening and shade, particularly along the proposed shared path • maintaining existing roadside vegetation, where possible • <u>planting tubestock for site revegetation with consideration of native species (such as members of Cumberland Plain Woodland, River-Flat Eucalypt Forest and Swamp Oak Floodplain Forest TECs), where practical and available at the time of planting</u> • <u>measures to minimise urban heat, including provision of surface water and soil moisture, permeable and grassed ground cover and tree cover</u> • <u>landscape design and species selection to mitigate aviation risk for the Western Sydney Airport informed by discussions with the M12 Motorway project team</u> • <u>consideration of planting in lieu of seeding on 4:1 batters to avoid maintenance complications</u> 				

No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
LV4	Noise walls, bus stops and pedestrian portals	The detailed design of the noise walls, bus stops and pedestrian portals will consider: <ul style="list-style-type: none"> reflecting the distinctive landscape character zones along the road corridor through colour, art and texture opportunities for heritage interpretation at key locations way-finding opportunities at pedestrian portals pedestrian and cyclist safety, including lighting and using CPTED principles <u>shading impacts of the noise wall through an updated shading assessment</u> <u>colour selection informed by an access/disability consultant to help users visibly identify their stop or access point.</u> 	Transport	Detailed design	N/A	Additional safeguard
<u>LV5</u>	<u>Construction light spill</u>	<u>Lighting of construction areas (if required) would be orientated to minimise glare and light spill impacts on nearby residences.</u>	<u>Contractor</u>	<u>Construction</u>	<u>Early work / main construction work</u>	<u>Additional safeguard</u>
<u>LV6</u>	<u>Overhead powerlines</u>	<u>The location of overhead powerlines and power poles would be confirmed during detailed design to minimise visual impacts on Mamre House, where possible.</u>	<u>Transport</u>	<u>Detailed design</u>	<u>N/A</u>	<u>Additional safeguard</u>
<u>LV7</u>	<u>Landscaping near asphalt verge</u>	<u>The detailed design will consider the potential for installation of jute netting at the interface between the asphalt shoulder and softer landscape surfaces to avoid scouring.</u>	<u>Transport</u>	<u>Detailed design</u>	<u>N/A</u>	<u>Additional safeguard</u>

No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
AQ1	Air quality	<p>An Air Quality Management Plan (AQMP) will be prepared and implemented as part of the CEMP. The AQMP will include, but not be limited to:</p> <ul style="list-style-type: none"> • potential sources of air pollution • air quality management objectives consistent with any relevant published EPA and/or OEHD/DPIE (now DPE) guidelines • minimise the number of stockpiles onsite, avoid stockpiling in exposed areas and ensure long term stockpiles are covered or stabilised • emission and dust mitigation and suppression measures to be implemented • vehicles and mobile plant to use designated haulage and access routes and restrict traffic speeds on site • all vehicles transporting soils, rock or other materials are covered when entering or exiting the site • maintain all vehicles and plant in accordance with manufacturer specifications • methods to manage work during strong winds or other adverse weather conditions. Daily monitoring of weather forecasts to be undertaken to determine when adverse weather conditions are predicted. • a progressive rehabilitation strategy for exposed surfaces • daily visual observations of dust to identify construction activities, vehicles, plant or equipment that are generating excessive air emissions. Additional mitigation strategies to be implemented where necessary. 	Contractor	Detailed design / pre-construction / construction	Early work / main construction work	<p>Core standard safeguard AQ1</p> <p>Section 4.4 of QA G36 <i>Environment Protection</i></p>

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No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
AQ2	Air quality	Concrete batching plant to be located at least 200 metres (where feasible) from residences.	Contractor	Detailed design / construction	Main construction work	Additional safeguard
AQ3	Air quality	Transport will continue consulting with DPIE-DPE regarding the potential timing and impacts on the St Marys Monitoring station during the operation of compound site 2 and options to mitigate this impact.	Transport	Detailed design / pre-construction	N/A	Additional safeguard
AQ4	<u>Potential odour</u>	<u>Any portable toilets established for use by construction workers for the proposal would be appropriately sited and maintained to minimise any offensive odours impacting nearby sensitive receivers.</u>	<u>Contractor</u>	<u>Construction</u>	<u>Main construction work</u>	<u>Additional safeguard</u>
SE1	Socio-economic	A Communication Community and Stakeholder Engagement Plan (CSEP) will be prepared and implemented as part of the CEMP to help provide timely and accurate information to the community during construction. The CSEP will include (as a minimum): <ul style="list-style-type: none"> 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 CP will be prepared in accordance with the <i>Community Involvement and Communications Resource Manual (RTA, 2008a)</i>.	Contractor	Pre-construction / construction	Early work / main construction work	Standard safeguard
SE2	Impacts on nearby property	Transport will continue to consult with the community and affected property owners and land occupiers until the completion of the proposal. Discussions including the nature and timing of construction works would be required to identify	Transport	Pre-construction/ construction	Early work / main construction work	Additional safeguard

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No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
	owners and land occupiers	relevant noise, traffic, air quality, access and visual impact mitigation measures for residents, stakeholders, and people using the proposal.				
SE3	Property acquisition	<p>All property acquisition will be carried out in accordance with the <i>Land Acquisition Information Guide</i> (Transport, 2014b) and the <i>Land Acquisition (Just Terms Compensation) Act 1991</i>.</p> <p>Transport will continue to consult with Penrith City Council regarding council owned land and assets. The design for the proposal will also be refined during detailed design to minimise impacts on community land, where possible.</p>	Transport	Detailed design/ pre-construction	N/A	Standard safeguard
SE4	Changes in access	Temporary and permanent changes in access will be discussed with impacted land occupiers prior to commencement of construction and during construction activities should arrangements change.	Transport	Pre-construction / construction	Early work / main construction work	Additional safeguard
SE5	Business consultation	<p>Transport will consult with businesses about construction activities required for the proposal, including freight and industrial businesses that use Erskine Business Park.</p> <p>Measures to maintain access and visibility to businesses on Mamre Road during construction would be discussed and implemented.</p>	Transport / Contractor	Pre-construction/ construction	Main construction work	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
SE6	Social infrastructure	Transport will consult with facilities near the proposal including Banks Public School, Catholic Care Mamre House, Feathered Friends, Erskine Park Rural Fire Brigade, Old MacDonald Childcare Centre, Peter Kearns Memorial Oval and DOGS NSW regarding construction activities.	Transport / Contractor	Pre-construction/ construction	Early work / main construction work	Additional safeguard
SE7	Relocation of bus stops during construction	Public transport users will be notified in advance of any changes to bus stop locations or bus routes through signage at the existing bus stop. Temporary bus stops would have similar features to existing bus stops, including shelters and rest areas for less mobile and elderly people and adequate way finding signage. Consultation with the relevant bus authorities will be undertaken (including school buses) to mitigate potential impacts to bus routes and times.	Transport / Contractor	Pre-construction / construction	Main construction work	Additional safeguard
SE8	Traffic management for all road users	Alternative routes for active transport users will be clearly identified by signage and the use of traffic controllers where required. This includes signage located in areas close to Banks Drive and Bakers Lane where school children may be travelling to and from school.	Transport	Pre-construction / construction	Main construction work	Additional safeguard
SE9	Removal of parking	Penrith City Council will be consulted about the permanent removal of parking spaces on Solander Drive and McIntyre Avenue.	Transport	Detailed design	N/A	Additional safeguard
SE10	<u>Tree root impacts on properties</u>	<u>Design solutions to minimise any potential impacts of the root systems of trees planted along Mamre Road on adjoining property will be confirmed during detailed design.</u>	<u>Transport</u>	<u>Detailed design</u>	<u>N/A</u>	<u>Additional safeguard</u>

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No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
<u>SE11</u>	<u>Council-owned assets</u>	<u>Transport will replace or reinstate any Council-owned assets impacted during construction.</u>	<u>Transport / Contractor</u>	<u>Detailed design / pre construction / construction</u>	<u>Main construction work</u>	<u>Additional safeguard</u>
O1	Resource use	<p>The following resource management hierarchy principles would be followed:</p> <ul style="list-style-type: none"> • avoid unnecessary resource consumption as a priority • avoidance would be followed by resource recovery (including reuse of materials, reprocessing, and recycling and energy recovery) • disposal would be undertaken as a last resort (in accordance with the <i>Waste Avoidance and Resource Recovery Act, 2001</i>). 	Contractor	Detailed design / pre-construction / construction	Early work / main construction work	Additional safeguard
O2	Energy consumption	Energy efficient LEDs would be considered for new streetlights installed as part of the proposal.	Transport	Detailed design	N/A	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
O3	Waste	<p>A Waste Management Plan (WMP) will be prepared and implemented as part of the CEMP. The WMP will include but not be limited to:</p> <ul style="list-style-type: none"> • measures to avoid and minimise waste associated with the project • classification of wastes and management options (re-use, recycle, stockpile, disposal) • statutory approvals required for managing both on and off-site waste, or application of any relevant resource recovery exemptions • <u>consideration of Sydney Waters' requirements for trade waste licence requests or discharge of chlorinated water</u> • procedures for storage, transport and disposal • monitoring, record keeping and reporting. <p>The WMP will be prepared taking into account the <i>Environmental Procedure - Management of Wastes on Transport for NSW Land</i> (Transport, 2014) and relevant Transport Waste Fact Sheets.</p>	Contractor	Detailed design / pre-construction / construction	Early work / main construction work	Section 4.2 of QA G36 <i>Environment Protection</i>
O4	Waste	<p>Additional soil samples will be required to meet a reasonable sampling density to classify any waste produced. Additional soil samples of natural soil material will also be required to meet the requirements of Excavated Natural Material under the Resource Recovery Order (RRO) / Resource Recovery Exemption (RRE).</p>	Contractor	Pre-construction / construction	Early work / main construction work	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
O5	Waste	Records of waste classifications, waste disposal, beneficial reuse of spoil and any asbestos monitoring and clearance certificates must be held by the contractor and provided to Transport on project completion.	Contractor	Pre-construction / construction	Early work / main construction work	Additional safeguard
O6	Utilities	<p>Prior to the commencement of works:</p> <ul style="list-style-type: none"> the location of existing utilities and relocation details will be confirmed following consultation with the affected utility owners and the <u>Western Sydney Utilities Collaboration - Technical Working Group</u> if the scope or location of proposed utility relocation works falls outside of the assessed proposal scope and <u>footprint proposal area or would involve additional ground disturbance</u>, further assessment will be undertaken. 	Contractor / <u>Transport</u>	Detailed design / pre-construction	Early work / main construction work	Additional safeguard
O7	Utilities	<p>All utilities work outside the proposal area that involves ground disturbance would require further environmental assessment.</p> <p><u>The detailed design of the utility adjustment and relocation strategy for the proposal will consider:</u></p> <ul style="list-style-type: none"> <u>planned future utilities or amplification of assets within the proposal area (as identified by utility owners) to avoid potential design conflicts</u> <u>potential impacts of additional loading or changes to ground levels on buried assets</u> 	Contractor / <u>Transport</u>	Detailed design / pre- construction	Early work / main construction work	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
O8	Hazards and risk management	<p>A Hazard and Risk Management Plan (HRMP) will be prepared and implemented as part of the CEMP. The HRMP will include, but not be limited to:</p> <ul style="list-style-type: none"> • details of hazards and risks associated with the activity • measures to be implemented during construction to minimise these risks • record keeping arrangements, including information on the materials present on the site, material safety data sheets, and personnel trained and authorised to use such materials • a monitoring program to assess performance in managing the identified risks • contingency measures to be implemented in the event of unexpected hazards or risks arising, including emergency situations. <p>The HRMP will be prepared in accordance with relevant guidelines and standards, including relevant Safe Work Australia Codes of Practice, and EPA or DPIE (now DPE) publications.</p>	Contractor	Detailed design / pre-construction / construction	Main construction work	Standard safeguard
O9	Hazards and risk management	<p>During construction, a bushfire management plan (BMP) would be prepared and included as part of the CEMP. This bushfire management plan should consider risk of construction compounds, feasible bushfire reduction methods and the potential to incorporate asset protection zones.</p>	Contractor	Construction	Early work / main construction work	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
<u>O10</u>	<u>Illegal dumping</u>	<u>During detailed design, further consideration will be given to any known illegal dumping areas and any appropriate mitigation measures to deter this behaviour, which should be adopted into the design.</u>	<u>Transport</u>	<u>Detailed design</u>	<u>N/A</u>	<u>Additional safeguard</u>
<u>O11</u>	<u>Utility impacts during construction</u>	<u>Transport will consult with utility owners during construction of the proposal, including providing early notice of construction staging and timing to allow sufficient time for utility owners to schedule shutdowns and reconnect its assets, as required.</u> <u>Safe, unrestricted access will be maintained to existing utility assets during construction, where possible. Utility owners will be permitted to assess the condition of impacted assets before, during and after construction.</u>	<u>Transport / Contractor</u>	<u>Construction</u>	<u>Early work / main construction work</u>	<u>Additional safeguard</u>
<u>O12</u>	<u>Impacts on Sydney Water assets</u>	<u>Sydney Water's Asset Adjustment process will be followed for the relocation, adjustment and/or protection of Sydney Water assets.</u>	<u>Transport</u>	<u>Detailed design / construction</u>	<u>Early work / main construction work</u>	<u>Additional safeguard</u>
<u>O13</u>	<u>Access to utilities</u>	<u>During detailed design, arrangements for safe access to utilities for ongoing maintenance within the proposal area will be confirmed. Any additional access track that is required will be sited to minimise environmental impacts (including on biodiversity, heritage, visual and surface water) as far as practicable.</u>	<u>Transport</u>	<u>Detailed design</u>	<u>N/A</u>	<u>Additional safeguard</u>

No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
CU1	Cumulative construction impacts	<p>Other developers would be consulted in accordance with the Community Stakeholder and Engagement Plan to:</p> <ul style="list-style-type: none"> • obtain information about project timeframes and impacts • manage the interfaces of the proposal's staging and programming in combination with the other projects occurring in the area • identify and implement appropriate safeguards and management measures to minimise cumulative impacts. 	Transport and Contractor	Pre-construction / construction	Early work / main construction work	Additional safeguard
CU2	Cumulative traffic impacts	<p>Transport would coordinate with the project teams <u>of planned developments nearby, Sydney Water, the Western Sydney Utilities Technical Group</u> and the Transport Management Centre for the Altis Warehouse and Logistics Hub, Upper South Creek Advanced Water Recycling Centre and WSEA Mamre Road Precinct developments about the proposed timing of the road and lane closures and identify alternate routes or additional safeguards and management measures, as required.</p> <p>This would include (but not be limited to) consultation with the project teams for the Altis Warehouse and Logistics Hub, Upper South Creek Advanced Water Recycling Centre and WSEA Mamre Road Precinct developments.</p>	Transport and Contractor	Pre-construction / construction	Early work / main construction work	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Relevant construction stage	Reference
CU3	Cumulative construction impacts	The CEMP would consider potential cumulative construction impacts from known surrounding development activities (see Section 6.12.3) as well as new planned development activities near the proposal, as they become known. This would include a process to regularly review and update mitigation measures as new works are identified that may lead to cumulative impacts or if complaints are received due to cumulative impacts.	Transport and Contractor	Pre-construction / construction	Early work / main construction work	Additional safeguard

6.3 Licensing and approvals

Table 6-2: Summary of licensing and approvals required

Instrument	Requirement	Timing
<i>Protection of the Environment Operations Act 1997</i> (s43)	Environment protection licence (EPL) for scheduled activities [road construction] from the EPA.	Prior to start of the activity.
<i>Fisheries Management Act 1994</i> (s199)	Notification to the Minister for Agriculture prior to any dredging or reclamation works.	A minimum of 28 days prior to the start of work.
<i>Heritage Act 1977</i> (s60)	Permit to carry out activities to an item listed on the State Heritage Register or to which an interim heritage order applies from the Heritage Council of NSW.	Prior to start of the activity.
<i>National Parks and Wildlife Act 1974</i> (s90)	Aboriginal heritage impact permit from Heritage NSW.	Prior to start of the activity.
<i>Crown Land Management Act 2016</i> (Division 3.4, 5.5 and 5.6)	Lease or licence to occupy areas of Crown land.	Prior to start of the activity.
<i>Roads Act 1933</i> (s138)	A Road Occupancy Licence would be required from the relevant roads authority by the contractor for prior to work on public roads	Prior to start of the activity.
State Environmental Planning Policy No 55—Remediation of Land (s16) (now consolidated as part of State Environmental Planning Policy (Resilience and Hazards) 2021)	Notification about Category 2 remediation work to council	At least 30 days before the start of the activity.

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Appendix A

Summary of community respondents and where issues are addressed

Summary of community respondents and where issues are addressed

Submission No.	Respondent	Section number where issues are addressed
1	Individual	2.2.1, 2.10.3
2	Individual	2.2.4, 2.4.3, 2.5.3, 2.6.2, 2.9.1, 2.10.1
3	Individual	2.3.6, 2.5.3
4	Individual	2.10.3
5	Individual	2.4.4
6	Individual	2.3.6, 2.5.3
7	Individual	2.2.1, 2.2.2, 2.2.5, 2.3.5, 2.10.3
8	Individual	2.3.3, 2.5.3, 2.5.4
9	Individual	2.5.1
10	Individual	2.3.4
11	Individual	2.3.7
12	Individual	2.3.3, 2.5.3
13	Individual	2.2.2, 2.5.3
14	Individual	2.4.4
15	Individual	2.3.9
16	Individual	2.4.4
17	Individual	2.2.2, 2.3.1
18	Individual	2.10.2
19	Individual	2.4.4, 2.6.2
20	Individual	2.3.1, 2.4.2, 2.4.4, 2.6.2, 2.8.1
21	Individual	2.2.2, 2.5.3, 2.10.3
22	Individual	2.10.3
23	Individual	2.3.1, 2.6.2, 2.9.2
24	Old MacDonald's Child Care	2.2.3, 2.4.1, 2.4.2, 2.4.4, 2.5.3, 2.7.1, 0, 2.7.4, 2.7.5, 2.8.2, 2.9.1, 2.10.1
25	Individual	2.3.3, 2.5.1
26	Individual	2.10.3
27	Individual	2.8.2
28	Individual	2.3.9
29	Individual	2.3.2, 2.4.1, 2.4.2, 2.4.4, 2.6.2, 2.7.4
30	Individual	2.2.1, 2.3.1, 2.3.2, 2.4.2, 2.4.3, 2.5.2, 2.5.3, 2.6.2, 2.7.4, 2.8.1, 2.10.1, 2.10.4
31	Individual	2.2.1, 2.3.4, 2.3.5, 2.3.9
32	Individual	2.2.3, 2.4.2, 2.5.2, 2.5.3, 2.6.1, 2.8.1, 2.9.1, 2.10.1
33	Individual	2.2.2, 2.2.5, 2.5.3, 2.5.4, 2.6.2
34	Individual	2.4.4
35	Individual	2.3.2, 2.4.4, 2.8.2, 2.9.1, 2.10.2
36	Individual	2.3.1, 2.3.2, 0, 2.4.2, 2.4.4, 2.7.3, 2.7.4

Appendix B

Revised Biodiversity Development Assessment Report



Biodiversity Development Assessment Report (BDAR)

Mamre Road Upgrade – Stage 1

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Executive summary

Project outline

Transport for NSW (TfNSW) proposes to upgrade about 3.8 kilometres of Mamre Road between the M4 Motorway, St Clair and Erskine Park Road, Erskine Park to a four-lane divided road (the proposal). The proposal is located in the Penrith City Local Government Area (LGA), New South Wales (NSW). The proposal forms Stage 1 of the proposed broader Mamre Road Upgrade project.

Mamre Road is a key transport corridor, which provides connections to the Western Sydney Employment Area and the proposed Western Sydney Aerotropolis. A key aim of the proposal is to improve road safety and movement between the M4 Motorway and Erskine Park Road through increasing the capacity of Mamre Road, which would support future economic and residential growth in the surrounding area.

The proposal would involve widening Mamre Road from one lane either direction to two lanes in each direction. The proposal includes changes and upgrades to existing intersections and new facilities for public transport, walking and cycling along Mamre Road. Sufficient space within the road corridor would also be provided for an additional lane in each direction if required in the future.

Niche Environment and Heritage Pty Ltd (Niche) has been commissioned to prepare a Biodiversity Development Assessment Report (BDAR) to support the Review of Environmental Factors (REF) for the proposal.

This BDAR complies with the Biodiversity Assessment Methodology (BAM) (DPIE 2020a) to adequately assesses potential impacts to threatened biodiversity listed on the NSW *Biodiversity Conservation Act 2016* (BC Act), and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Methodology

Field survey was completed across multiple months in accordance with the BAM and relevant threatened biodiversity survey guidelines.

Surveys completed included:

- Floristic and BAM plots to determine Plant Community Type (PCT) and condition
- Hollow-bearing tree targeted survey
- Cumberland Plain Land Snail and Dural Snail targeted searches
- Spotlighting
- Anabat analysis
- Opportunistic and fauna habitat observations
- Searches for threatened plants.

Results

The field survey confirmed that about 9.30 hectares of native vegetation and associated habitat, and 34.90 hectares of non-native vegetation (comprising of existing Mamre Road, services, footpaths, cleared areas) occurs within the vegetation clearing boundary. The native vegetation has been subjected to historical clearing, edge effects from the existing Mamre Road and surrounding residential/rural land.

The native vegetation comprises the following Plant Community Types (PCTs):

- PCT 849 Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion

- PCT 835 Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion
- PCT 1800 Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley.

The PCTs are also listed as the following Threatened Ecological Communities (TECs) under both State and Commonwealth Legislation:

- PCT 849 aligns to Cumberland Plain Woodland which is listed as Critically Endangered Ecological Community (CEEC) under the BC Act and the EPBC Act.
- PCT 835 aligns to River-flat Eucalypt Forest which is listed as a CEEC under the BC Act and Endangered Ecological Community (EEC) under the EPBC Act.
- PCT 1800 aligns to Swamp Oak Floodplain Forest, listed as an EEC under the BC Act and EPBC Act.

No threatened flora species were identified during the field investigations in the vegetation clearance boundary.

Seven threatened fauna species were recorded during the field survey, including Cumberland Plain Land Snail, Grey-headed Flying-fox, Southern Myotis, Large Bentwing-bat, Little Bentwing-bat, Greater Broad-nosed Bat and Yellow-bellied Sheath-tail-bat.

Potential impacts

The proposal would result in the direct impact to about 9.30 ha of vegetation regarded as 'native vegetation,' as defined in the BAM. The majority of vegetation likely to be affected by the proposal is located adjacent to Mamre Road, and has been subject to historic clearing, grazing, and other agricultural activities, and is therefore thinned in areas, and dominated in areas by a range of introduced species.

The proposal would have a direct impact to two threatened biodiversity species that are regarded as 'species credits' as per the requirements of the BAM: Cumberland Plain Land Snail, and Southern Myotis.

A further 35 threatened fauna species are predicted in the BAM Calculator (BAM-C) to have foraging habitat within the PCTs of the proposal area. Such species are regarded as 'ecosystem credit' fauna that do not require any further consideration in a BDAR.

Avoid, Minimise and Mitigate

TfNSW have aimed to avoid and minimise environmental impacts from the proposal as far as practical through options analysis and design refinement to reduce impacts. A series of mitigation measures to manage potential indirect impacts from the proposal would also be employed in accordance with TfNSW Biodiversity Guidelines.

Biodiversity offsetting

The unavoidable impacts of the proposal on ecological values includes the clearing of about 9.30 hectares of vegetation regarded as 'native vegetation,' as defined in the BAM, and associated fauna habitat.

Through the application of the BAM, associated guidelines and the BAM-C, the following biodiversity credit offsets are required to offset the unavoidable impacts:

- 125 credits for PCT 835 Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion
- 112 credits for PCT 849 Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion

- 8 credits for PCT 1800 Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley
- 157 credits for Southern Myotis
- 87 credits for Cumberland Plain Land Snail.

Assessments of significance under the EPBC Act were also completed for threatened biodiversity (Cumberland Plain Woodland, River-flat Eucalypt Forest, Yellow Wagtail, and Grey-headed Flying-fox) likely to be impacted by the proposal. Given the proposal is being undertaken by TfNSW under Division 5.1 of the EP&A Act, the strategic assessment applies, and no further Referral and associated offsets under the Commonwealth are required.

Glossary

Definitions

Accredited person or assessor	Means as person accredited under section 6.10 (of the BC Act) to prepare reports in accordance with the BAM.
Biodiversity credit report	The report produced by the BAM-C that sets out the number and class of biodiversity credits required to offset the remaining adverse impacts on biodiversity values at a development site, or on land to be biodiversity certified, or that sets out the number and class of biodiversity credits that are created at a biodiversity stewardship site (DPIE 2020).
Biodiversity offsets	The gain in biodiversity values achieved from the implementation of management actions on areas of land, to compensate for losses to biodiversity values from the impacts of development (DPIE 2020)
Biodiversity Stewardship site	Refers to land which is the subject to a Biodiversity Stewardship Site agreement under the BC Act
Bionet Vegetation classification	Refers to the vegetation community-level classification for use in vegetation mapping programs and regulatory biodiversity impact assessment frameworks in NSW. The BioNet Vegetation Classification is published by the Department and available at www.environment.nsw.gov.au/research/Visclassification.htm .
Biodiversity Offsets and Agreement Management System	The system used to administer the Biodiversity Offsets Scheme. BOAM is used to access the version of the Calculator that can be used to perform and submit BAM assessments, submit BAM related applications, generate a credit obligation, calculate a credit price or apply to sell or retire credits.
BioNet Atlas	The DPIE database of flora and fauna records (formerly known as the NSW Wildlife Atlas). The Atlas contains records of plants, mammals, birds, reptiles, amphibians, some fungi, some invertebrates (such as insects and snails listed under the BC Act) and some fish (DPIE 2020).
Calculator or BAM-C	Biodiversity Assessment Method Calculator – a tool that applies the BAM to calculate the number and type of credits required to offset the impacts of development on biodiversity or credits generated at a biodiversity stewardship site.
Cumulative impact	The extent to which the development or activity contributes to the cumulative impacts of existing and planned developments or activities on threatened species, ecological communities, habitats, Areas of Outstanding Biodiversity Value and key threatening processes.
Direct impact	Direct impacts on biodiversity values include those related to clearing native vegetation and threatened species habitat, and impacts on biodiversity values prescribed by the Biodiversity Conservation Regulation 2017 (the BC Regulation) (DPIE 2020)

Ecosystem credit	A measurement of the value of EECs, CEECs and threatened species habitat for species that can be reliably predicted to occur with a PCT. Ecosystem credits measure the loss in biodiversity values at a development site and the gain in biodiversity values at a biodiversity stewardship site.
Ecosystem credits	A measurement of the value of threatened ecological communities, threatened species habitat for species that can be reliably predicted to occur with a PCT, and PCTs generally. Ecosystem credits measure the loss in biodiversity values at a development, activity, clearing or biodiversity certification site and the gain in biodiversity values at a biodiversity stewardship site (DPIE 2020).
Habitat	An area or areas occupied, or periodically or occasionally occupied, by a species, population or ecological community, including any biotic or abiotic component.
Indirect impact	Impacts that occur when the proposal affects native vegetation and threatened species habitat beyond the development footprint or within retained areas (e.g. transporting weeds or pathogens, dumping rubbish). This includes impacts from activities related to the construction or operational phase of the proposal and prescribed impacts (DPIE 2020).
MNES	A matter of national environmental significance (MNES) protected by a provision of Part 3 of the EPBC Act (Cth)
Mitchell landscape	Landscapes with relatively homogeneous geomorphology, soils and broad vegetation types, mapped at a scale of 1:250,000 (DPIE 2020).
Mitigation	Action to reduce the severity of an impact (OEH 2014).
Native vegetation	(a) trees (including any sapling or shrub or any scrub), (b) understorey plants , (c) groundcover (being any type of herbaceous vegetation), (d) plants occurring in a wetland. A plant is native to New South Wales if it was established in New South Wales before European settlement (BC Act).
PlantNET NSW	An online database of the flora of New South Wales which contains currently accepted taxonomy for plants found in the State, both native and exotic.
Population	A group of organisms, all of the same species, occupying a particular area (DPIE 2020).
Proposal area	The area of land that is directly impacted on by the proposal that is being assessed under the EP&A Act, including access roads, and areas used to store construction materials (OEH 2014). It includes the construction and operational areas for the proposal.
Spatial datasets	Spatial databases required to prepare a BDAR <ul style="list-style-type: none"> ○ BioNet NSW (Mitchell) Landscapes – Version 3.1 ○ NSW Interim Biogeographic Regions of Australia (IBRA region and sub-regions) – Version 7 ○ NSW soil profiles

	<ul style="list-style-type: none"> ○ hydrogeological landscapes ○ acid sulfate soils risk ○ digital cadastral database ○ Vegetation Information Systems maps ○ Geological sites of NSW.
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Species credits	The class of biodiversity credits created or required for the impact on threatened species that cannot be reliably predicted to use an area of land based on habitat surrogates. Species that require species credits are listed in the Threatened Biodiversity Data Collection.
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Target species	A species has been identified within the assessment area or is considered to have a moderate to high likelihood of occurrence and may be impacted by the proposal.
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Threatened Biodiversity Data Collection	<p>A publicly assessable online database (registration required) which contains information for listed threatened species, populations and ecological communities.</p> <p>Part of the BioNet database, published by EES and accessible from the BioNet website at www.bionet.nsw.gov.au.</p>
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Vegetation clearing boundary	The area of vegetation to be directly impacted by the proposal during construction activities.
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Abbreviations

AOBV	Area of Outstanding Biodiversity Value
BAM	Biodiversity Assessment Method
BC Act	<i>Biodiversity Conservation Act 2016 (NSW)</i>
BC Regulation	Biodiversity Conservation Regulation 2017 (NSW)
BDAR	Biodiversity Development Assessment Report
BOAMS	Biodiversity Offsets and Agreement Management System
BOS	Biodiversity Offset Scheme
CEEC	Critically Endangered Ecological Community
CEMP	Construction Environmental Management Plan
DAWE	Department of Agriculture, Water and the Environment
DIWA	Directory of Important Wetlands in Australia
DPIE	Department of Planning, Industry and Environment
DPI	Department of Primary Industries
EEC	Endangered ecological community
EES	NSW Environment Energy and Science Group within the Department of Planning, Industry and Environment
Environment Agency Head	Environment Agency Head, Environment, Energy and Science Group, Department of Planning, Industry and Environment
EP&A Act	<i>Environment Planning and Assessment Act 1979 (NSW)</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth).</i>
Fisheries NSW Policy and Guidelines	Fisheries NSW Policy and guidelines for fish habitat conservation and management (Update 2013)
FM Act	Fisheries Management Act 1994 (NSW)
GDE	Groundwater dependent ecosystems
IBRA	Interim Biogeographically Regionalisation of Australia
MNES	Matters of National Environmental Significance
PCT	Plant Community Type

REF	Review of Environmental Factors
SEPP	State Environmental Planning Policy
SAII	Serious and Irreversible Impacts
TBDC	Threatened Biodiversity Data Collection
TECs	Threatened ecological communities (VECs, EECs and CEECs)
TfNSW	Transport for NSW
VEC	Vulnerable Ecological Community
VIS	Vegetation information system

1 Introduction

1.1 Proposal overview

Transport for NSW (TfNSW) proposes to upgrade about 3.8 kilometres of Mamre Road between the M4 Motorway, St Clair and Erskine Park Road, Erskine Park to a four-lane divided road (the proposal). The proposal is located within the City of Penrith local government area (LGA) in Sydney, New South Wales (NSW). The proposal forms Stage 1 of the larger Mamre Road Upgrade Project, which is proposed to be delivered by TfNSW in two stages. Overall, the Mamre Road Upgrade Project would involve upgrades to a 10 kilometre long section of Mamre Road between the M4 Motorway, St Clair and Kerrs Road, Kemps Creek.

Mamre Road is a key transport corridor, which provides connections to the Western Sydney Employment Area and the proposed Western Sydney Aerotropolis. A key aim of the proposal is to improve road safety and movement between the M4 Motorway and Erskine Park Road through increasing the capacity of Mamre Road, which would support future economic and residential growth in the surrounding area.

The proposal would involve widening Mamre Road from one lane either direction to two lanes in each direction. The proposal includes changes and upgrades to existing intersections and new facilities for public transport, walking and cycling along Mamre Road. Sufficient space within the road corridor would also be provided for an additional lane in each direction if required in the future.

Niche Environment and Heritage Pty Ltd (Niche) has been commissioned to prepare a Biodiversity Development Assessment Report (BDAR) to support the Review of Environmental Factors (REF) for the proposal.

This BDAR complies with the Biodiversity Assessment Methodology (BAM) (DPIE 2020a) to adequately assess potential impacts to threatened biodiversity listed on the NSW *Biodiversity Conservation Act 2016* (BC Act), and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The process of completing this BDAR has also supported the planning and design development of the proposal including identifying environmental risks, constraints and areas of sensitivity and making recommending for the avoidance or minimisation of potential impacts.

1.2 The proposal

The proposal includes the upgrade of about 3.8 kilometres of Mamre Road between the M4 Motorway, St Clair and Erskine Park Road, and Erskine Park (Figure 1).

The proposal has been designed to NSW and Australian engineering, road safety, environmental and transport planning standards developed by Transport for NSW, Austroads and Standards Australia.

Key features of the proposal have been discussed in detail in the REF for the proposal and include (shown on Figure 2):

- an upgrade of Mamre Road to a four-lane divided road with a wide central median that would allow for widening to six lanes in the future, if required
- changes to intersections with Mamre Road including:
 - an upgrade to the existing signalised intersection at Banks Drive including a new western stub for access and a U-turn facility
 - a new signalised intersection at Solander Drive including a new western stub for access and a U-turn facility
 - a new signalised intersection at Luddenham Road with new turning lanes
 - an upgrade to the existing signalised intersection at Erskine Park Road with new turning lanes
 - modified intersection arrangements (left in, left out only) at McIntyre Avenue and Mandalong Close

- a new shared path along the eastern side of Mamre Road and provision for a future shared path on the western side
- reinstatement of bus stops near Banks Drive with provision for additional bus infrastructure in the future
- changes to property access to Mamre House, Erskine Park Rural Fire Service and other private properties
- drainage and flooding infrastructure upgrades including culvert crossings, water quality basins, grass swales and channel tail-out work
- new traffic control facilities including new traffic signals and relocation of existing electronic variable message signage
- roadside furniture and street lighting
- noise walls along the eastern side of Mamre Road at St Clair
- utility relocations
- establishment of temporary ancillary facilities to support construction including compound sites, stockpile and laydown locations, temporary access tracks, temporary waterway crossings and concrete batching plants.

Construction of the proposal is expected to start in 2022 and be completed in late 2025, subject to approval, funding and weather considerations.

Construction of the proposal is planned to be carried out in two stages: early work and main construction work. Early work would involve utility relocations, site establishment activities, property adjustments and other low impact work required to facilitate construction.

The key proposal objectives are to:

- improve road safety in line with the *NSW Road Safety Strategy 2012-2021 Safe System Directions and Safer Roads Key Focus*
- improve movement and travel times between M4 Motorway and Erskine Park Road for general traffic, freight and bus services operating along the corridor
- support economic growth and productivity by providing increased road capacity for the projected traffic volumes on Mamre Road
- improve quality of service, sustainability and liveability by providing facilities for walking, cycling and future public transport needs and improving the urban design of the road corridor
- maintain a safe and efficient environment for all road users.

1.3 Defining the proposal area and vegetation clearance boundary

The proposal area for the proposal contains all areas proposed for ground disturbance (including construction and operation) and encompasses the key infrastructure elements as summarised in section 1.2, and detailed in the REF for the proposal (Figure 1).

The proposal area is about 44.28 hectares, which includes the operational footprint (the Mamre Road upgrade, associated median, drainage and all associated infrastructure for the ongoing operation of the proposal) and includes establishment of temporary ancillary facilities to support construction including compound sites, stockpile and laydown locations, temporary access tracks, temporary waterway crossings and concrete batching plants.

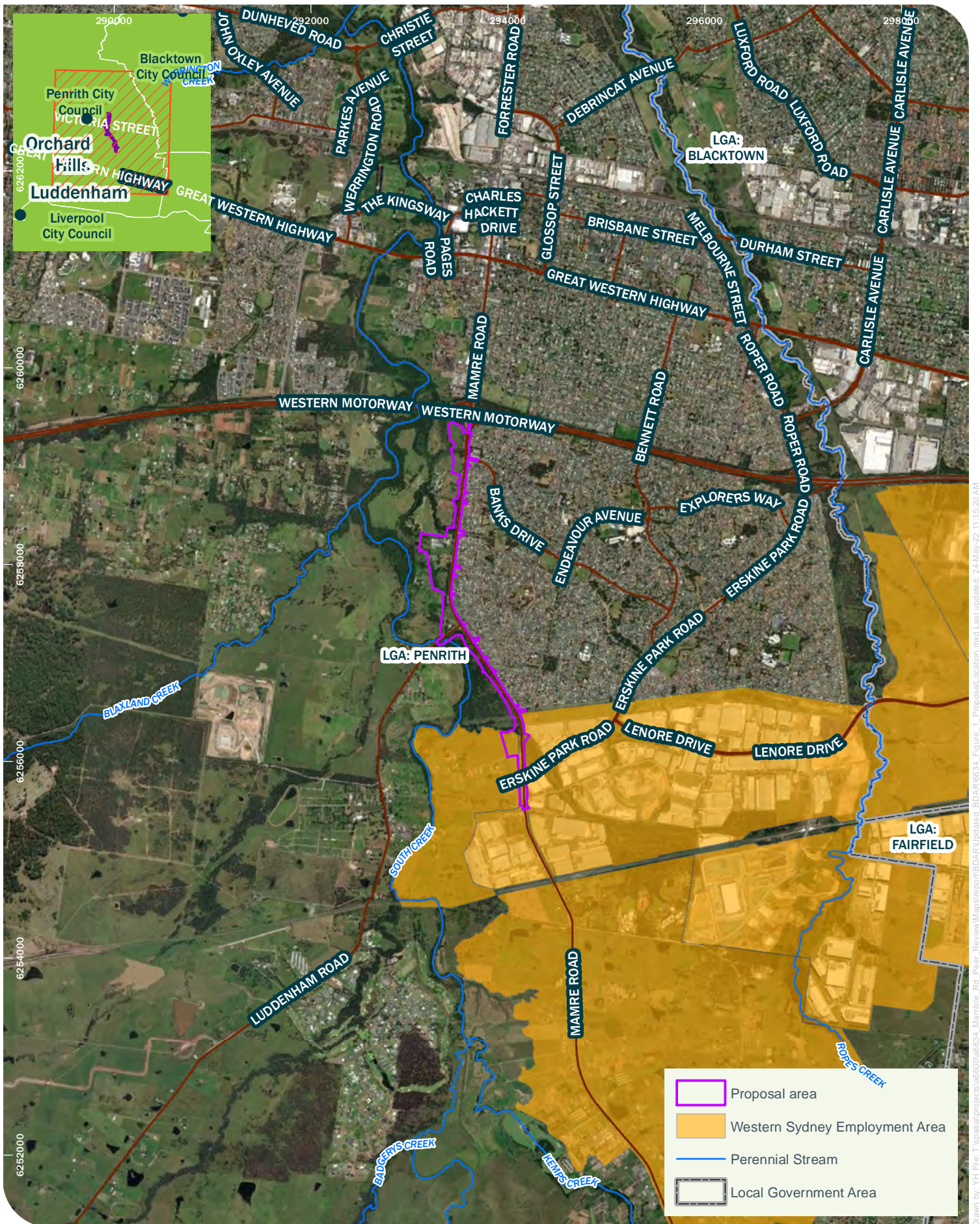
The cleared area within the proposal area is about 34.90 hectares, which consists of non-native vegetation, the existing Mamre Road and easement, and surrounding agricultural/residential land and infrastructure services.

Native vegetation occupies about 9.30 hectares of the proposal area, which predominately consists of scattered native eucalypts as discussed in section 3.

Much of the native vegetation to the north of the proposal area consists of patches of native vegetation that are relatively small (0.3 to 0.8 hectares), owing to the historic vegetation clearing that has occurred. To the south of the proposal area, the connectivity of habitat is more prominent given the Luddenham BioBank site (BA408) occurs immediately adjacent to

the existing Mamre Road corridor. The design of the proposal and the implementation of relevant mitigation measures assist in preventing and/or minimising potential indirect impacts to the existing BioBank site (section 8).

The vegetation clearance boundary is associated with the native vegetation that must be cleared to support the proposal. The vegetation clearance boundary is the area of direct impact, which has discussed in section 7, and is shown on Figure 3.

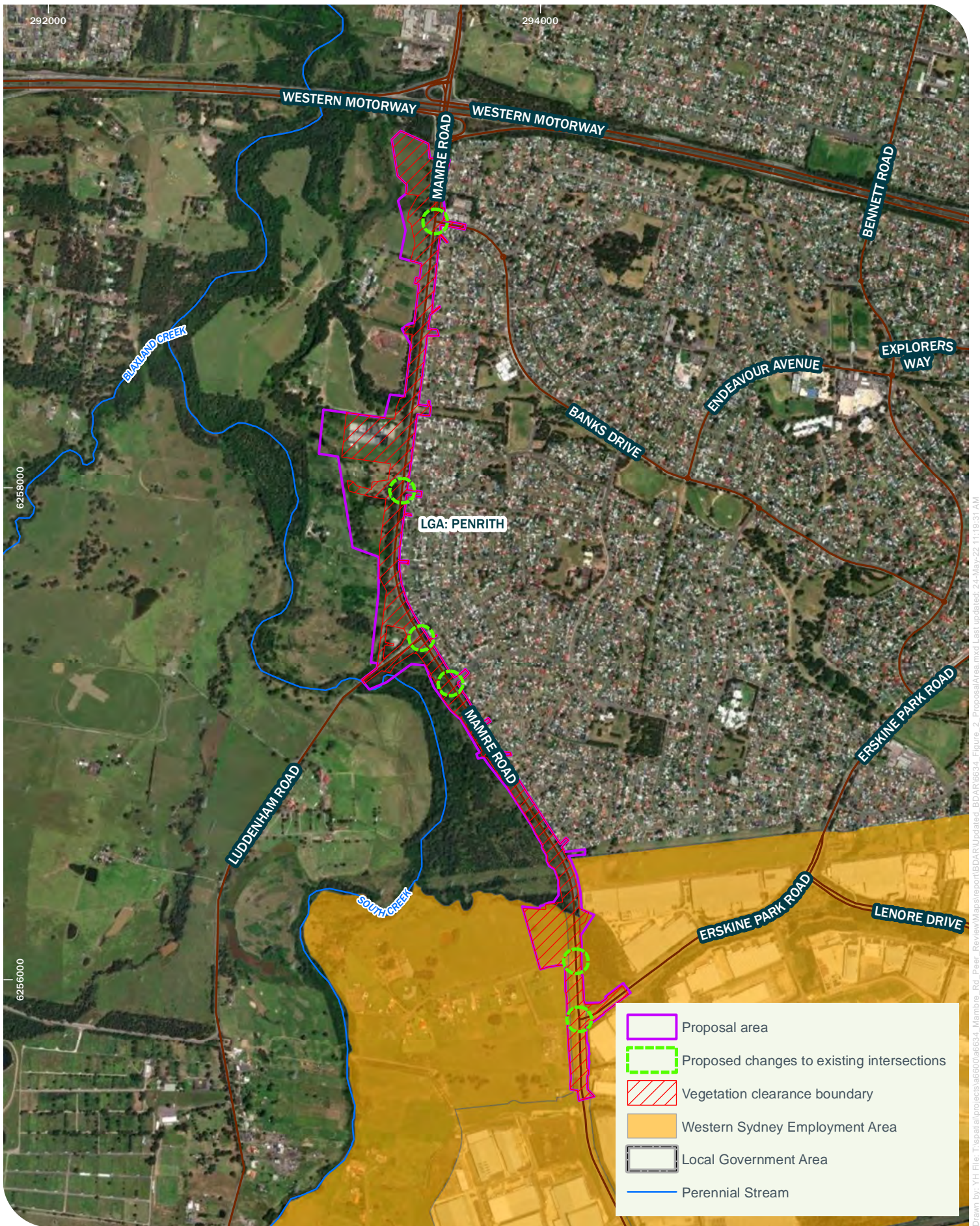


Location of proposal
Biodiversity Development Assessment Report (BDAR)

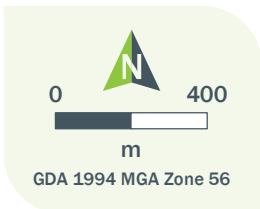
Figure 1

Niche PM: Luke Baker
Niche Proj. #: 6634
Client: Transport for NSW / Aurecon

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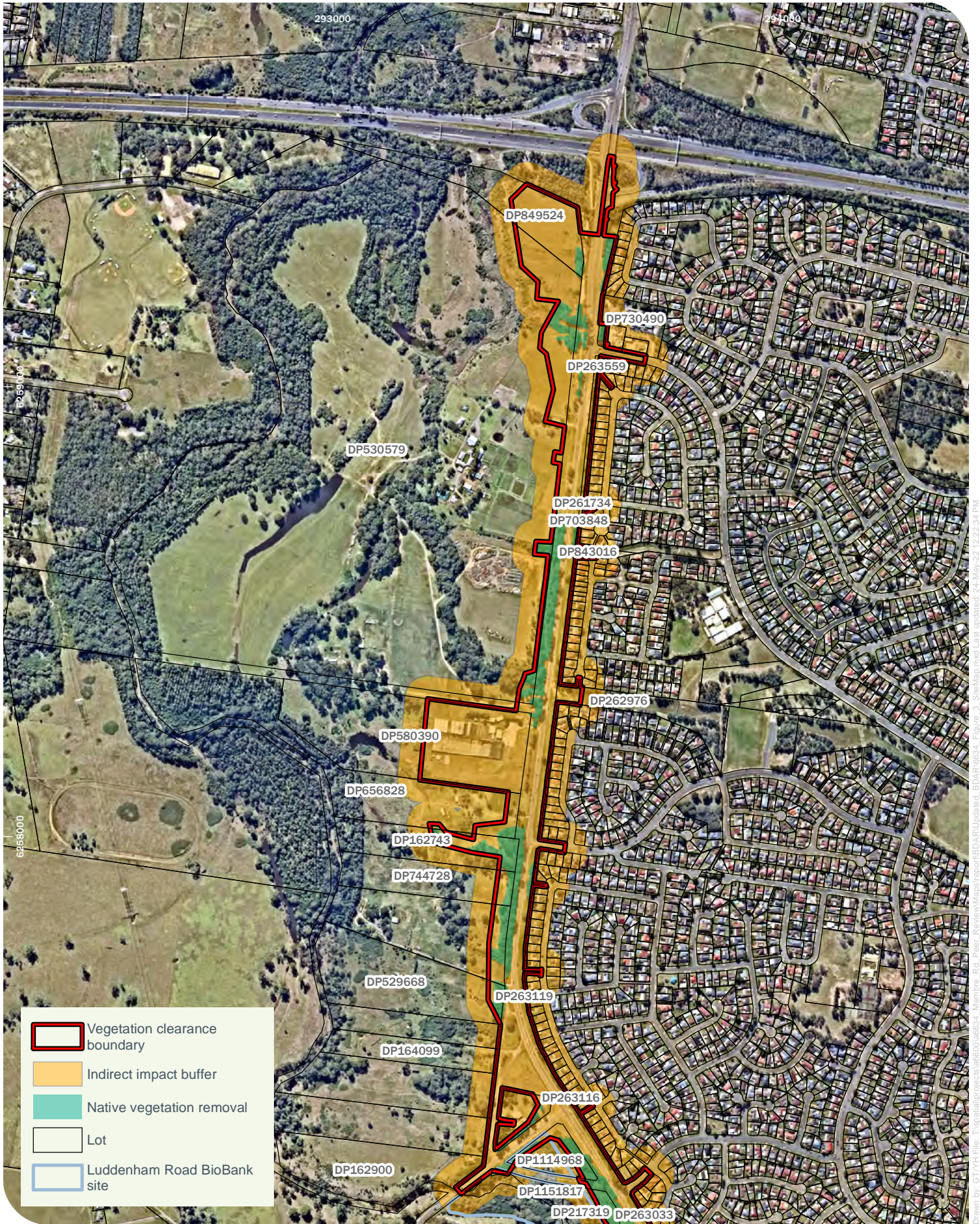


Niche PM: Luke Baker
Niche Proj. #: 6634
Client: Transport for NSW / Aurecon

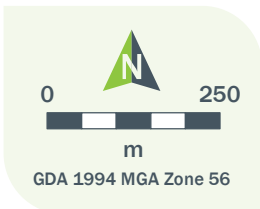
The proposal area
Biodiversity Development Assessment Report (BDAR)

Figure 2

World Imagery: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community Nearthmap 2020



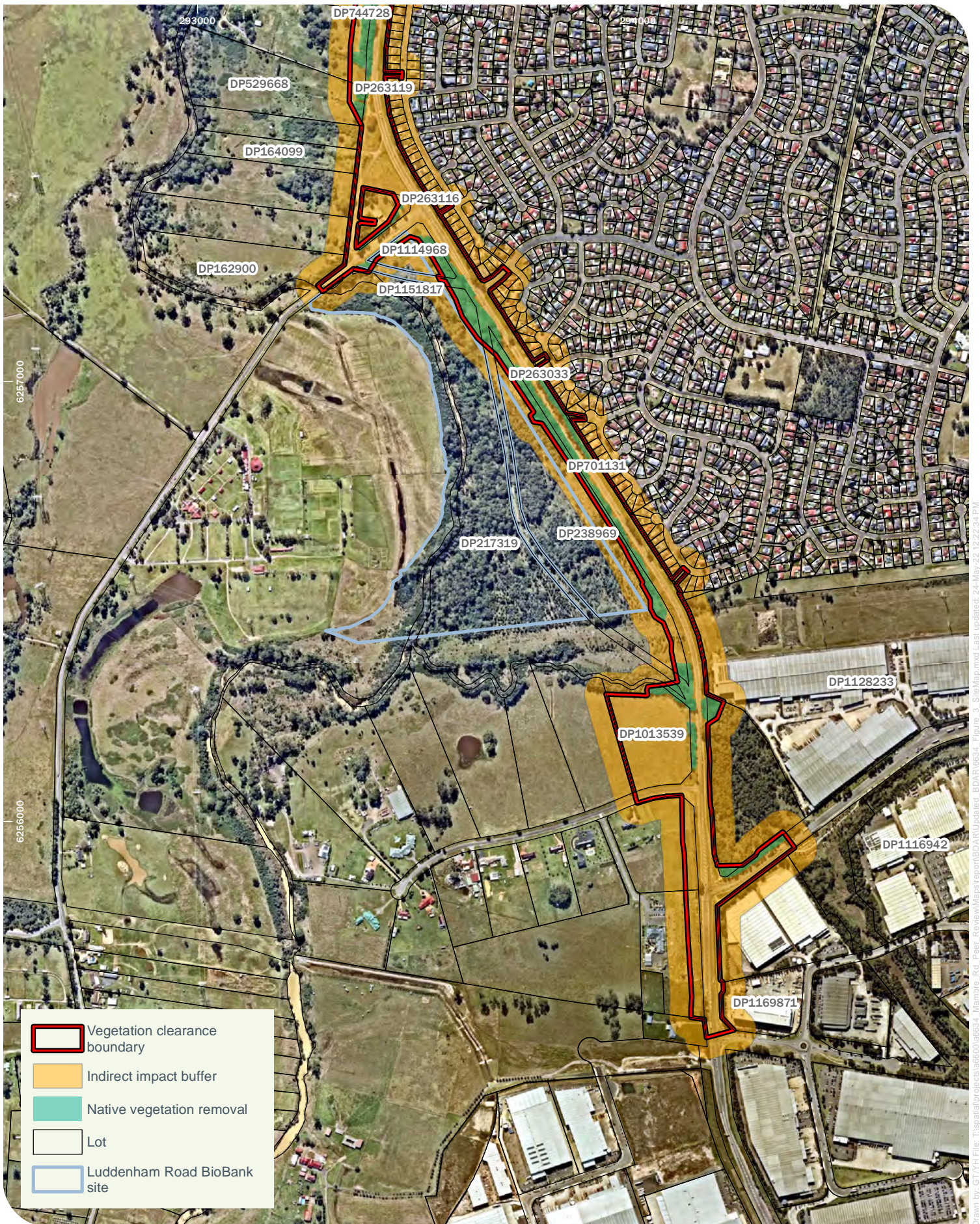
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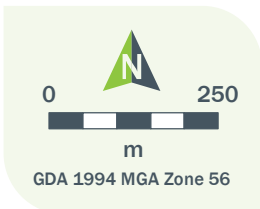
The proposal area and vegetation clearance boundary
 Mamre Road Upgrade – Stage 1
 Biodiversity Development Assessment Report (BDAR)

Niche PM: Luke Baker
 Niche Proj. #: 6634
 Client: Transport for NSW / Aurecon

Figure 3.1



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The proposal area and vegetation clearance boundary
Mamre Road Upgrade – Stage 1
Biodiversity Development Assessment Report (BDAR)

Niche PM: Luke Baker
 Niche Proj. #: 6634
 Client: Transport for NSW / Aurecon

Figure 3.2

1.4 Legislative context

1.4.1 Biodiversity Conservation Act 2016 (BC Act)

The *NSW Biodiversity Conservation Act 2016* (BC Act) came into effect on the 25 August 2017. This Act repealed the *Threatened Species and Conservation Act 1995* (TSC Act), *Native Vegetation Act 2003* and parts of the *National Parks and Wildlife Act 1974*. All threatened entities previously listed under the TSC Act have now been listed under the schedules of the BC Act.

The BC Act outlines the framework for addressing impacts on biodiversity from development and clearing. It establishes a framework to avoid, minimise and offset impacts on biodiversity from development through the Biodiversity Offsets Scheme. The Biodiversity Offsets Scheme creates a transparent, consistent and scientifically based approach to biodiversity assessment and offsetting for all types of development that are likely to have a significant impact on biodiversity.

The Biodiversity Offsets Scheme is not mandatory for activities approved under Division 5.1 of the EP&A Act although the determining authority must be satisfied that the proposed activity is unlikely to significantly affect threatened species in accordance with Section 7.3 of the BC Act.

Given the proposal would result in significant impacts to threatened biodiversity, in particular the impact to Cumberland Plain Woodland, TfNSW have decided to 'opt' into the BDAR process, which ensures that suitable biodiversity offsets are provided for impacts to threatened biodiversity as per the requirements of the BAM.

1.4.2 Fisheries Management Act 1994 (FM Act)

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

- Conserve fish stocks and key fish habitats;
- Conserve threatened species, populations and ecological communities of fish and marine vegetation; and
- Promote ecologically sustainable development, including the conservation of biological diversity.

Protection is provided by integrating the conservation of threatened species, endangered populations and EEC/CEECs into development control processes under the EP&A Act.

Part 7A Division 4 of the FM Act prohibits, without a licence or permit, activities that damage habitats or harm threatened species, populations or ecological communities.

The proposal would impact the tributaries of South Creek which is an identified 'Key Fish Habitat' (KFH) under the FM Act (discussed in section 4.3.2).

1.4.3 EPBC Act Assessment Requirements

Matters of National Environmental Significance (MNES) are protected under the EPBC Act. The BAM requires proponents to identify and assess the impacts on all nationally listed threatened species and threatened ecological communities that may be present on or near the development site. Therefore, the BAM has partly been used to perform assessment of impacts under the EPBC Act.

In September 2015, a "strategic assessment" approval was granted by the Federal Minister in accordance with the EPBC Act. The approval applies to TfNSW activities being assessed under Division 5.1 of the EP&A Act with respect to potential impacts on nationally listed threatened species, ecological communities and migratory species. Obligations arising from the approval have been incorporated into TfNSW environmental impact assessment procedures, guidelines and templates.

The practical effect of the approval is that TfNSW projects assessed via an REF:

- Must address and consider potential impacts on nationally listed threatened species, populations, ecological communities and migratory species, including application of the “avoid, minimise, mitigate and offset” hierarchy.
- Do not require referral to the Federal Department of Agriculture, Water and Environment (DAWE) for these matters, even if the activity is likely to have a significant impact.

Given the proposal being undertaken by TfNSW under Division 5.1 of the EP&A Act, the strategic assessment applies. This BDAR provided an assessment for threatened biodiversity listed on the EPBC Act throughout sections 5 and 0, including further assessment of impacts under the EPBC Act undertaken via assessments of significance for EPBC Act listed species with the potential to be affected by the proposal (Annexure E). Avoidance and mitigation measures have also been described in section 6 and 8.

1.5 Assessment guidelines used in this report

The assessment presented in this BDAR was undertaken in accordance with the BAM and has considered and applied where relevant, the following guidelines throughout the course of the field work and reporting:

NSW survey guidelines

- DPIE (2020b), Surveying threatened plants and their habitats. NSW survey guide for the Biodiversity Assessment Method.
- DPIE (EES) (2020c), NSW Survey Guide for Threatened Frogs. A guide for the survey of threatened frogs and their habitats for the Biodiversity Assessment Method
- OEH (2018a), Biodiversity Assessment Method Operational Manual – Stage 1.
- OEH (2018b), ‘Species credit’ threatened bats and their habitats NSW survey guide for the Biodiversity Assessment Method.

National survey guidelines

- Commonwealth of Australia (2010a) Survey Guidelines for Australia’s Threatened Bats.
- Commonwealth of Australia (2010b) Survey Guidelines for Australia’s Threatened Birds.
- Commonwealth of Australia (2011a) Survey Guidelines for Australia’s Threatened Frogs.
- Commonwealth of Australia (2011b) Survey Guidelines for Australia’s Threatened Mammals, Commonwealth of Australia.
- Commonwealth of Australia (2011c) Survey Guidelines for Australia’s Threatened Reptiles
- Commonwealth of Australia (2013) Draft survey guidelines for Australia’s threatened orchids.

1.6 Personnel

This BDAR has been approved for submission by Niche. The Niche Assessors and Aurecon staff that have been involved in the preparation of this BDAR include those listed in Table 1-1.

All staff involved in the preparation of this BDAR are appropriately qualified and experienced environmental professionals as demonstrated in Table 1-1.

Table 1-1: Personnel

Name	Role	Years of experience	Qualifications
Luke Baker	Project management, and quality Assurance	15	Bachelor of Applied Science (Environmental Management), Accredited BAM Assessor (BAAS17033)
Dr Amanda Griffith	Fauna field survey and quality assurance	18	Bachelor of Science (Hons), PhD, Accredited BAM Assessor (BAAS19016)
Patrick McEvoy	Biodiversity credit calculations	5	Bachelor of Science Accredited BAM Assessor (BAAS20018)
Dr Jai Green-Barber	Fauna field surveys and report writing	3	PhD, Bachelor of Science Accredited BAM Assessor (BAAS20002)
Isabel Lyons	Flora and fauna surveys, flora surveys and report writing	2	Bachelor of Science
Annabel Grundy	Fauna surveys, flora surveys, data management	1	Bachelor of Science
Kayla Asplet	Anabat analysis	5	Bachelor of Science (Honours)
Sarah Glauert (Aurecon)	Field surveys – Fauna	13	Bachelor of Science (Conservation Biology) Accredited BAM Assessor (BAAS17097)
Paul Gadsby (Sole-trader)	Field surveys	5	Accredited BAM Assessor (BAAS20010) Bachelor of Science (Environmental Science) Masters of Conservation Biology
Janelle So (Aurecon)	Field surveys – Fauna	1	Bachelor of Advanced Science (Honours) (Biology and Ecology)

Name	Role	Years of experience	Qualifications
Liam Stephen (Aurecon)	Field surveys	1	Bachelor of Science (Land Resources) (Environmental Science) (Honours)

1.7 Structure of this report

The primary objective of this assessment is to prepare a BDAR for the proposal that is consistent with the BAM and associated guidelines. This BDAR details the impact the proposal would have on biodiversity; details the avoidance and mitigation measures proposed; and calculates the proposal's biodiversity offset requirement.

The structure of the report is outlined below:

- Section 1 – Introduction – Provides an introduction to the report
- Section 2 – Landscape features – Describes the landscape features of the proposal area
- Section 3 – Native vegetation – Describes vegetation within the proposal area
- Section 4 –Threatened species – Describes threatened species listed under the BC Act and habitat in the proposal area
- Section 5 – Matters of National Environmental Significance – Describes relevant Matters of Environmental Significance
- Section 6 – Avoidance and minimise impacts
- Section 7 – Impact Assessment – Describes the unavoidable construction and operation impacts of the proposal
- Section 8 – Mitigation measures – Outlines mitigation measures to minimise impacts
- Section 9 – Offsetting – Describes the proposal's offset requirements
- Section 10 – Conclusion – Presents the conclusions of the assessment
- Section 11 – References – Presents the list of reference documents used in the assessment.

2 Landscape features

2.1 Identified features

As detailed in Section 4 of the BAM, a landscape assessment for the proposal is required, which was conducted within the BAM Calculator (BAM-C). Landscape value is an assessment of factors including:

- Native vegetation cover
- Rivers, streams and estuaries
- Areas of geological significance
- Habitat connectivity.

For each factor the current state of the landscape is assessed and then compared with the state of the landscape if the proposal were to proceed.

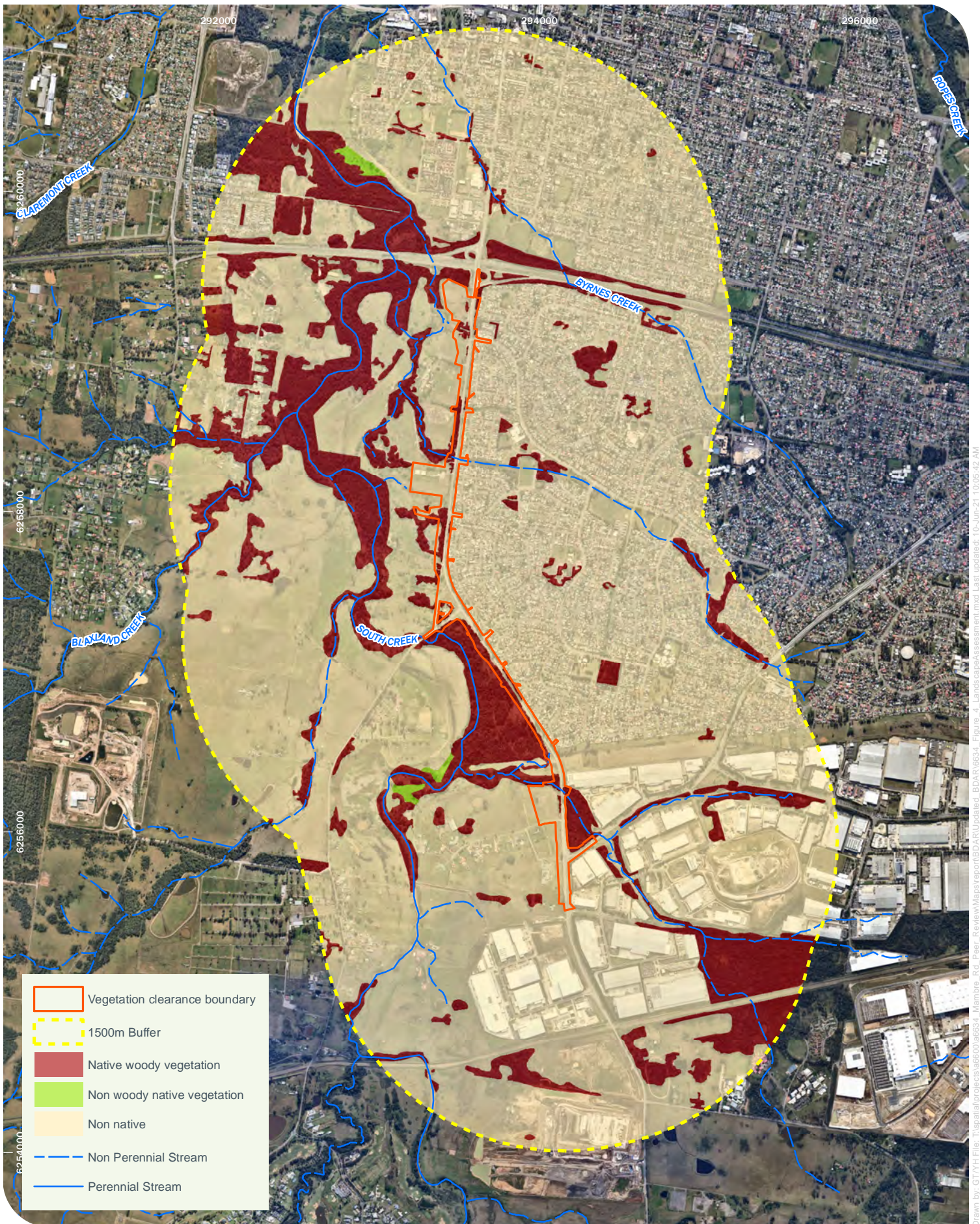
The landscape features have been described in Table 2-1, along with the associated Figure references.








Table 2-1: Landscape features

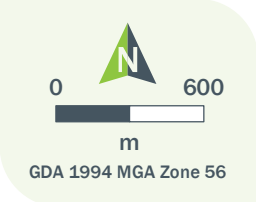
Landscape feature	Description	Figure reference
IBRA bioregions and subregions	The proposal is located within the Sydney Basin IBRA Bioregion; and the Cumberland IBRA Subregion.	Figure 4
NSW landscape regions (Mitchell landscapes)	<p>Two NSW landscape regions (Mitchell landscapes) occur across the proposal area. The regions are described by Mitchell (2002):</p> <ol style="list-style-type: none"> i. Hawkesbury – Nepean Channels and Floodplains: which is described as a meandering channel and moderately wide floodplain of the Hawkesbury and Nepean Rivers. Quaternary sand and gravel, general elevation 0 to 20 metres, local relief less than 10 metres. Undifferentiated alluvial sand to poorly structured gradation profiles of sandy loam or clay loam. ii. Cumberland Plain: which is described as low rolling hills, small number of volcanic vents, partly covered by Tertiary river gravels and sands, general elevation 30 to 120 metres, local relief 50 metres. Pedal uniform red to brown clays on volcanic hills. Red and brown texture-contrast soils on crests grading to yellow harsh texture-contrast soils in valleys. <p>The Cumberland Plain landscape region (Mitchell landscape) occupies the majority of the proposal area (about 29 ha) compared to the Hawkesbury – Nepean Channels and Floodplains (about 17 ha).</p> <p>The Cumberland Plain landscape region (Mitchell landscape) was therefore entered into the BAM-C.</p>	Figure 4

Landscape feature	Description	Figure reference
Native vegetation extent in the buffer area	<p>In accordance with the BAM, and assessor must determine the extent of native woody vegetation, native grasslands, and non-native vegetation with a 1,500 m buffer applied to the proposal area.</p> <p>A 1,500 m buffer was applied to the proposal area resulting in an overall buffer area of 2,104 ha. Aerial interpretation was used to map the area of native vegetation, and non-native vegetation within the buffer area.</p> <p>In total, areas devoid of native vegetation (cleared areas)/existing infrastructure/areas that would be classified in the BAM as 'non-native vegetation') occupies 1,736 ha of the buffer area.</p> <p>Native woody vegetation comprises of about 363 ha, which includes the following areas of native vegetation that occur within the proposal area:</p> <ul style="list-style-type: none"> i. 4.61 ha of Cumberland shale plains woodland (PCT 849) ii. 4.22 ha of Cumberland riverflat forest (PCT 835) iii. 0.47 ha of Cumberland Swamp Oak riparian forest (PCT 1800). <p>Based on aerial photography interpretation, we have estimated that there is about five hectares of native grassland.</p> <p>The area of native vegetation (native woody and native grassland) within the 1,500 metre buffer therefore covers 17.5 percent of the buffer area (368 hectares of 2,104 hectares). The percentage of 18 percent (rounded) was entered into the BAM-C as the extent of native vegetation.</p>	Figure 4
Cleared areas	<p>As detailed above, the area of non-native vegetation or cleared land/existing infrastructure is about 1,736 ha. Within the proposal area, approximately 34.90 ha of non-native vegetation/cleared land is present (Table 3-2). This is associated predominately with Mamre Road, road easements, and surrounding agricultural/residential land and infrastructure services.</p>	Figure 4
Rivers and streams	<p>The proposal area includes a portion of South Creek as shown on Figure 4.</p> <p>The proposal would have a minor direct impact to South Creek due to the construction of headwalls that outlet to South Creek.</p> <p>The proposal design and mitigation measures detailed in section 8 have minimised impacts to watercourses.</p>	Figure 4
Wetlands	<p>No wetlands are mapped within the proposal area, however it is noted that there is one small area of native vegetation that contains native species that can inhibit waterlogged areas (eg. <i>Juncus</i> spp. <i>Persicaria</i> spp.). This area is shown on Figure 5 as PCT 849 which has been attributed to 'low condition' class given it has been historically cleared and is in a regenerating state. The impacts to this patch of PCT 849 low has been addressed in section 7.</p>	Figure 4

Landscape feature	Description	Figure reference
Connectivity features	<p>In a larger regional context, the proposal area is surrounded by residential development to the east, and a mix of residential/rural landscapes to the west. The key biodiversity feature within the locality is the vegetation along South Creek. South Creek provides an important fauna corridor throughout Western Sydney, and provides informal protection for native vegetation, comprising largely of TECs typical of Western Sydney. The South Creek riparian corridor connects the site to Wianamatta Regional park about 5.5 km to the north of the proposal area.</p> <p>The native vegetation across much of the proposal area consists of scattered eucalypts which align to the PCTs detailed in section 3.2.</p> <p>The proposal would impact the edge of existing patches of native vegetation.</p> <p>Much of the native vegetation to the north of the proposal area consists of patches that are relatively small (0.3 ha to 1 ha), owing to the historic vegetation clearing that has occurred. These areas provide 'island' habitat, or 'stepping-stones' for fauna between other similar scattered patches to the west. Given the isolation of these patches and exposure to edge effects from Mamre Road and surrounding land uses, the patches contain a large percentage of weed coverage and evidence of erosion and rubbish dumping.</p> <p>To the south of the proposal area, the connectivity of habitat is more prominent given the native vegetation of the site is adjoined to larger native patches. To the south of Luddenham Road, the proposal occurs immediately adjacent to the Luddenham Road BioBank site. This site contains over 40 ha of native vegetation that will be protected in-perpetuity. About 0.14 ha along the north-east corner of the Luddenham Road BioBank site would be impacted by the proposal.</p>	Figure 4
Areas of Geological Significance	<p>The proposal area is located on relatively flat terrain within the Cumberland Plain. No rocky outcrops, crevices or cliffs are located within the proposal area or immediately adjacent. The proposal would therefore not have an impact upon areas of geographical significance.</p>	N/A
Areas of outstanding biodiversity value	<p>The Register of Declared Areas of Outstanding Biodiversity Value has information about declared Areas of Outstanding Biodiversity Value in NSW. Area of Outstanding Biodiversity Value declarations in NSW include the following:</p> <ul style="list-style-type: none"> • Gould's Petrel – critical habitat declaration • Little penguin population in Sydney's North Harbour – critical habitat declaration • Mitchell's Rainforest Snail in Stotts Island Nature Reserve – critical habitat declaration • Wollemi Pine – critical habitat declaration. <p>None of the areas of Outstanding Biodiversity Value that are listed above would be impacted by the proposal, given none are located within the proposal area.</p>	N/A



-  Vegetation clearance boundary
-  1500m Buffer
-  Native woody vegetation
-  Non woody native vegetation
-  Non native
-  Non Perennial Stream
-  Perennial Stream



Landscape Assessment
Mamre Road Upgrade – Stage 1
Biodiversity Development Assessment Report (BDAR)

Niche PM: Luke Baker
 Niche Proj. #: 6634
 Client: Transport for NSW / Aurecon

Figure 4

Drawn by: GT/YH File: T:\spatial\projects\6600\at6634_Mamre_Rd_Peier_Review\MapReports\BDAR\Updated_BDAR\6634_Figure_4_LandscapeAssessment.mxd Last updated: 10-Jun-21 10:05:42 AM

3 Native vegetation

3.1 Method

3.1.1 Background research

A review of relevant literature, databases and existing vegetation mapping was undertaken to identify vegetation, threatened flora and Threatened Ecological Communities (TECs) that are listed under both NSW and Commonwealth legislation, with potential to occur at the proposal area. The literature review was undertaken prior to the field survey to inform field survey requirements. A likelihood of occurrence analysis (Annexure 1) was then undertaken for each species/TEC, based on suitability of habitat present within the proposal area.

The following databases were used for this purpose:

- Department of Planning, Infrastructure and the Environment (DPIE) BioNet, Atlas of NSW Wildlife (DPIE 2019b)
- Department of Agriculture, Water and Environment (DAWE) EPBC Act Protected Matters Search Tool Report (DoEE 2019a)
- Threatened Species Collection Database (DPIE 2021)
- BAM-C outputs.

3.1.2 Vegetation survey undertaken

Prior to field validation, the proposal area was stratified using aerial photographic interpretation (API), and existing vegetation mapping projects, such as the Cumberland Plain Mapping Project (NPWS 2002, Tozer et al 2003).

Following a review of the existing mapping, field surveys were carried out on 16 to 18 September 2020, 22 February, 26 February 2021, 30 March 2020, 14 April 2021, 29 April 2021 and 4 May 2021, to stratify the vegetation as per the BAM.

In total, nine BAM plots were completed within the proposal area to meet the minimum plot requirement as per the BAM (Table 3-1 and Figure 5). Several transects were also completed, which assisted in vegetation zone delineation and the vegetation mapping validation.

Table 3-1: Minimum number of plots required and completed per zone area

PCT Code / vegetation zone	Vegetation zone area (ha)	Plots required	Plots completed
PCT 849_medium	3.68	2	2
PCT 849_low	0.93	1	1
PCT 835_medium	2.97	2	2
PCT 835_low	1.25	1	3
PCT 1800_medium	0.47	1	1
Total	9.30	7	9

3.1.3 Limitations

Numerous plant and animal species are cryptic or difficult to detect. Some cryptic plant species are more easily detected at certain times of the year, such as during flowering events. Some fauna can only be detected during certain seasons (e.g. migration patterns or intra-torpor periods). These limitations were addressed by undertaking surveys across differing months, analysis species specific habitat, employing a range of trapping and survey techniques.

3.2 Vegetation mapping results

The vegetation survey confirmed the presence of three PCTs within the proposal area:

- PCT 849 Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
- PCT 835 Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion
- PCT 1800 Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley.

Different condition classes were assigned to areas of vegetation where obvious differences in structure and quality occurred, resulting in three PCTs and five vegetation categories (zones) as shown in Table 3-2.

In general, all five vegetation zones reflected the edge effects from the existing road, including weed occurrence, sedimentation, erosion and some debris. Additionally, historical and current clearing for agricultural purposes is evident across the site.

Where areas of PCT 849 and PCT 835 were small and isolated, the condition was generally lower, with less canopy cover, lower species diversity and typically higher abundance of exotic species.

The vegetation within the BioBank site directly south of Luddenham Road and the vegetated area directly north of Erskine Park Road were in a moderate condition. The canopy in these patches typically comprised trees of 30 centimetre diameter breast height (dbh), some mature (<80 dbh), as well as regenerating tree species were observed throughout the moderate condition vegetation.

Typically, the dominant eucalypts within the proposal area consisted of Forest Red Gum (*Eucalyptus tereticornis*) and Grey Box (*Eucalyptus moluccana*), with some occurrences of Swamp Sheoak (*Casuarina glauca*), and White Feather Honey Myrtle (*Melaleuca decora*). The mid to ground cover of the proposal area had relatively high instances of Blackthorn (*Bursaria spinosa*), Kidney Weed (*Dichondra repens*), Twining Glycine (*Glycine clandestina*), Weeping Grass (*Microlaena stipoides*), and Forest Nightshade (*Solanum prinophyllum*).

Table 3-3 to Table 3-7 detail the condition of each vegetation zone as well as species composition, conservation status and landscape characteristics.

A full species list for all surveyed plots is found in Annexure B, and the extent of vegetation within the proposal area is shown in Figure 5.

Table 3-2 Plant community types by vegetation zone

Vegetation Zone	Plant community type (PCT)	Vegetation Formation	Vegetation Class	Threatened Ecological Community ¹	PCT Cleared Extent	Condition identified (Used in BAM-C)	Vegetation integrity score	Patch size (ha)	Area (ha) within vegetation clearance boundary
849_medium	PCT 849 Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Grassy Woodlands	Coastal Valley Grassy Woodlands	Yes - aligns to the CEEC Cumberland Plain Woodland (BC and EPBC Act)	93	Medium	48.6	101	3.68
849_low	PCT 849 Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Grassy Woodlands	Coastal Valley Grassy Woodlands	Yes - aligns to the CEEC Cumberland Plain Woodland (BC Act)	93	Low	7.6	101	0.93
835_medium	PCT 835 Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Forested Wetlands	Coastal Floodplain Wetlands	Yes - aligns to River-Flat Eucalypt Forest (a CEEC under the BC Act and a EEC under the EPBC Act)	93	Medium	72.4	101	2.97
835_low	PCT 835 Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Forested Wetlands	Coastal Floodplain Wetlands	Yes - aligns to River-Flat Eucalypt Forest (a CEEC under the BC Act)	93	Low	27.6	101	1.25
1800_medium	PCT 1800 Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley.	Forested Wetlands	Coastal Floodplain Wetlands	Yes - aligns to the EEC Swamp Oak Floodplain Forest (BC Act)	60	Medium	36.1	101	0.47

¹ Alignment to NSW and Commonwealth TECs have been provided in Table 3-3 to Table 3-7

Vegetation Zone	Plant community type (PCT)	Vegetation Formation	Vegetation Class	Threatened Ecological Community ¹	PCT Cleared Extent	Condition identified (Used in BAM-C)	Vegetation integrity score	Patch size (ha)	Area (ha) within vegetation clearance boundary
Non-native	Non-native	-	-	-	-	-	-	-	34.90
Total									44.28

Table 3-3 Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849) in moderate condition

PCT 849 _Moderate	
Vegetation formation	Grassy Woodlands
Vegetation class	Coastal Valley Grassy Woodlands
Conservation status	Aligns to Cumberland Plain Woodland in the Sydney Basin Bioregion listed as a Critically Endangered Ecological Community under the BC Act and EPBC Act.
% cleared	93
Characteristics of the PCT	DPIE (2021d) characterises PCT 849 as having a gentle topography associated with the shale plains of western Sydney and carries an open grassy woodland dominated by <i>Eucalyptus moluccana</i> (Grey Box), <i>Eucalyptus tereticornis</i> (Forest Red Gum) and Ironbark species such as <i>Eucalyptus crebra</i> or <i>Eucalyptus fibrosa</i> . It is typified by a sparse to moderate cover of shrubs and a high cover of grasses and forbs. Tozer <i>et al.</i> (2010) define the primary habitat for the community as occurring at elevations less than 150 meters above sea level with some sites occurring at higher elevations where the landscape remains gently inclined.
Extent in the assessment area (ha)	3.68 hectares
Condition	The vegetation in this zone is in a moderate condition. The canopy is well established with mature (dbh >80cm) <i>Eucalyptus moluccana</i> (Grey Box) and <i>E. tereticornis</i> (Forest Red Gum) present as well as saplings (signs of regeneration) of these species. A shrub layer predominantly comprised of <i>Bursaria spinosa</i> (Native Blackthorn) and a diverse ground cover of grasses and forbs present throughout the vegetation zone. Exotic species are present in a low to moderate abundance throughout the vegetation zone and include species such as, <i>Eragrostis curvula</i> (African Lovegrass) in the understorey and <i>Olea europaea</i> subsp. <i>cuspidata</i> (African Olive) in the midstorey.
Plots completed	Two (Plots 4 and 5)
Composition condition score	23.6
Structure condition score	64.5
Function condition score	75.4
Vegetation integrity score	48.6

Composition

Trees: 3
Shrubs: 0.5
Grass and grass like: 2.5
Forb: 5.5
Fern: 0
Other:1.5



Photo 1. BAM plot 4

Photo



Photo 2. BAM plot 5

Justification	<p>As mentioned above, diagnostic canopy species of PCT 849 include <i>Eucalyptus tereticornis</i> (Forest Red Gum) and <i>Eucalyptus moluccana</i> (Grey Gum), both of which were observed throughout this vegetation zone. Most of the observed trees were around 30 dbh, however, mature (>80 dbh) and juvenile (<5 dbh) trees were also observed and recorded in this vegetation zone.</p> <p>The midstorey ranged from a sparse to dense cover of <i>Bursaria spinosa</i> (Blackthorn) which is a diagnostic species of Cumberland Plain Woodland.</p> <p>Plots sampled confirm the presence of groundcover species diagnostic of PCT 849, including <i>Microlaena stipoides</i> (Weeping Grass) and <i>Bothriochloa macra</i> (Redlegs Grass) and <i>Sporobolus creber</i> (slender Rat's Tail Grass). Forb species include <i>Dichondra repens</i> (Kidney Weed), <i>Wahlenbergia gracilis</i> (Australian Bluebell), <i>Glycine microphylla</i> (Small-leaf Glycine) and <i>Asperula conferta</i> (Common Woodruff).</p> <p>A full species list for all surveyed plots is found in Annexure A and the extent of vegetation within the proposal area is shown in Figure 5. The native vegetation and other diagnostic features within these areas conformed with NSW State and the Commonwealth description for the TEC (as explained below).</p>
How it meets the BC Act Determination	<p>PCT 849_ Moderate meets the BC Act listing of the CEEC Cumberland Plain Woodland based on the following characteristics (DPIE 2021g):</p> <ul style="list-style-type: none"> • The vegetation zone is characterised by the presence of <i>Eucalyptus tereticornis</i> (Red Gum) and <i>E. moluccana</i> (Grey Gum). • A shrub layer dominated by <i>Bursaria spinosa</i> (Blackthorn) is present. • The understorey is characterised by a high abundance of native grasses and a high diversity of forbs. • Characteristic species are present as identified in the Scientific Determination • Occurs within the known range of the TEC.
How it meets the EPBC Act Determination	<p>PCT 849_ Moderate meets the EPBC Act listing of the CEEC Cumberland Plain Woodland based on the following characteristics (DAWE 2010):</p> <ul style="list-style-type: none"> • Native tree species present with a minimum projected foliage cover of 10%. • The patch of the ecological community is 0.5 ha or greater in size. • Of the perennial understorey vegetative cover present, 50% is made up of native species.

Table 3-4 Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849) Low condition

PCT 849_Low	
Vegetation formation	Grassy Woodlands
Vegetation class	Coastal Valley Grassy Woodlands
Conservation status	Aligns to Cumberland Plain Woodland in the Sydney Basin Bioregion listed as a Critically Endangered Ecological Community under the BC Act.
% cleared	93
Characteristics of the PCT	DPIE (2021d) characterises PCT 849 as having a gentle topography associated with the shale plains of western Sydney and carries an open grassy woodland dominated by <i>Eucalyptus moluccana</i> (Grey Box), <i>Eucalyptus tereticornis</i> (Forest Red Gum) and Ironbark species such as <i>Eucalyptus crebra</i> (Small-leaved Ironbark) or <i>Eucalyptus fibrosa</i> (Broad-leaved Ironbark). It is typified by a sparse to moderate cover of shrubs and a high cover of grasses and forbs. Tozer et al. (2010) define the primary habitat for the community as occurring at elevations less than 150 meters above sea level with some sites occurring at higher elevations where the landscape remains gently inclined.
Extent in the assessment area (ha)	0.93 hectares
Condition	<p>The condition of this vegetation zone is low, there were no mature canopy species within this vegetation condition, however there was evidence of regeneration. The midstorey is scattered and regenerating, but where present comprises <i>Bursaria spinosa</i> (Native Blackthorn). Native ground cover is present in the zone, however it is typically suppressed by exotic species.</p> <p>Weed cover is high throughout the zone, and is typically dominated by <i>Eragrostis curvula</i> (African Lovegrass) in the understorey and <i>Olea europaea subsp. cuspidata</i> (African Olive) in the midstorey.</p>
Plots completed	1 (Plot 7)
Composition condition score	17.5
Structure condition score	9.1
Function condition score	2.8
Vegetation integrity score	7.6
Composition	Trees: 2 Shrubs: 2 Grass and grass like: 3 Forb: 3 Fern: 9 Other: 2

Photo



Photo 3. BAM plot 7

Justification

As mentioned above, diagnostic canopy species of PCT 849 include *Eucalyptus tereticornis* (Forest Red Gum) and *Eucalyptus moluccana* (Grey Box), both of which were observed to be regenerating in this vegetation zone. Additionally, the moderate condition vegetation surrounding the Low condition vegetation was identified as PCT 849.

A regenerating midstorey of *Bursaria spinosa* (Blackthorn), which is a diagnostic species of PCT 849, was observed and recorded in this vegetation zone.

Plots sampled confirm the presence of groundcover species diagnostic of PCT 849 including *Themeda australis* (Kangaroo Grass), *Brunoniella australis* (Blue Trumpet), *Glycine tabacina* and *Centella asiatica* (Indian Pennywort).

A full species list for all surveyed plots is found in Annexure A and the extent of vegetation within the proposal is shown in Figure 5. The native vegetation and other diagnostic features within these areas conformed with NSW State description for the TEC (as explained below).

How it meets the BC Act Determination

PCT 849_Low meets the BC Act listing of the CEEC Cumberland Plain Woodland based on the following characteristics (DPIE 2021g):

- Characterised by the presence of regenerating *Eucalyptus tereticornis* (Red Gum) and *E. moluccana* (Grey Box) species
- A sparse shrub layer dominated by *Bursaria spinosa* (Blackthorn) is present.
- The understorey is characterised by native grasses and a moderate diversity of forbs
- Characteristic species are present as identified in the Scientific Determination
- Occurs within the known range of the TEC.

How it meets the EPBC Act Determination

PCT 849_Low does not meet the EPBC Act Determination criteria for the CEEC Cumberland Plain Woodland due to the zone not meeting the first condition threshold:

- Native tree species are not present at the minimum projected foliage cover of 10%.

As the zone does not meet the first condition threshold it is automatically not considered the listed ecological community (DAWE 2010).

Table 3-5 Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 835) moderate condition

PCT 835_Moderate	
Vegetation formation	Forested Wetlands
Vegetation class	Coastal Floodplain Wetlands
Conservation status	Aligns to River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions listed as an EEC under the BC Act and as a CEEC under EPBC Acts.
% cleared	93
Characteristics of the PCT	DPIE (2021d) characterises PCT 835 as an open eucalypt forest situated on broad alluvial flats of the Hawkesbury and Nepean river systems. It also forms narrower ribbons alongside streams and creeks that drain the Cumberland Plain. Typically, the canopy includes one of either <i>Angophora floribunda</i> (Rough-barked Apple) or <i>Angophora subvelutina</i> (Broad-leaved Apple) and one or both of <i>Eucalyptus tereticornis</i> (Forest Red Gum) and <i>Eucalyptus amplifolia</i> (Cabbage Gum). The ground layer is characterised by an abundant cover of grasses with small herbs and ferns. Cumberland Riverflat Forest occurs at altitudes between one and 160 metres above sea level and with a mean annual rainfall of 750-1000 millimetres.
Extent in the assessment area (ha)	2.97 hectares
Condition	The vegetation in this zone is in a moderate condition. The canopy is well established with mature (dbh >80cm) <i>E. tereticornis</i> (Red Gum) and <i>Angophora floribunda</i> (Rough-barked Apple) present, a shrub layer predominantly comprised of <i>Bursaria spinosa</i> (Native Blackthorn), and a diverse ground cover of grasses and forbs. Exotic species are present in a moderate to low abundance throughout the vegetation zone and include, <i>Bidens pilosa</i> (Cobbler's Pegs), <i>Verbena bonariensis</i> (Purpletop), <i>Olea europaea subsp. cuspidata</i> (African Olive) and <i>Ligustrum sinensis</i> (Small-leaf Privet) in the midstorey.
Plots completed	2 (Plots 3 and 6)
Composition condition score	58.9
Structure condition score	81.3
Function condition score	79.4
Vegetation integrity score	72.4
Composition	Trees: 2.5 Shrubs: 1.5 Grass and grass like: 4.5 Forb: 5.5 Fern: 0 Other:2.5

Photo



Photo 4. BAM plot 3



Photo 5. BAM plot 6

PCT 835_Moderate

Justification	<p>As mentioned above, diagnostic canopy species of PCT 835 include <i>Angophora floribunda</i> (Rough-barked Apple) and <i>Eucalyptus tereticornis</i> (Forest Red Gum), both of which were observed throughout this vegetation zone. Most of the observed trees were around 30 dbh, however, mature (>80 dbh) and juvenile (<5 dbh) trees were also observed and recorded in this vegetation zone.</p> <p>The midstorey had a spare cover of <i>Bursaria spinosa</i> (Blackthorn) which is a diagnostic species of PCT 835.</p> <p>Plots sampled confirm the presence of groundcover species diagnostic of PCT 835 including <i>Microlaena stipoides</i> (Weeping Grass), <i>Dichondra repens</i> (Kidney Weed), <i>Clematis aristata</i> (Old Mans Beard), <i>Oplismenus aemulus</i> (Basket Grass), <i>Wahlenbergia gracilis</i> (Australian Bluebell), <i>Glycine microphylla</i> (Small-leaf Glycine) and <i>Geranium solanderi</i> (Native Geranium).</p> <p>A full species list for all surveyed plots is found in Annexure A and the extent of vegetation within the proposal is shown in Figure 5. The native vegetation and other diagnostic features within these areas conformed with NSW State and the Commonwealth description for the TEC (as explained below).</p>
How it meets the BC Act Determination	<p>PCT 835_ Moderate meets the BC Act listing of the CEEC River-flat Eucalypt Forest based on the following characteristics (DPIE 2021g):</p> <ul style="list-style-type: none">• Characterised by the presence of <i>Eucalyptus tereticornis</i>, <i>Angophora floribunda</i> and <i>Casuarina glauca</i>• A shrub layer dominated by <i>Bursaria spinosa</i> is present.• The understorey is characterised by a high abundance of native grasses and a high diversity of forbs• Characteristic species are present as identified in the Scientific Determination• Occurs within the known range of the TEC.
How it meets the EPBC Act Determination	<p>PCT 835_ Moderate meets the EPBC Act listing of the CEEC River-flat Eucalypt Forest based on the following characteristics:</p> <ul style="list-style-type: none">• 30% of its total understorey vegetation cover is comprised of native species (exotic annuals are excluded from this assessment)• Ground cover richness ≥ 4 native species per 0.04 ha sample plot• Small contiguous patch size ≥ 0.5 ha within a patch of native vegetation ≥ 5 ha <p>Based on PCT 835_Moderate meeting the above condition thresholds it meets the Category C2 'Large or contiguous patch in moderate condition' (DoEE 2021).</p>

Table 3-6 Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 835) low condition

PCT 835_Low	
Vegetation formation	Forested Wetlands
Vegetation class	Coastal Floodplain Wetlands
Conservation status	Aligns to River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions listed as an EEC under the BC Act.
% cleared	93
Characteristics of the PCT	DPIE (2021d) characterises PCT 835 as an open eucalypt forest situated on broad alluvial flats of the Hawkesbury and Nepean river systems. It also forms narrower ribbons alongside streams and creeks that drain the Cumberland Plain. Typically, the canopy includes one of either <i>Angophora floribunda</i> (Rough-barked Apple) or <i>Angophora subvelutina</i> (Broad-leaved Apple) and one or both of <i>Eucalyptus tereticornis</i> (Forest Red Gum) and <i>Eucalyptus amplifolia</i> (Cabbage Gum). The ground layer is characterised by an abundant cover of grasses with small herbs and ferns. Cumberland Riverflat Forest occurs at altitudes between one and 160 metres above sea level and with a mean annual rainfall of 750-1000 millimetres.
Extent in the assessment area (ha)	1.25 hectares
Condition	The vegetation in this zone is in a low condition. There are no mature canopy species, however young trees and canopy regeneration was observed. The shrub layer is sparse, but where present include diagnostic species such as <i>Acacia parramattensis</i> (Parramatta wattle) and <i>Bursaria spinosa</i> (Native Blackthorn). There is low to moderate species diversity due to suppression by exotic species in the midstorey and understorey. Exotic species are present high abundance throughout the vegetation zone, with the most abundant species being <i>Eragrostis curvula</i> (African Lovegrass) and <i>Chloris gayana</i> (Rhodes Grass), other species include <i>Bidens pilosa</i> (Cobbler's Pegs), <i>Verbena bonariensis</i> (Purpletop), <i>Olea europaea</i> subsp. <i>cuspidata</i> (African Olive) and <i>Ligustrum sinensis</i> (Small-leaf Privet) in the midstorey.
Plots completed	3 (Plots 1, 2 and 9)
Composition condition score	33.9
Structure condition score	16
Function condition score	38.7
Vegetation integrity score	27.6
Composition	Trees: 1.7 Shrubs: 2.3 Grass and grass like: 3.3 Forb: 3 Fern: 0 Other:1

Photo



Photo 6. BAM plot 1



Photo 7. BAM plot 2



Photo 8. BAM plot 9

PCT 835_Low

Justification	<p>As mentioned above, diagnostic canopy species of PCT 835 include <i>Eucalyptus tereticornis</i> (Forest Red Gum), <i>Angophora floribunda</i> (Rough-barked Apple) and <i>Casuarina glauca</i> (Swamp Oak), which were all recorded regenerating in this vegetation zone.</p> <p>The shrub layer in this vegetation zone is sparse, but where present, include species such as <i>Acacia parramattensis</i> (Parramatta wattle) and <i>Bursaria spinosa</i> (Native Blackthorn), both of which are diagnostic species of PCT 835.</p> <p>Plots sampled confirm the presence of groundcover species diagnostic of PCT 835, including <i>Microlaena stipoides</i> (Weeping Grass), <i>Dichondra repens</i> (Kidney Weed), <i>Clematis aristata</i> (Old Mans Beard), and <i>Glycine microphylla</i> (Small-leaf Glycine).</p> <p>A full species list for all surveyed plots is found in Annexure A and the extent of vegetation within the proposal is shown in Figure 5. The native vegetation and other diagnostic features within these areas conformed with NSW State description for the TEC (as explained below).</p>
How it meets the BC Act Determination	<p>PCT 835_Low meets the BC Act listing of the CEEC River-flat Eucalypt Forest based on the following characteristics (DPIE 2021g):</p> <ul style="list-style-type: none">• Characterised by the presence of <i>Eucalyptus tereticornis</i>, <i>Angophora floribunda</i> and <i>Casuarina glauca</i>• The understorey in intact areas is characterised by native grasses and a moderate diversity of forbs• Characteristic species are present as identified in the Scientific Determination• Occurs within the known range of the TEC.
How it meets the EPBC Act Determination	<p>PCT 835_Low does not meet the EPBC Act Determination criteria for the CEEC River-flat Eucalypt Forest due to the zone not meeting the condition thresholds for a small patch (≥ 0.5 ha) which are:</p> <ul style="list-style-type: none">• 30% of its total understorey vegetation cover is comprised of native species (exotic annuals are excluded from this assessment)• Ground cover richness ≥ 4 native species per 0.04 ha sample plot <p>As the zone does not meet the above condition thresholds it is not considered the listed ecological community (DoEE 2021).</p>

Table 3-7 Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley (PCT 1800) in moderate condition

PCT 1800_Low	
Vegetation formation	Forested Wetlands
Vegetation class	Coastal Floodplain Wetlands
Conservation status	Aligns to Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions listed as an EEC under the BC Act.
% cleared	60
Characteristics of the PCT	DPIE (2021d) characterises PCT 1800 as being found on the riverflats of the Cumberland Plain in western Sydney and in the Hunter Valley. The distinguishing feature is the prominent stands of <i>Casuarina glauca</i> (Swamp Oak) found along or near streams. Often these are relatively young trees, swarming amongst a mix of old and young eucalypts such as <i>Angophora floribunda</i> (Rough-barked Apple), <i>Eucalyptus tereticornis</i> (Forest Red Gum) and <i>Eucalyptus moluccana</i> (Grey Box). This community features an open grassy and herbaceous understorey, as is typical of riverflat forests.
Extent in the assessment area (ha)	0.47 hectares
Condition	The condition of vegetation within the proposal area is low. <i>Casuarina glauca</i> (Swamp Oak) dominates this vegetation zone and was observed regenerating. Midstorey was sparse in the vegetation zone, however <i>Cupaniopsis anacardioides</i> (Tuckeroo) was observed regenerating. Native understorey species abundance and diversity is low, where present species include <i>Microlaena stipoides</i> (Weeping Grass), <i>Dichondra repens</i> (Kidney Weed) and <i>Lobelia purpurascens</i> (White Root). Weed cover in this vegetation zone is moderate, with the cover increasing closer to the waterway and road. The most common exotic species include <i>Rubus fruticosus</i> (Blackberry) and <i>Cestrum parqui</i> (Green Cestrum).
Plots completed	1 (Plot 8)
Composition condition score	32.7
Structure condition score	19.3
Function condition score	74.6
Vegetation integrity score	36.1
Composition	Trees: 1 Shrubs: 0 Grass and grass like: 3 Forb: 5 Fern: 0 Other:1

Photo



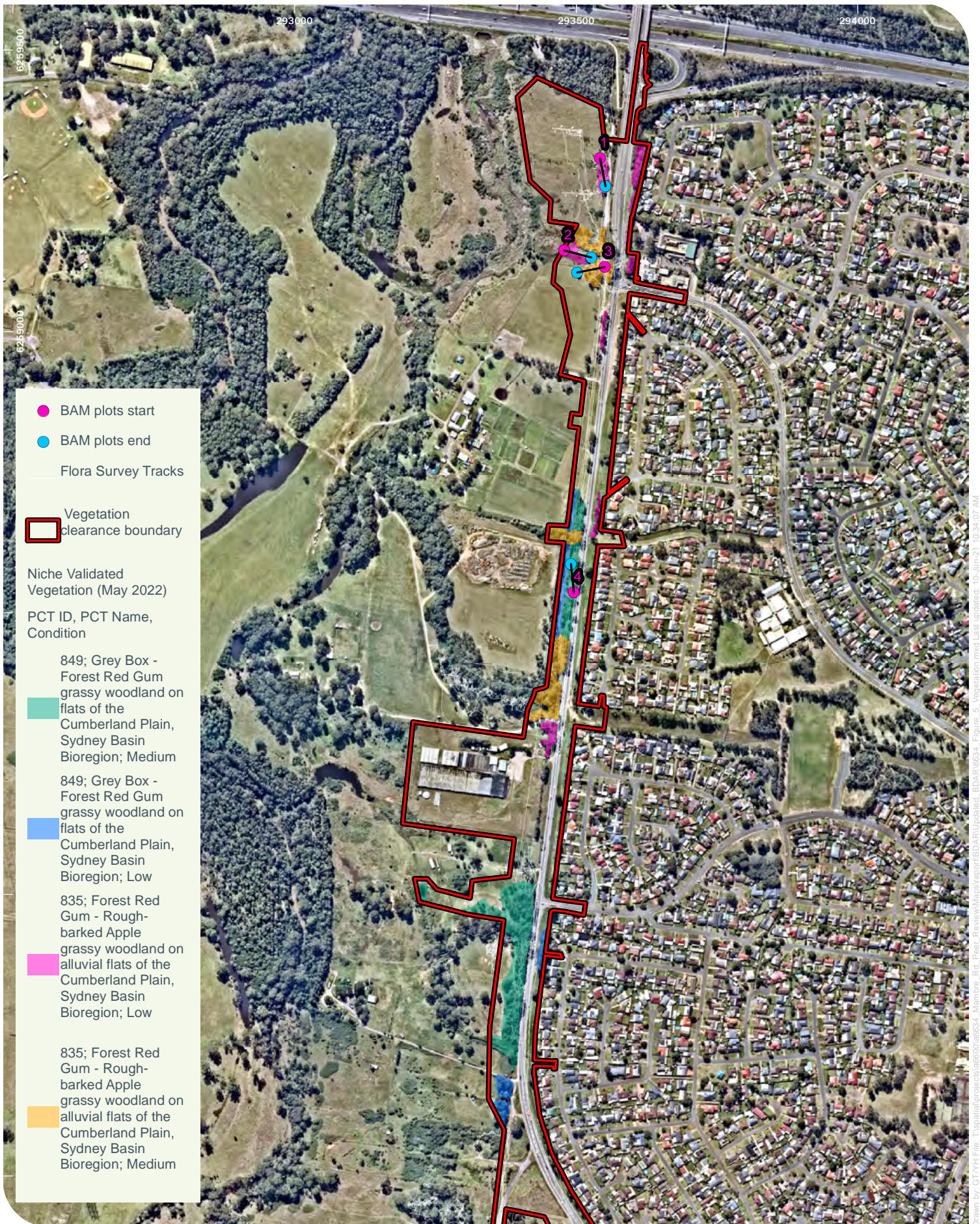
Photo 9. BAM plot 8

Justification	<p>As mentioned above, the diagnostic canopy species of PCT 1800 is <i>Casuarina glauca</i> (Swamp Oak) which was observed as the only canopy species in this vegetation zone. Native midstorey was absent in the plot, however <i>Cupaniopsis anacardioides</i> (Tuckeroo) was observed regenerating within the vegetation zone, and is considered to be a diagnostic species of PCT 1800. Plots sampled confirm the presence of groundcover species diagnostic of PCT 1800 including <i>Lomandra longifolia</i> (Spiny-headed Mat-rush) and <i>Oplismenus imbecillis</i> (Creeping Beard Grass).</p>
How it meets the BC Act Determination	<p>PCT 1800_Low meets the BC Act listing of the CEEC Swamp Oak Floodplain Forest based on the following characteristics (DPIE 2021g):</p> <ul style="list-style-type: none"> • Characterised by <i>Casuarina glauca</i> dominating the canopy • Characteristic species are present as identified in the Scientific Determination. • Vegetation zone appeared to be waterlogged and was situated along a drainage line in the south of the site. • Occurs within the known range of the TEC.
How it meets the EPBC Act Determination	<p>PCT 1800_Low is a small contiguous patch (0.5 ha - 2 ha, and is connected to a larger area of native vegetation of at least 5 ha). However, this patch does not meet the condition thresholds which for a small contiguous patch include:</p> <ul style="list-style-type: none"> • Mostly native understorey Non-native species comprise less than 50% of total understorey vegetation cover • AND transformer species comprise less than 30% of total understorey vegetation cover <p>As PCT 1800_Low does not meet the above EPBC Act Determination criteria it is not considered the listed EEC Coastal Swamp Oak (<i>Casuarina glauca</i>) Forest (DoEE 2018).</p>

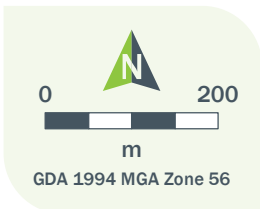
3.3 Weeds

The weed species commonly found across the proposal area included: *Bidens pilosa* (Cobblers pegs), *Taraxacum officinale* (Dandelion), *Sonchus oleraceus* (Common Sowthistle), *Lysimachia arvensis* (Scarlet Pimpernel), *Eragrostis curvula* (African lovegrass), and *Senecio madagascariensis* (Fire weed).

Weeds that were recorded throughout the BAM plot collected that are regarded as 'High Threat Weeds', include the following: *Ligustrum sinense* (Small-leaved privet), *Rubus fruticosus* sp. agg. (Blackberry), *Asparagus asparagoides* (Asparagus fern), *Olea europaea* subsp. *cuspidate* (African olive), *Bidens pilosa* (Cobblers pegs), *Cyperus eragrostis*, *Cestrum parqui* (Cestrum), *Paspalum dilatatum* (Paspalum), *Ehrharta erecta* (Ehrharta), *Ageratina adenophora* (Crofton weed), and *Cardiospermum grandiflorum* (Balloon vine).



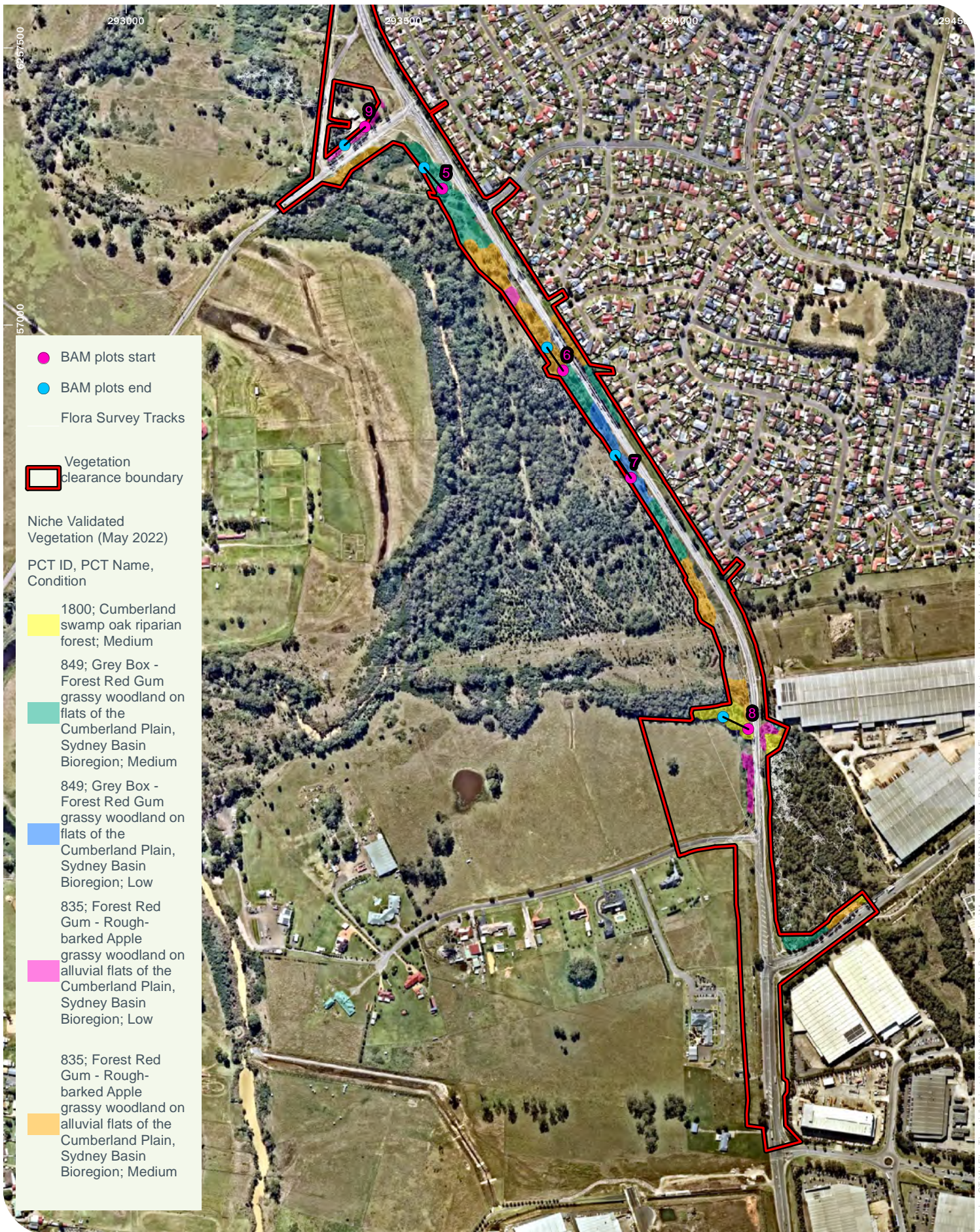
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Validated Vegetation mapping
Mamre Road Upgrade – Stage 1
Biodiversity Development Assessment Report (BDAR)

Niche PM: Luke Baker
 Niche Proj. #: 6634
 Client: Transport for NSW / Aurecon

Figure 5.1



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3.4 Threatened ecological communities

A list of TECs occurring or potentially occurring within 10 km of the proposal area as generated from the database searches is detailed in section 3.1 and Annexure A. The database searches identified seven TECs that have been identified as potentially occurring within the locality.

Based on the results of the detailed vegetation validation, and review of the listing advice and descriptions of the TECs, it has been determined that three of the PCTs recorded within the proposal area met the descriptions of TECs under the BC Act and/or EPBC Act (Table 3-2) (Figure 6). A description associated with the alignment to each TEC is provided below:

3.4.1 Cumberland Plain Woodland in the Sydney Basin Bioregion

PCT 849 identified within the proposal area corresponds with the TEC Cumberland Plain Woodland in the Sydney Basin Bioregion. This TEC has been listed as a Critically Endangered Ecological Community (CEEC) in Part 1 of Schedule 2 of the BC Act, and is also listed as a CEEC under the EPBC Act.

As discussed in Table 3-3, the alignment of the PCT 849 to the BC Act listing of Cumberland Plain Woodland CEEC is supported by the following:

- The structure of the vegetation within the proposal area that correlate with PCT 849 is of a grassy woodland, comprising of key diagnostic species of the CEEC, including *Eucalyptus molucanna* and *E. tereticornis*
- A shrub layer dominated by *Bursaria spinosa* is present which is typical of the TEC
- Characteristic understorey species is present
- Occurs within the known range of the TEC.

A total of 4.61 hectares of the BC Act listed Cumberland Plain Woodland occurs at the site.

In regards to the Commonwealth listing, a total of 3.68 hectares the EPBC Act listed Cumberland Plain Woodland occurs at the proposal area. This is made up of the moderate condition class of PCT 849 which aligns with the definition of Cumberland Plain Woodland as per the EPBC Act listing based on the following characteristics (DEWHA 2009):

- Native tree species present with a minimum projected foliage cover of 10 percent
- The patch of the ecological community is 0.5 hectares or greater in size
- Of the perennial understorey vegetative cover present, 50 percent is made up of native species.

The low condition class of PCT 849 does not meet the Commonwealth listing given native tree species are not present at the minimum projected foliage cover of 10 percent.

3.4.2 River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions

PCT 835 identified within the proposal area corresponds with the TEC River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions. This TEC is listed in Schedule 2, Part 2 of the BC Act as an EEC.

As discussed in Table 3-5, the alignment of 4.22 hectares of PCT 835 to the BC Act listing River-Flat Eucalypt Forest EEC is supported by the following:

- Characterised by the presence of *Eucalyptus tereticornis*, *Angophora floribunda* and *Casuarina glauca*
- The understorey in intact areas is characterised by native grasses and a moderate diversity of forbs
- Characteristic species are present as identified in the Scientific Determination
- Occurs within the known range of the TEC.

In regards to the Commonwealth listing, a total of 2.97 hectares the EPBC Act listed River-Flat Eucalypt Forest occurs at the site. This is made up of the moderate condition class of PCT 835 which meets the Commonwealth definition due to the following:

- 30 percent of its total understorey vegetation cover is comprised of native species (exotic annuals are excluded from this assessment)
- Ground cover richness ≥ 4 native species per 0.04 hectare sample plot
- Small contiguous patch size ≥ 0.5 hectare within a patch of native vegetation ≥ 5 hectare
- Based on PCT 835 Moderate meeting the above condition thresholds it meets the Category C2 'Large or contiguous patch in moderate condition' (DoEE 2021).

The low condition class of PCT 835 does not meet the EPBC Act Determination criteria for the CEEC River-flat Eucalypt Forest due to the zone not meeting the condition thresholds for a small patch (≥ 0.5 hectares) which are:

- 30 percent of its total understorey vegetation cover is comprised of native species (exotic annuals are excluded from this assessment)
- Ground cover richness ≥ 4 native species per 0.04 hectare sample plot.

3.4.3 Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions

PCT 1800 within the proposal area corresponds with the TEC Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions, which is listed as an EEC under the BC Act.

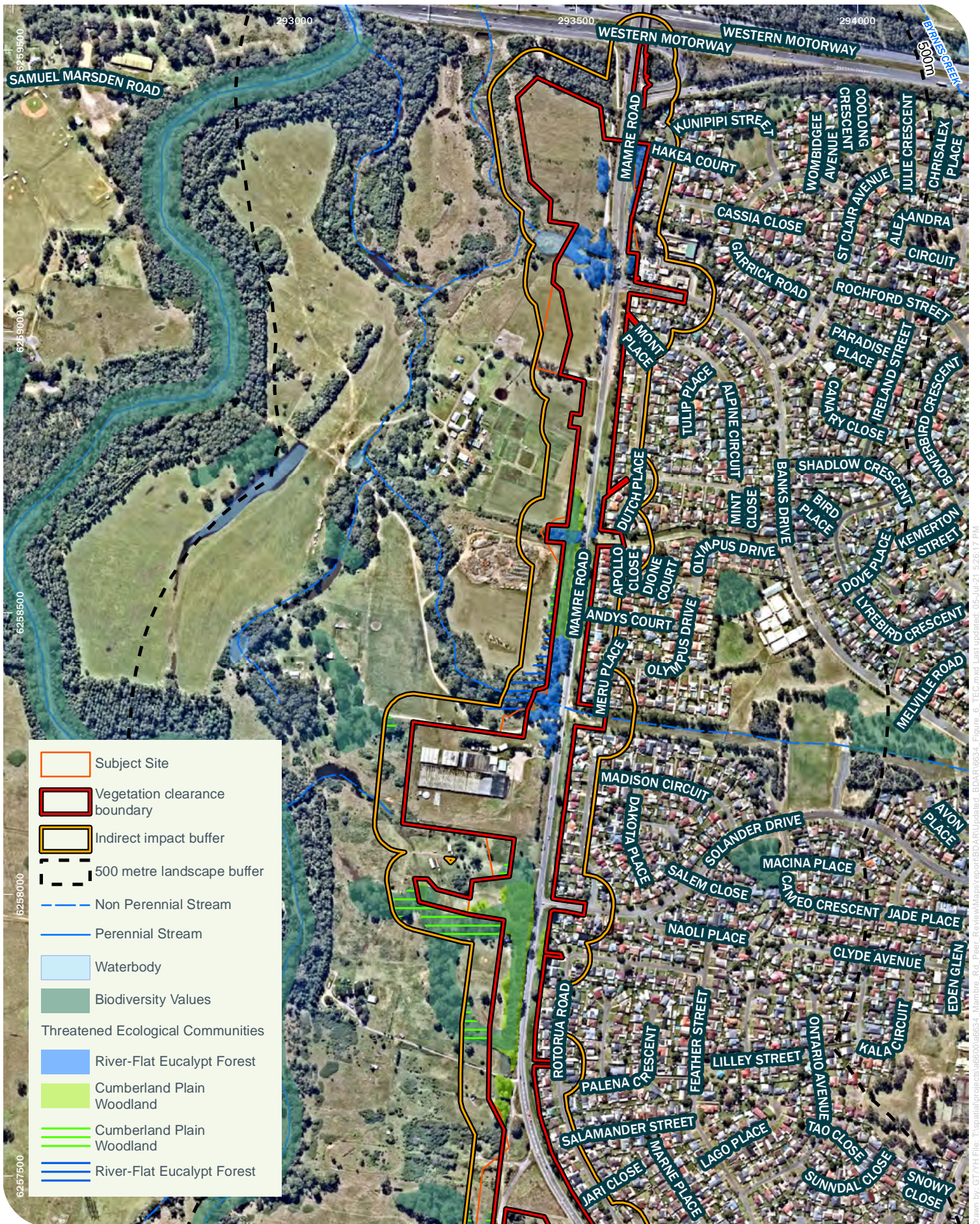
As discussed in Table 3-7, the alignment of the PCT 1800 to the BC Act listing Swamp Oak Floodplain Forest EEC is supported by the following:

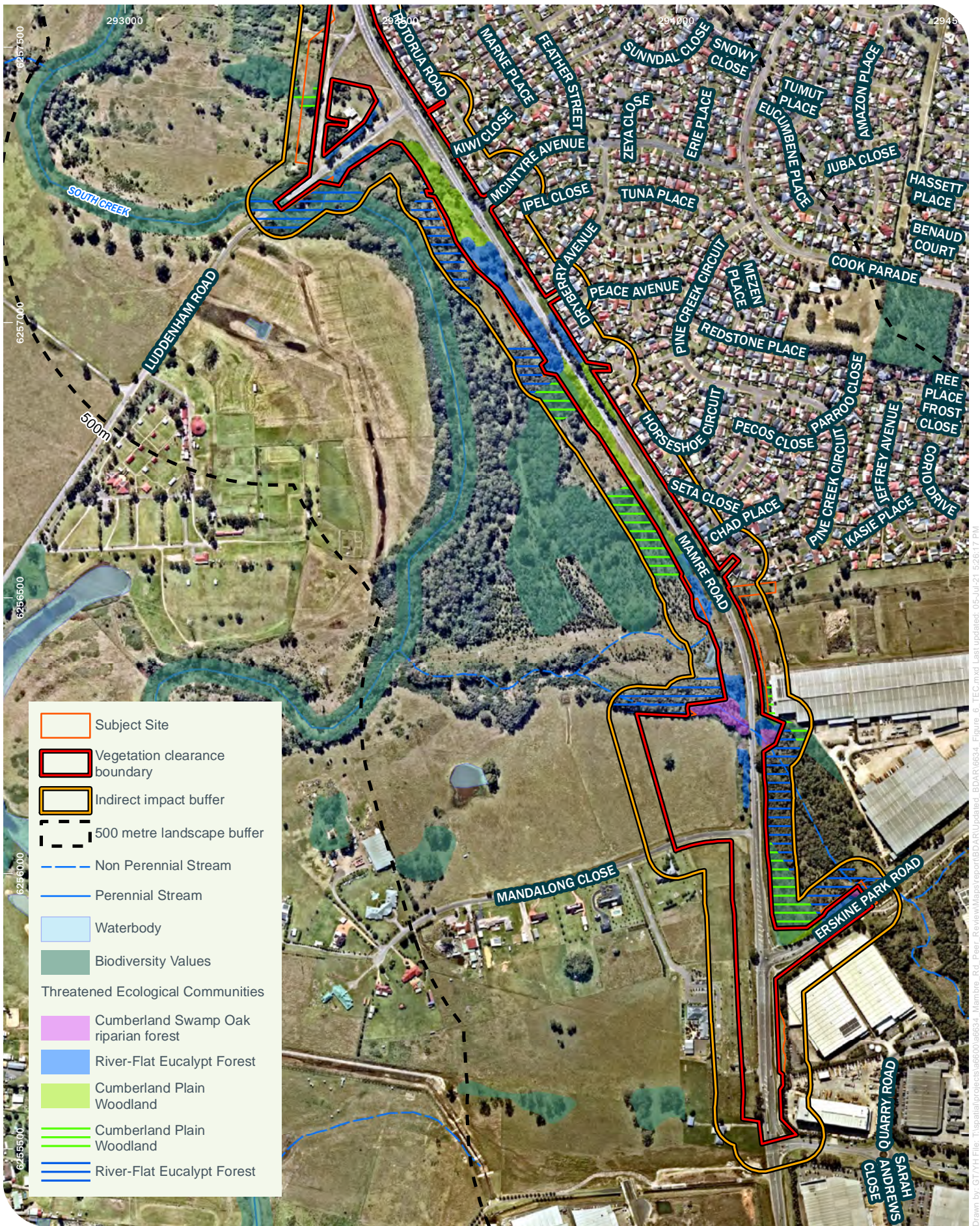
- This TEC is associated with grey-black clay-loams and sandy loams, saline groundwater, and found on waterlogged or periodically inundated flats, drainage lines and edges of other water bodies as is common for coastal floodplains. The proposal area contains clay loams on the edge of riparian areas within floodplains
- Characterised by *Casuarina glauca* dominating the canopy
- Characteristic species are present as identified in the Scientific Determination.
- Vegetation zone appeared to be waterlogged and was situated along a drainage line in the south of the site
- Occurs within the known range of the TEC.

In regards to the Commonwealth listing, the vegetation within the subject does not meet the Commonwealth definition.

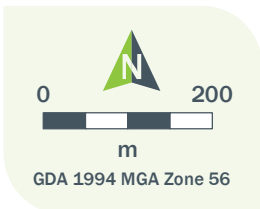
3.5 Groundwater dependent ecosystems

Groundwater dependant ecosystems (GDEs) have been discussed in the Water Quality and soil impact assessment for the proposal (Aurecon 2021). The assessment concludes that South Creek is classified as high potential aquatic GDE. The terrestrial GDEs that occur adjacent to South Creek within the proposal area are classified as high potential GDEs (DPIE 2020f). This includes the PCTs: PCT 849 Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion, and PCT 835 Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion.





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Threatened Ecological Communities
 Mamre Road Upgrade – Stage 1
 Biodiversity Development Assessment Report (BDAR)

Niche PM: Luke Baker
 Niche Proj. #: 6634
 Client: Transport for NSW / Aurecon

Figure 6.2

4 Threatened species

4.1 Threatened flora

4.1.1 Background research

Relevant databases were reviewed prior to field survey to identify data gaps and inform survey design. A 10 kilometre radius was placed around the proposal area (referred to as the locality) to inform a database search area. The database search is used to identify threatened biodiversity and migratory species that may occur within the proposed area, and the locality. The following databases were used for this purpose:

- Department of Planning, Infrastructure and the Environment (DPIE) BioNet, Atlas of NSW Wildlife (DPIE 2019b)
- Department of Agriculture, Water and Environment (DAWE) EPBC Act Protected Matters Search Tool Report (DAWE 2019a)
- Threatened Species Collection Database (DPIE 2021)
- BAM-C outputs.

The result of the database searches and the BAM-C was used to determine flora species to target during field surveys (Annexure A).

4.1.2 Terrestrial flora survey methodology

A total of 39 threatened flora species with the potential to occur or have habitat within the locality are presented in Annexure 1. These species were identified based on the database searches or as generated by the BAM-C.

In total, about 60 hours of threatened flora survey was conducted across the site (Table 4-1). The landscape was relatively open resulting in limited observer obstruction during the transect walks.

Table 4-1. Threatened flora timing and effort

Dates of survey	Ecologist	Estimate of total hours of survey completed
16 to 18 September 2020	Sarah Glauert (BAM Accredited Assessor BAAS17097) Janelle So	24 hours
22 February; 26 February 2021	Paul Gadsby (BAM Accredited Assessor BAAS20010), Janelle So, Liam Stephen	32 hours
30 March 2021	Paul Gadsby (BAM Accredited Assessor BAAS20010), Janelle So,	10 hours
14 April 2021	Luke Baker (BAM Accredited Assessor BAAS17033) Yogesh Nair (BAM Accredited Assessor BAAS18144)	8 hours
29 April 2021 4 May 2021	Isabelle Lyons (Ecologist) Annabelle Grundy (Ecologist)	16 hours
Total		90 hours

All surveys have been conducted in accordance with the relevant guidelines highlighted in section 1.5, and the requirements specified in the Threatened Biodiversity Database Collection (TBDC)² as at April 2021.

4.1.3 Threatened flora results

The field survey entailed sufficient effort (over 90 hours of traverses) to determine the occurrence of threatened flora within the proposal area (Table 4-2) (Annexure 1).

No threatened flora species were recorded within the proposal area.

The analysis concluded that historic clearing events have changed the resilience across large portions of the site, particularly in vegetation zones PCT 849 Low condition and PCT 835 Low condition. These vegetation zones had relatively low recruitment of native species, and were relatively open in terms of native ground cover.

The dominance of introduced grasses, such as *Eragrostis curvula* (African love grass), *Chloris gayana* (Rhodes grass) and *Paspalum dilatatum* (Paspalum) across portions of the proposal area also would act as a suppressant for threatened flora to regenerate.

Furthermore, portions of the proposal area were dominated by introduced grasses which were regularly slashed or mown, would likely suppress threatened flora from occurring.

In accordance with Section 6.4 of the BAM, the list of potentially occurring threatened flora species may be further refined where:

- habitat constraints listed for the species in the TBDC are absent from the proposal area (or particular vegetation zones), or
- habitat constraints or microhabitats on which the species depends are sufficiently degraded such that the species is unlikely to use the proposal area, or
- the species is vagrant in the IBRA subregion, or
- an expert report is prepared (in accordance with Subsection 6.5.2 of the BAM) stating that the species is unlikely to be present on the proposal area.

Table 4-2 lists the candidate threatened flora species provides comment on the survey effort completed, and justifies where a species has been removed from further consideration.

² Threatened Biodiversity Data Collection: part of the BioNet database, published by the Biodiversity Conservation Division and accessible from the BioNet website at www.bionet.nsw.gov.au.

Table 4-2: Results for threatened flora requiring survey under the BAM-C

Scientific Name	BAM recommended survey month												Survey completed and justification if the threatened species needs to be considering further	Considered further	
	J	F	M	A	M	J	J	A	S	O	N	D			
<i>Acacia bynoeana</i>	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	The species was not detected during targeted survey. Survey completed during recommended survey time - conspicuous species that is unlikely to remain undetected during field survey.	Not considered further.
<i>Acacia pubescens</i>	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	The species was not detected during targeted survey. Survey completed during recommended survey time - conspicuous species that is unlikely to remain undetected during field survey.	Not considered further.
<i>Caladenia tessellata</i>										Y	Y			The species was not detected during targeted survey. Survey completed during recommended survey time. Furthermore the species has not been recorded in the region historically, nor has it been recorded during the extensive field surveys that have been related to the Western Sydney Growth Centres and associated Aerotropolis development.	Not considered further.
<i>Callistemon linearifolius</i>	Y	Y	Y								Y	Y	Y	The species was not detected during targeted survey. The survey was completed during the recommended survey time. The species is highly conspicuous species that is unlikely to remain undetected even if not flowering.	Not considered further.
<i>Cynanchum elegans</i>	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	The species was not detected during targeted survey. Survey completed during recommended survey time - conspicuous species that is unlikely to remain undetected during field survey.	Not considered further.
<i>Deyeuxia appressa</i>													Y	Whilst the survey was not completed during December, the likelihood for the presence of this species within the proposal area is very low. The species has not been recorded since 1942 in Sydney, and is presumed extinct. The areas of previous occupancy are not near the proposal area. Furthermore, the site does not contain 'moist' forest/woodland habitat which the species was once known to occupy. The condition of the proposal area (historically cleared with edge effects), coupled with lack of historic records and assumed extinction, is reasonable to assume it is unlikely to be present. Further impact assessment is therefore not required.	Not considered further.

Scientific Name	BAM recommended survey month												Survey completed and justification if the threatened species needs to be considering further	Considered further	
	J	F	M	A	M	J	J	A	S	O	N	D			
<i>Dillwynia tenuifolia</i>								Y	Y	Y				The species was not detected during targeted survey. Survey completed during recommended survey time - conspicuous species that is unlikely to remain undetected during field survey.	Not considered further.
<i>Eucalyptus benthamii</i>	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	The species was not detected during targeted survey. Survey completed during recommended survey time - conspicuous species that is unlikely to remain undetected during field survey.	Not considered further.
<i>Grevillea juniperina</i> subsp. <i>juniperina</i>	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	The species was not detected during targeted survey. Survey completed during recommended survey time - conspicuous species that is unlikely to remain undetected during field survey.	Not considered further.
<i>Gyrostemon thesioides</i>	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	The species was not detected during targeted survey. Survey completed during recommended survey time.	Not considered further.
<i>Hibbertia</i> sp. <i>Bankstown</i>									Y	Y	Y	Y		The species was not detected during targeted survey. Survey completed during recommended survey time. Furthermore, the proposal area does not occur in Bankstown where the species is known to occupy.	Not considered further.
<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i> - endangered population	Y	Y									Y	Y		The species was not detected during targeted survey. Survey was completed during recommended survey time. This species is conspicuous, and is unlikely to remain undetected during field survey. With the exception of Balloon Vine (<i>Cardiospermum grandiflorum</i>) and Moth Vine (<i>Araujia sericifera</i>), no other vines were recorded in the proposal area. It is highly unlikely that the species would be present within the proposal area.	Not considered further.
<i>Maundia triglochinos</i>	Y	Y	Y								Y	Y		The survey was not completed during the recommended survey month for <i>Maundia triglochinos</i> . Potential habitat for <i>Maundia triglochinos</i> is within PCT835 Low which occurs to the far north of the proposal area. This area holds water after periods of rain, and contains some native rushes and forbs which is typical of habitat occupied by the species. Luke Baker (Ecologist) inspected this area during the field survey on the 14 April 2021 and confirmed that the species is not present. Luke has extensive experience with <i>Maundia triglochinos</i> . Luke has designed and lead a multi-year <i>Maundia triglochinos</i> monitoring program for the Pacific Highway Upgrade (Oxley to Kemsey Bypass), and thus is	Not considered further.

Scientific Name	BAM recommended survey month												Survey completed and justification if the threatened species needs to be considering further	Considered further	
	J	F	M	A	M	J	J	A	S	O	N	D			
														very familiar with the species and associated habitat. During the monitoring program, the species can be detected all year, with the greatest issue with detection generally being areas inundated which prevents detection of the species is it is underwater. Given the area of potential habitat was damp and not inundated at the time of survey, this presented reasonable conditions for survey.	
<i>Persicaria elatior</i>	Y	Y	Y	Y	Y								Y	The species was not detected during targeted survey. Survey completed during recommended survey time - conspicuous species that is unlikely to remain undetected during field survey.	Not considered further.
<i>Persoonia bargoensis</i>	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	The species was not detected during targeted survey. Survey completed during recommended survey time - conspicuous species that is unlikely to remain undetected during field survey.	Not considered further.
<i>Persoonia hirsuta</i>	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	The species was not detected during targeted survey. Survey completed during recommended survey time - conspicuous species that is unlikely to remain undetected during field survey.	Not considered further.
<i>Pilularia novae-hollandiae</i>											Y	Y	Y	The habitat across much of the proposal area is does not suit the requirement for this species (Shallow swamps and waterways). The only area of habitat that could be very marginally suitable is located within PCT 835 Low towards the north of the proposal area. This area did contain some native sedges and rushes, given it would periodically receive run off to the east of Mamre Road. However, whilst there is some very marginal habitat, the ground cover in this area is highly dominated by introduced species. Furthermore, species has not been recorded during the extensive field surveys in Western Sydney for the proposed airport (GHD 2016) which occurs about 10 km south and would offer better condition habitat compared to the proposal area.	Not considered further.

Scientific Name	BAM recommended survey month												Survey completed and justification if the threatened species needs to be considering further	Considered further
	J	F	M	A	M	J	J	A	S	O	N	D		
<i>Pimelea curviflora</i> <i>var. curviflora</i>	Y	Y	Y							Y	Y	Y	Survey was not completed during the recommended survey time, however the species is confined to the area between north Sydney in the south, and Maroota in the north-west which is well away from the proposal area. Furthermore, the species grows on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands. Such habitat is absent from the proposal area.	Not considered further.
<i>Pimelea spicata</i>	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	The species was not detected during targeted survey. Survey completed during recommended survey time - conspicuous species that is unlikely to remain undetected during field survey.	Not considered further.
<i>Pomaderris brunnea</i>								Y	Y	Y			The species was not detected during targeted survey. Survey completed during recommended survey time - conspicuous species that is unlikely to remain undetected during field survey.	Not considered further.
<i>Pterostylis saxicola</i>										Y			Survey was not completed during the recommended survey time, however the habitat types within the proposal area are not suitable. The species is known to grows in small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines. Associated vegetation above these rock shelves is sclerophyll forest or woodland on shale or shale/sandstone transition soils. Such features are not present, and thus highly unlikely to occur in the proposal area.	Not considered further.
<i>Pultenaea pedunculata</i>									Y	Y	Y		The species was not detected during targeted survey. Survey completed during recommended survey time - conspicuous species that is unlikely to remain undetected during field survey.	Not considered further.
<i>Thesium australe</i>	Y	Y									Y	Y	The species was not detected during targeted survey. Survey completed during recommended survey time.	Not considered further.

4.1.4 Threatened flora for further consideration

Our survey and analysis confirmed that no threatened flora requiring species credits were recorded within the proposal area. Threatened flora are therefore not required to be assessed further.

4.2 Threatened fauna

4.2.1 Background research

As for the native vegetation and flora assessment, a review of relevant literature, databases and existing vegetation mapping was carried out to identify vegetation (fauna habitat) and threatened fauna with the potential to occur within the proposal area. Data reviewed included:

- Department of Planning, Infrastructure and the Environment (DPIE) BioNet, Atlas of NSW Wildlife (DPIE 2019b)
- Department of the Agriculture, Water and Environment (DAWE) EPBC Act Protected Matters Search Tool Report (DoEE 2019a)
- Threatened Species Collection Database (DPIE 2021)
- BAM-C outputs.

The result of the database searches and the BAM-C were used to determine fauna species to target during field surveys (Annexure A).

4.2.2 Terrestrial fauna survey methodology

The likelihood of occurrence for threatened fauna, along with the candidate threatened fauna as per the BAM-C dictated the survey method approach. The database analysis determined the potential for 72 threatened fauna to occur, or have potential habitat within the locality.

The fauna survey was designed to detect potentially occurring threatened species and allow for an inventory of species to be compiled for the proposal area. Primarily, the field survey program was designed to target threatened fauna that are regarded as 'species credit' fauna, and those listed as threatened on the EPBC Act.

An overview of the survey dates has been provided in Table 4-3 below, with further detail provided in Table 4-4 and Figure 7.

Table 4-3. An overview of fauna field survey dates

Dates of survey	Ecologist	Key survey tasks completed during field campaign
16 to 18 September 2020	Sarah Glauert (Senior Ecologist/ Accredited Assessor BAAS17097) Janelle So (Ecologist - Aurecon)	Threatened flora survey, habitat mapping, Cumberland Plain Land Snail searches, Hollow-bearing tree mapping.
22 February 2021 26 February 2021 30 March 2021	Paul Gadsby (BAM Accredited Assessor BAAS20010), Janelle So (Ecologist), Liam Stephen (Ecologist)	Cumberland Plain Land Snail searches

Dates of survey	Ecologist	Key survey tasks completed during field campaign
22 February 2021 23 February 2021 1 March 2021 2 March 2021 9 March 2021	G. Tear (Ecologist) W. Thurston (Ecologist / BAM Accredited Assessor BAAS18019) D. Pisani (Ecologist) D. Raines (Ecologist) S. Stephenson (Field officer) A. Chapman (Ecologist)	Owl surveys, spotlighting, threatened amphibian surveys.
14 April 2021	Luke Baker (BAM Accredited Assessor) Yogesh Nair (BAM Accredited Assessor)	Vegetation mapping, threatened flora survey, habitat mapping.
29 April 2021 4 May 2021	Isabelle Lyons (Ecologist) Annabelle Grundy (Ecologist)	Vegetation mapping, threatened flora survey.
26 to the 28 April 2021	Dr Jai Green-Barber Annabelle Grundy	Cumberland Plain Land Snail Searches, SAT searches, spotlighting, stag watching, hollow-bearing tree mapping, bird survey, amphibian survey.

Table 4-4. Threatened Fauna Survey Methodology

Type	Key target species	Minimum survey requirements ¹	Survey completed
Amphibians – All amphibians	Green and Golden Bell Frog (<i>Litoria aurea</i>) And All threatened amphibians	Survey Period – November-March Survey method – Aural-visual surveys (minimum 4 days) / Acoustic recorder (minimum 14 days) / Tadpole search (minimum 2 days) (DPIE, 2020).	Nocturnal surveys including spotlighting and call playback – 22 to 23 February, 1, 2 and 9 March 2021 (7.30pm-10.30pm 9 hours) 27 to 28 April 2021 (6.30-8.30pm 4 hours)
Threatened birds – All birds	Gang-gang Cockatoo (<i>Callocephalon fimbriatum</i>)	Survey Period – October-January (if suitable habitat as defined in TBDC is present) (see Table 4-6) Survey method – Area searches/ transect surveys	Habitat assessment and diurnal area searches – 27 to 28 April (2.30-5.30pm 6 hours), 29 April and 4 May (8 hours).
	Eastern Osprey (<i>Pandion cristatus</i>)	Survey Period – April-November Area searches for individuals detected by sightings, calls and signs of occupancy (Commonwealth of Australia, 2004).	Diurnal survey for individuals, and large stick nests, 16 to 18 September 2020 (6 hours) 27 to 28 April (2.30-5.30pm 6 hours), 29 April and 4 May (8 hours).

Type	Key target species	Minimum survey requirements ¹	Survey completed
	White-bellied Sea-Eagle (<i>Haliaeetus leucogaster</i>)	Survey Period – July-December (DEC, 2004b). Survey method – Area searches for individuals detected by sightings, calls and signs of occupancy (Commonwealth of Australia, 2004).	Diurnal survey for individuals, and large stick nests, 16 to 18 September 2020 (6 hours) 27 to 28 April (2.30-5.30pm 6 hours), 29 April and 4 May (8 hours).
	Little Eagle (<i>Hieraaetus morphnoides</i>)	Survey Period – August-October (DEC, 2004b). Survey method – Area searches for individuals detected by sightings, calls and signs of occupancy (Commonwealth of Australia, 2004).	Diurnal survey for individuals, and large stick nests, 16 to 18 September 2020 (6 hours) 27 to 28 April (2.30-5.30pm 6 hours), 29 April and 4 May (8 hours).
	Square-tailed Kite (<i>Lophoictinia isura</i>)	Survey Period – September-January (DEC, 2004b). Survey method – Area searches for individuals detected by sightings, calls and signs of occupancy (Commonwealth of Australia, 2004).	Diurnal survey for individuals, and large stick nests, 16 to 18 September 2020 (6 hours) 27 to 28 April (2.30-5.30pm 6 hours), 29 April and 4 May (8 hours).
	Bush Stone-curlew (<i>Burhinus grallarius</i>)/ All threatened Owl	Survey Period – All year. Survey method – Diurnal survey including search, habitat walk-through to flush, listen/Nocturnal survey including listening (dusk), spotlighting and call playback (NSW NPWS 2006)	Diurnal surveys – 27 to 28 April 2021 (2.30-5.30pm 6 hours) Nocturnal surveys including spotlighting and call playback – 27 to 28 April 2021 (6.30-8.30pm 4 hours)
Mammals – all	Eastern Pygmy-possum (<i>Cercartetus nanus</i>)	Survey Period – October-March Survey method – trapping/nest-boxes/camera-traps	Habitat assessment – 27 to 28 April (2.30-5.30pm 6 hours), 29 April and 4 May (10am-3pm 10 hours). Nocturnal area searches – 23 and 26 February 2021, 1, 2 and 9 March 2021 (>20 hours) 27 to 28 April 2021 (6.30-8.30pm 4 hours).

Type	Key target species	Minimum survey requirements ¹	Survey completed
	Squirrel Glider (<i>Petaurus norfolcensis</i>)	Survey Period – All year. Survey method – Trapping (minimum 3 nights)/hair tubes (minimum 4 nights)call detection/call playback (minimum 2 nights)/ spotlighting (minimum 2 nights)/stag watching (minimum 30 minutes prior to sunset and 60 minutes following sunset) / next box and camera traps (minimum 14 nights) (Commonwealth of Australia, 2004; DEC 2004a).	Spotlighting, 27 to 29 April 2021 (6.30-8.30pm two nights/4 hours)
	Koala (<i>Phascolarctos cinereus</i>)	Survey Period – All year. Survey method – Hair tubes (minimum 4 nights)call detection/call playback (minimum 2 nights)/ spotlighting (minimum 2 nights)/scat search (minimum 30-minutes) (Commonwealth of Australia, 2004; DEC 2004a).	Spotlighting, 27 to 29 April 2021 (6.30-8.30pm two nights/4 hours) 2x 30 min searches on 2 separate nights, 27 to 29 April 2021 (7.30-8.00pm two nights/1 hour) Searches for scats around base of feed trees search, 27 to 28 April 2021 (8 hours).
Mammals - Microbats	Large-eared Pied Bat (<i>Chalinolobus dwyeri</i>)	Survey Period – November-January Survey method – harp trap/mist net (minimum 4 days)/acoustic detection (minimum 4 days)/ radiotracking/roost search (OEH, 2018).	Outside of recommended survey time however microbats were still recorded on detectors. The acoustic detection was also placed for a far greater number of nights than guidelines propose: – 26 April to 13 May 2021 (5pm-6am 18 nights/234 hours).
	Little Bent-winged Bat (<i>Miniopterus australis</i>)	Survey Period – December-February Survey method – harp trap (minimum 4 days) (OEH, 2018).	Outside of recommended survey time however microbats were still recorded on detectors. The acoustic detection was also placed for a far greater number of nights than guidelines propose:
	Large Bent-winged Bat (<i>Miniopterus orianae oceanensis</i>)	Survey Period – December-February Survey method –harp trap (minimum 4 days) (OEH, 2018).	– 26 April to 13 May 2021 (5pm-6am 18 nights/234 hours).
	Southern Myotis (<i>Myotis Macropus</i>)	Survey Period – October-March Survey method – harp trap/mist net (minimum 4 days)/acoustic detection (minimum 4 days)/ radiotracking/roost search (OEH, 2018).	Outside of recommended survey time however microbats were still recorded on detectors. The acoustic detection was also placed for a far greater number of nights than guidelines propose:

Type	Key target species	Minimum survey requirements ¹	Survey completed
Moluscs	Cumberland Plain Land Snail (<i>Meridolum corneovirens</i>)	Survey Period – All year. Survey method – Hand search under logs and other debris, amongst leaf and bark accumulations around bases of trees and under grass clumps.	Diurnal leaf litter search, 16 to 18 September 2020 (8 hours), and 27 to 28 April 2021 (8 hours).
	And Dural Land Snail (<i>Pommerhelix duralensis</i>)		

4.2.3 Weather conditions

The daily temperatures at the closest weather station at Horsley Park Equestrian Centre (BoM 2021) which is about 10 kilometres south east of Mamre Road, have been provided in Table 4-5.

The mean weather conditions during the survey period include the following:

- September 2020: An average day temperatures of 25 degrees, and at lowest temperature of about 11 degrees during night surveys
- February/March 2021: An average day temperatures of 28 degrees, and at lowest temperature of about 17 degrees during night surveys
- April/May 2021: An average day temperatures of 22 degrees, and at lowest temperature of about 11 degrees during night surveys.

Table 4-5: Weather prior to and during field work

Date	Temperature Minimum	Temperature Maximum	Wind maximum km/h	Rain
13 September 2020	7.2	24.9	31	0
14 September 2020	8.4	23.1	30	0.2
15 September 2020	11.7	24.0	24	0
16 September 2020	10.2	27.9	26	0
17 September 2020	12.3	30.9	54	0
18 September 2020	12.8	17.6	13	0
19 February 2021	18.5	28.2	31	15.8
20 February 2021	18.3	29.9	26	0
21 February 2021	18.8	29.1	30	0
22 February 2021	18.9	30.6	35	0
23 February 2021	18.3	20.3	28	0.2
26 February 2021	14.8	29.9	35	2.6

Date	Temperature Minimum	Temperature Maximum	Wind maximum km/h	Rain
27 February 2021	18.1	23.3	19	0.2
28 February 2021	18.2	29.8	30	0.2
1 March 2021	17.5	35	31	0
2 March 2021	16.6	22.7	19	0
6 March 2021	16.2	24.7	30	0
7 March 2021	13.4	27.4	26	0
8 March 2021	16.5	30.3	50	0
9 March 2021	16.6	31.8	41	5.2
24 April 2021	5.5	22.4	13	0
25 April 2021	5.6	22.1	26	0
26 April 2021	9.2	22.7	15	0
27 April 2021	10.6	22.9	24	0
28 April 2021	10.8	22.2	15	0
29 April 2021	9.1	23.7	19	0
4 May 2021	12.4	15.7	28	0
5 May 2021	13.1	19.1	26	11.4
6 May 2021	14.6	21.3	50	18
7 May 2021	17.3	21.7	30	14.4
8 May 2021	12.3	25.3	19	0.4
9 May 2021	14.0	20.3	15	0
10 May 2021	10.8	24.1	30	0
11 May 2021	12.0	22.5	35	0.4
12 May 2021	12.1	21.4	20	0.2
13 May 2021	11.6	23.3	19	0

4.2.4 Limitations

General survey

The survey was designed primarily to detect threatened biodiversity listed as 'species credit' fauna, or threatened biodiversity listed on the EPBC Act. The survey did not entail multiple monitoring seasons as such level of assessment is not required.

Acoustic bat surveys

Acoustic surveys were conducted between April and May 2021. The acoustic survey was just outside the recommended survey period for threatened microbat species (October to March; DPIE 2018), however, climatic conditions at the time of the assessment were still mild (daily average temperature of 22°C) (Table 4-5). Microbats were also detected on the anabat recording units regardless of the recommended months. The team also supplemented the survey with a far greater number of trap nights than that specified in the guidelines.

Bat call identification analysis

Multiple bat species may call simultaneously, and therefore calls were assigned to a species if >50% of pulses within a sequence were assigned to that species and only passes with a minimum of three pulses classified to the same species were identified. Since linear calls produced by some species (i.e., *Nyctophilus* spp.) cannot be assigned to species level due to characteristic frequency overlap, they were grouped and labelled '*Nyctophilus* species'.

Calls were only positively identified when the defining characteristics were present and there was no chance of confusion between species with overlapping and/or similar calls. In this survey, there were some call sequences that could not be positively identified to species level. Further, some species recorded in this survey can have call profiles that overlap with other species. When overlap occurs, species with similar call profiles are assigned to multi species groups of two or three potential species depending on the characteristics displayed in the recorded call sequences.

Calls with intermediate characteristics were assigned mixed species labels. The species recorded in this survey with overlapping call profiles are described below. Large Bent-winged Bat calls overlap in frequency with those of and *Vespadelus darlingtoni* (Large Forest Bat) in the Sydney Basin.

The calls of Large Bent-winged Bats can be separated from the Forest Bats by a down-sweeping tail which neither of the Forest Bats displays (generally being up-sweeping or absent). Large Bent-winged Bat calls are often variable in pulse shape and time between pulses whereas the Forest Bats commonly have regular pulses evenly spaced pulses.

4.2.5 Terrestrial fauna and fauna habitat

Fauna species recorded in the proposal area are listed in Annexure B. A total 48 species were recorded during field surveys, comprising one mollusc, two fish, three frogs, three reptiles, 17 birds, and 22 mammals.

Seven threatened fauna species were recorded during the field survey within the proposal area, including: Cumberland Plain Land Snail, Grey-headed Flying-fox, Southern Myotis, Large Bentwing-bat, Little Bentwing-bat, Greater Broad-nosed Bat and Yellow-bellied Sheathtail-bat.

Each of the threatened fauna above are discussed further in section 5.3.

Our assessment stratified the proposal area into different habitat types, which are shown on Figure 8 and are described below.

Woodland / Forest habitat

The habitats that occur within the proposal area consist of narrow areas of woody/forest habitat types comprising of the PCTs discussed in section 3.2. These areas are highly fragmented and disturbed, and are therefore considered unlikely to support a high diversity of non-urban tolerant fauna species.

The majority of canopy trees within the proposal area had a dbh of less than 20 centimetres, and multiple deteriorating tree protection sleeves were observed around the bases of trees suggesting that some of the area was previously cleared and has since regenerated. Midstorey vegetation across much of the proposal area was relatively patchy, and consists primarily of introduced species. A grassy ground layer is present and limited areas of leaf litter occurs around the larger trees.

The habitat resources occur close to the roads edge, in highly disturbed patches of vegetation with limited connectivity, and are subject to a high level of noise and light pollution. These factors likely limit these areas to only being suitable for highly urban tolerant species.



Photo 10. Patches of woodland immediately adjacent to Mamre Road

Hollow bearing trees and fallen timber

A hollow-bearing tree survey was carried out during the April-May 2021 field survey. The location of hollow-bearing trees and stags are provided in Annexure C and shown on Figure 7.

Ten hollow-bearing trees were recorded within the proposal area, which were predominantly *Eucalyptus moluccana*, with one *Eucalyptus eugenioides* and one *Eucalyptus tereticornis*. The size of the hollows ranged in size from less than 5 to 20 centimetres.

Trunks of hollow-bearing trees were inspected for glider feeding scars, and the base was inspected for the presence of owl pellets or prey, to which no evidence of usage was observed during the time of the survey.

Areas of hollow-bearing trees were also observed from vantage points during both diurnal and nocturnal surveys. The only fauna species observed leaving the hollows during the survey activity were Rainbow Lorikeets (*Trichoglossus haematodus*).

No hollow-bearing trees had suitable large enough for the subject threatened species based on information provided in the TBDC.

Limited areas of open woodland containing fallen timber occur, thus not presenting ideal habitat for the Bush Stone-curlew (*Burhinus grallarius*).

Culverts

Based on field observations, the concrete box girder bridge spanning South Creek and only one culvert appeared to have potential for roosting bats. The culvert was located adjacent to South Creek (near the intersection of Luddenham Road and Mamre Road) and was about one metre in diameter. All other culverts were assessed acoustically, however were considered marginal in dimensions (< 0.5 metres diameter). Despite this, thorough visual inspections of each culvert (i.e. searches for physical presence, guano, staining, ammonia-like odours, evidence of roost points, expansion joints, portholes, cracks and fissures) was not possible at the time of the assessment due to safety/access concerns, areas of water inundation in some areas of the culverts, debris and sharps, and risk of direct roost disturbance (if present). No suitable maternity caves/sites for Large Bentwing-bat or Little Bentwing-bat occur within or nearby the proposal area.



Photo 11. Potential microbat roosting habitat within culverts spanning a non-perennial stream north of the intersection of Mamre Road and Erskine Park Road

Riparian area

South Creek generally flows from south to north, meandering alongside the proposal area.

Two unnamed tributaries of South Creek, flowing north westerly and several other local drainage lines traverse the proposal area (Aurecon 2021).

The unnamed tributary 1 catchment and local drainage catchment is entirely urbanized with residential land use to the east of the proposal boundary. Most of the northern portion of the unnamed tributary 2 catchment is urbanized with a mix of residential and industrial land use, with the southern portion of the catchment currently consisting of agricultural land and remnant vegetation.



Photo 12. Forest/Woodland habitat immediately adjacent to riparian area

4.2.6 Threatened fauna results

The field survey entailed sufficient effort to determine the occurrence and potential for habitat within the proposal area, for the subject threatened fauna to occur (Annexure 1).

Seven threatened fauna species were recorded with the proposal area:

- **Cumberland Plain Land Snail** (listed as Endangered on BC Act): The Cumberland Plain Land Snail was recorded during leaf litter targeted searches during the September 2020 and February/March 2021 surveys. Two populations of the Cumberland Plain Land Snail were recorded on either side of Mamre Road as shown on Figure 8. Population 1 would likely extend into the neighbouring BioBank site, occupying an area of about 40 hectares, whilst Population 2 would be limited to the five hectare patch of vegetation between Erskine Park Road and Mamre Road.
- **Grey-headed Flying-fox** (listed as Vulnerable under both the BC Act and EPBC Act): The Grey-headed Flying Fox was observed flying over the proposal area during nocturnal surveys in April 2021. The field survey confirmed the absence of camp sites.
- **Southern Myotis** (listed as Vulnerable under the BC Act and is a Species Credit Species under the BAM): The species was acoustically recorded along South Creek near the bridge along Luddenham Road (Anabat location 871 (b); Figure 8).
- **Large Bentwing-bat** (listed as Vulnerable under the BC Act and as there is an absence of breeding habitat, the species is classed as Ecosystem Credit Species under the BAM): The species was acoustically recorded across five of the six Anabat locations (Figure 8).
- **Little Bentwing-bat** (listed as Vulnerable under the BC Act and as there is an absence of breeding habitat, the species is classed as Ecosystem Credit Species under the BAM): The species was acoustically recorded across two of the six Anabat locations (Figure 8).
- **Greater Broad-nosed Bat** (listed as Vulnerable under the BC Act and is an Ecosystem Credit Species under the BAM): The species was acoustically recorded across two of the six Anabat locations (Figure 8).
- **Yellow-bellied Sheathtail-bat** (listed as Vulnerable under the BC Act and is an Ecosystem Credit Species under the BAM): The species was acoustically recorded across four of the six Anabat locations (Figure 8).

As per the BAM, each of the subject threatened fauna as per the BAM-C must be addressed. The threatened fauna species predicted or potentially occurring within the IBRA subregion as generated by the BAM-C were reviewed and refined post field survey on the basis of the vegetation types, condition and habitat features, as well as the results of field survey.

In accordance with Section 6.4 of the BAM the threatened fauna list of potentially occurring species may be further refined where:

- habitat constraints listed for the species in the TBDC are absent from the proposal area (or particular vegetation zones), or
- habitat constraints or microhabitats on which the species depends are sufficiently degraded such that the species is unlikely to use the proposal area, or
- the species is vagrant in the IBRA subregion, or
- an expert report is prepared (in accordance with Subsection 6.5.2 of the BAM) stating that the species is unlikely to be present on the proposal area.

The list of predicted and candidate species generated via the BAM-C is presented in Table 4-6. A status for each species is provided which represents the basis for deciding whether a species was present or absent from the proposal area. No ecosystem credit species were omitted from the BAM-C.

Table 4-6: Results for threatened fauna requiring survey in the BAM-C

Scientific Name	Common name	Survey effort	Survey completed and justification if the threatened species needs to be considering further	Further consideration?
<i>Anthochaera phrygia</i>	Regent Honeyeater	September; October; November; December	The proposal area does not occur within the 'important Regent Honeyeater' map as per the BAM Important Areas Map. Therefore the 'species credit' component associated with Regent Honeyeater breeding habitat is not triggered. The Regent Honeyeater is therefore not considered further.	Not considered further.
<i>Burhinus grallarius</i>	Bush-stone Curlew	All year	A targeted survey was completed during recommended survey time using call playback, and spotlighting. The species was not detected during targeted survey, and thus as per the BAM, the species is not required to be considered further.	Not considered further.
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	October; November; December; January	As per the directions on the TBCD, hollow-bearing tree survey has been used to identify whether potential nest hollows are present (defined as hollows in forest and woodland eucalypts; (i) at least 9 m above the ground and, (ii) with hollow diameter of 10 cm or larger). Although a small number of hollows that are a suitable height and size are present, they are situated on the edge of a busy main road in an area considered to degraded to support this species. The Gang-gang Cockatoo therefore does not need a targeted survey and is therefore not considered further.	Not considered further.
<i>Cercartetus nanus</i>	Eastern Pygmy Possum	January; February; March; October; November; December	The proposal area does not occur within a location that fits the distribution of the species as described in the Scientific Determination for the species - 'In New South Wales the species is found in coastal areas and at higher elevation in the south, but north of Newcastle at higher elevation only'. This is supported by the closest record for the Eastern Pygmy Possum, occurring 12.6 km to the west of the proposal area in the Blue Mountains area. Despite the habitat not being ideal for the species, we undertook spotlighting survey but did not record the species. Although the timing was outside of the recommended survey time provided in the TBCD, the LMCC (2014a) guidelines state that at any time of the year a survey may 'still detect the species, though the months of September to June are optimal'. Given that our survey was conducted in April only 1 month outside the months recommended by the BAM-C, but within the optimal months stated by LMCC (2014a), and that the proposal area is not in an area that fits the distribution of the species as described in the Scientific Determination for the species, the species is considered to have a low likelihood of occurrence.	Not considered further.
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	January; November; December	The habitat descriptions provided in OEH (2018a) 'Species credit' threatened bats and their habitats NSW survey guide for the Biodiversity Assessment Method' note that the Large-eared Pied Bat breeding habitat occurs within 2 km of caves, scarps, cliffs, rock and disused quarries. The proposal area does not occur within 2 km of such features. The species was also not recorded during the Anabat analysis. The use of bat call detector is the recommended method for recording this species LMCC (2014a). Given the absence of records and the distance from breeding resources, the proposal area is unlikely to support habitat for the Large-eared Pied Bat.	Not considered further.
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	July to December	The White-bellied Sea-Eagle is a dual credit species, with breeding habitat triggering species credits. The TBCD states that 'Breeding habitat is live large old trees within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines AND the presence of a large stick nest within tree canopy; or an adult with nest material; or adults observed duetting within breeding period. Our surveys which were conducted within the recommended survey time did not record the presence of the White-bellied Sea-Eagle, nor did it record any large stick nests.	Not considered further.

Scientific Name	Common name	Survey effort	Survey completed and justification if the threatened species needs to be considering further	Further consideration?
<i>Hieraaetus morphnoides</i>	Little Eagle	April, September, October	<p>The Little Eagle is a dual credit species, with breeding habitat triggering species credits.</p> <p>Little Eagle Breeding habitat is defined in the TBCD as 'live (occasionally dead) large old trees within suitable vegetation AND the presence of a male and female; or female with nesting material; or an individual on a large stick nest in the top half of the tree canopy'.</p> <p>Our surveys which were completed during recommended survey time did not record the presence of the Little Eagle, nor did it record any large stick nests.</p> <p>Therefore, it is concluded that the proposal area does not contain breeding habitat for the Little Eagle.</p>	Not considered further.
<i>Lathamus discolor</i>	Swift Parrot	May, June, July, August,	<p>The species is a dual credit species, with the species credit component mapped as an important area. These mapped areas do not require survey as it is presumed that the species is present. The proposal area does not occur within an important area.</p>	Not considered further.
<i>Litoria aurea</i>	Green and Golden Bell Frog	January, February, march, November, December	<p>The specific habitat requirements for the species as detailed in BioNet, habitat for the Green and Golden Bell Frog includes:</p> <ul style="list-style-type: none"> - 'marshes, dams and stream-sides, particularly those containing bullrushes (<i>Typha</i> spp.) or spikerushes (<i>Eleocharis</i> spp.). - water-bodies that are unshaded, free of predatory fish such as Plague Minnow.' <p>The site provides some suitable habitat for Green and Gold Bell Frogs due to the presence of waterbodies with macrophyte vegetation (i.e. <i>Typha</i> sp.), however the predatory fish Eastern Gambusia (<i>Gambusia holbrooki</i>) are present within the watercourses. As such, it is unlikely that the species is present at the site. Surveys were completed regardless during recommended survey times and included both spotlighting and call playback, which failed to detect the species.</p>	Not considered further.
<i>Lophoictinia isura</i>	Square-tailed Kite	January, September, October, November, December	<p>Breeding habitat is living large old trees within suitable vegetation AND the presence of a male and female; or female with nesting material; or an individual on a large stick nest in the top half of the tree canopy.</p> <p>Our surveys which were conducted within the recommended survey time did not record the presence of the Square-tailed Kite, nor did it record any large stick nests.</p>	Not considered further.
<i>Meridolum corneovirens</i>	Cumberland Plain Land Snail	All year	<p>Surveys completed during recommended survey times detected potentially, two populations of Cumberland plain land snail, one on the east and one other west Mamre Road (Figure 7). Additional surveys completed in April 2021 detected no additional populations.</p>	Considered further.

Scientific Name	Common name	Survey effort	Survey completed and justification if the threatened species needs to be considering further	Further consideration?
<i>Miniopterus australis</i>	Little Bentwing- Bat	January, February December	<p>Acoustic surveys were conducted between April and May 2021. The acoustic survey was just outside the recommended survey period for this species (December to February; DPIE 2018), however, climatic conditions at the time of the assessment were still mild (Table 4-5), and the detectors were left for a longer period to satisfy survey requirements (18 trap nights per Dectector). Despite, being outside of the recommended survey period we acoustically recorded this species in five of the six deployment locations.</p> <p>The highest number of passes recorded for this species was at location 875(b) (209 passes in total).</p> <p>In accordance with the BAM, this species is identified as a Dual Credit Species and is only considered to be a Species Credit Species for breeding habitat only. Breeding habitat (as defined in the BAM) needs to identified or assumed within the study area.</p> <p>Breeding habitat as identified by the BAM, states:</p> <p><i>“Caves, tunnels, mines or other structures known or suspected to be used by M. australis including species records in the NSW BioNet Atlas with microhabitat code ‘IC – in cave’; observation type code ‘E nest-roost’; with numbers of individuals >500; or from the scientific literature...all areas of potential breeding habitat on the subject land where breeding individuals of a threatened bat species are determined to be present.”</i></p> <p>The species has similar breeding/roosting ecology to Large Bentwing-bat and are often found co-roosting (Dwyer 1968). In NSW the largest maternity colony is in close association with a large maternity colony of Large Bentwing-bat and appears to depend on the large colony to provide the high temperatures needed to rear its young. None are known in the greater Sydney region.</p> <p>A 10-kilometre BioNet search of Little Bentwing-bat records identified multiple acoustic records within the broader surrounds. No records were no records with the microhabitat code ‘IC – in cave’; observation type code ‘E nest-roost’; with numbers of individuals >500.</p> <p>Based on multiple lines of evidence, the study area and broader surrounds are likely to support roosting (in the form of over wintering/hibernacula and day roosts) and foraging habitat only. Therefore, this species is classed as an Ecosystem Credit Species.</p>	Not considered further (Ecosystem Credit Species)

Scientific Name	Common name	Survey effort	Survey completed and justification if the threatened species needs to be considering further	Further consideration?
<i>Miniopterus orianae oceanensis</i>	Large Bentwing Bat	January, February, December	<p>Acoustic surveys were conducted between April and May 2021. The acoustic survey was just outside the recommended survey period for this species (December to February; DPIE 2018), however, climatic conditions at the time of the assessment were still mild (Table 4-5), and the detectors were left for a longer period to satisfy survey requirements (18 trap nights per Dectector). Despite, being outside of the recommended survey period we acoustically recorded this species in five of the six deployment locations.</p> <p>The highest number of passes recorded for this species was at location 875(b) (209 passes in total).</p> <p>In accordance with the BAM, to be classed as a Species Credit Species breeding habitat needs to identified or assumed within the study area.</p> <p>Breeding habitat as identified by the BAM, states:</p> <p><i>“Caves, tunnels, mines or other structures known or suspected to be used by M. schreibersii oceanensis including species records in the NSW BioNet Atlas with microhabitat code ‘IC – in cave’; observation type code ‘E nest-roost’; with numbers of individuals >500; or from the scientific literature...all areas of potential breeding habitat on the subject land where breeding individuals of a threatened bat species are determined to be present.”</i></p> <p>Large Bentwing-bat has complex roosting ecology and tends to utilise different roost types at different times of the year. During winter, Females and males congregate in smaller colonies, which may occur in human made structures such as old mines, stormwater channels and disused buildings. These roosts are usually cool, which enables individuals to enter hibernation (can be up to 12 days at a time between feeds) to conserve energy when food sources are low. Mating takes place in late autumn or early winter (Dwyer 1995). Females are fertilised late autumn/early winter, but copulation doesn’t take place until shortly before the females emerge from hibernation in August. Females occupy the over-wintering roosts (like culverts) until they migrate in September when they move to maternity roosts (Dwyer 1963). During these migrations, females have been recorded moving at least 70 kilometres overnight between roosts. A distance of several hundred kilometres may be travelled between over-wintering sites and maternity roosts. In some cases, acclimatisation roosts may be used prior to the females moving to their maternity roosts. These roosts are believed to assist bats to adjust to the high humidity that is experienced in the maternity roost for creching young (Hoye and Spence 2004). Furthermore, only three major maternity roosts are known in New South Wales, Willi Willi caves near Kempsey, Drum Cave at Bungonia near Goulburn, and Church Cave at Wee Jasper (Hamilton Smith and Dwyer 1965). All three roosts occur in limestone karst systems and are located in domed caverns where the great number of bats elevate both temperature and humidity and in turn speed development of the young (Dwyer 1971). It is likely that unknown maternity roosts exist within the vicinity of Sydney (Wilson 2000).</p> <p>A 10-kilometre BioNet search of Large Bentwing-bat records identified multiple acoustic records within the broader surrounds, and harp trapping records, however, no greater than 2 individuals were physically observed/trapped. There were no records with the microhabitat code ‘IC – in cave’; observation type code ‘E nest-roost’; with numbers of individuals >500.</p> <p>The species is known to persist in the Greater Sydney region, as it has been documented adapting to the urban environment (Hoye and Spence 2004), it is an open space forager and will utilise artificial light as an attractant for prey and has been documented as roosting in artificial structures since 1892.</p> <p>Based on multiple lines of evidence, the study area and broader surrounds are likely to support roosting (in the form of over wintering/hibernacula and day roosts) and foraging habitat only. Therefore, this species is classed as an Ecosystem Credit Species.</p>	Not considered further (Ecosystem Credit Species)

Scientific Name	Common name	Survey effort	Survey completed and justification if the threatened species needs to be considering further	Further consideration?
<i>Myotis macropus</i>	Southern Myotis	January, February, October, November, December	<p>Acoustic surveys were conducted between April and May 2021. The acoustic survey was on the shoulder months of the recommended survey period (October to March; DPIE 2018), however, climatic conditions at the time of the assessment were still mild (Table 4-5), and the detectors were left for a longer period to satisfy survey requirements (18 trap nights per Dectector). Despite, being outside of the recommended survey period we acoustically recorded this species in one of the detector locations (871(b)).</p> <p>Southern Myotis has a high affinity with suitable waterbodies (home range is unlikely to extend beyond 200 metres of a waterbody forages along creek lines/riparian corridors and roosting in tree hollows, culverts, bridges and other man-made structures (Campbell 2009).</p> <p>In accordance with the BAM, this species is classified as Species Credit Species for breeding and foraging habitat within the study area. Therefore, this species habitat will require further consideration in accordance with the BAM.</p>	Further consideration required. Species is a Species Credit Species
<i>Ninox connivens</i>	Barking Owl	March to December	<p>The species is regarded as a dual credit species with breeding habitat triggering species credits. Breeding can be identified by "suitable habitat AND 1. presence of male and female or 2. calling to each other (duetting) or 3. find nest or 4. existing breeding habitat identified".</p> <p>The BAM-C lists the following habitat constraints in reference to potential habitat for the Barking Owl.</p> <ul style="list-style-type: none"> - Hollow bearing trees. - Living or dead trees with hollows greater than 20 cm diameter and greater than 4m above the ground. <p>The proposal area does not contain any suitable hollows that constitute potential breeding habitat. We completed the spotlighting surveys at the end of April 2021 which is only one week before the start of the recommended survey times. Our field survey did not record the Barking Owl on the proposal area, nor any nests during the hollow-bearing tree surveys. Thus, breeding habitat is considered unlikely to occur within the proposal area.</p>	Not considered further.
<i>Ninox strenua</i>	Powerful Owl	May, June, July, August	<p>The species is regarded as a dual credit species with breeding habitat triggering species credits. Breeding can be identified by "suitable habitat AND 1. presence of male and female or 2. calling to each other (duetting) or 3. find nest or 4. existing breeding habitat identified".</p> <p>The BAM-C lists the following habitat constraints in reference to potential habitat for the Powerful Owl.</p> <ul style="list-style-type: none"> - Hollow bearing trees. - Living or dead trees with hollows greater than 20 cm diameter and greater than 4m above the ground. <p>The proposal area does not contain any suitable hollows that constitute potential breeding habitat. We completed the spotlighting surveys at the end of April 2021 which is only one week before the start of the recommended survey times. Our field survey did not record the Powerful Owl on the proposal area, nor any nests during the hollow-bearing tree surveys. Thus, breeding habitat is considered unlikely to occur within the proposal area.</p>	Not considered further.
<i>Pandion cristatus</i>	Eastern Osprey	April to November	<p>Survey completed during recommended survey time.</p> <p>Our surveys which were conducted within the recommended survey time did not record the presence of the Eastern Osprey, nor did it record any large stick nests.</p>	Not considered further.

Scientific Name	Common name	Survey effort	Survey completed and justification if the threatened species needs to be considering further	Further consideration?
<i>Petaurus norfolcensis</i>	Squirrel Glider	All year	Survey completed during recommended survey time and was not detected, nor has the species been recorded within the South Creek corridor during surveys for the Growth Centres, including the Airport which occurs greater habitat to that of the proposal area. The proposal area is a highly disturbed roadside areas subject to noise and light pollution.	Not considered further.
<i>Phascolarctos cinereus</i>	Koala	All year	Survey completed during recommended survey time and was not detected. Given the small number of records which occur in the locality, the presence of predominately younger trees, and the lack of connectivity to nearby bushland, it is unlikely that this species occurs within the proposal area.	Not considered further.
<i>Pommerhelix duralensis</i>	Dural Land Snail	All year	Surveys were completed during recommended survey time. No Dural Land Snails were detected. Given that Cumberland Plain Land Snails were detected during these surveys which are of a similar size and utilise similar habitat, it is considered likely that this species would have been detected during these same surveys if present. Additionally, this species more commonly occurs further north and is rare in the Penrith LGA.	Not considered further.
<i>Pteropus poliocephalus</i>	Grey-headed Flying Fox	October, November, December	Survey was not completed during the recommended survey time, however as the species was detected in April no additional surveys are required to confirm presence. It should be noted that this species was observed flying over the proposal area and foraging in trees within the proposal area, but is not believed to roost or breed within the proposal area. The nearest breeding camp is located about 3.3km north-east of the proposal area, and was reported to contain between 500-2,499 individuals when it was last surveyed in February 2020 (Commonwealth of Australia, 2020).	Not considered.
<i>Tyto novaehollandiae</i>	Masked Owl	June, July, August, September	<p>The species is regarded as a dual credit species with breeding habitat triggering species credits. Breeding can be identified by "suitable habitat AND 1. presence of male and female or 2. calling to each other (duetting) or 3. find nest or 4. existing breeding habitat identified".</p> <p>The BAM-C lists the following habitat constraints in reference to potential habitat for the Masked Owl.</p> <ul style="list-style-type: none"> - Hollow bearing trees. - Living or dead trees with hollows greater than 20 cm diameter and greater than 4m above the ground. <p>The proposal area does not contain any suitable hollows that constitute potential breeding habitat. We completed the spotlighting surveys at the end of April 2021 which is only one week before the start of the recommended survey times. Our field survey did not record the Masked Owl on the proposal area, nor any nests during the hollow-bearing tree surveys. Thus, breeding habitat is considered unlikely to occur within the proposal area.</p>	Not considered further.
Predicated threatened fauna				
<i>Anthochaera phrygia</i>	Regent Honeyeater	No requirement to survey for these species, as the BAM-C assumes presence.		
<i>Artamus cyanopterus cyanopterus</i>	Dusky Woodswallow			
<i>Botaurus poiciloptilus</i>	Australasian Bittern			
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo			
<i>Chthonicola sagittata</i>	Speckled Warbler			

Scientific Name	Common name	Survey effort	Survey completed and justification if the threatened species needs to be considering further	Further consideration?
<i>Circus assimilis</i>	Spotted Harrier			
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subspecies)			
<i>Daphoenositta chrysoptera</i>	Varied Sittella			
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll			
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle			
<i>Glossopsitta pusilla</i>	Little Lorikeet			
<i>Grantiella picta</i>	Painted Honeyeater			
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle			
<i>Hieraaetus morphnoides</i>	Little Eagle			
<i>Ixobrychus flavicollis</i>	Black Bittern			
<i>Lathamus discolor</i>	Swift Parrot			
<i>Lophoictinia isura</i>	Square-tailed Kite			
<i>Melanodryas cucullata cucullata</i>	Hooded Robin (south-eastern form)			
<i>Melithreptus gularis gularis</i>	Black-chinned Honeyeater (eastern subspecies)			
<i>Micronomus norfolkensis</i>	Eastern Coastal Free-tailed Bat			
<i>Miniopterus australis</i>	Little Bent-winged Bat			
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat			
<i>Neophema pulchella</i>	Turquoise Parrot			
<i>Ninox connivens</i>	Barking Owl			
<i>Ninox strenua</i>	Powerful Owl			
<i>Pandion cristatus</i>	Eastern Osprey			

Scientific Name	Common name	Survey effort	Survey completed and justification if the threatened species needs to be considering further	Further consideration?
<i>Petaurus australis</i>	Yellow-bellied Glider			
<i>Petroica boodang</i>	Scarlet Robin			
<i>Petroica phoenicea</i>	Flame Robin			
<i>Phascolarctos cinereus</i>	Koala			
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox			
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat			
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat			
<i>Stagonopleura guttata</i>	Diamond Firetail			
<i>Tyto novaehollandiae</i>	Masked Owl			

4.2.7 Threatened fauna for further consideration

As discussed in Table 4-2, our survey and analysis confirm that two threatened fauna requiring species credits were recorded within the proposal area: Southern Myotis and the Cumberland Plain Land Snail, and as such both species require further consideration. The area of potential habitat that occurs within the proposal area (referred to as the species polygon) has been provided in Table 4-7 (shown in Figure 9 and Figure 10), and the associated impacts to the area of habitat has been discussed in section 7.3.

Table 4-7. Potential habitat for Cumberland Plain Land Snail and Southern Myotis

Species	Potential habitat	Area of potential habitat (ha)
Cumberland Plain Land Snail	<p>Two populations of the Cumberland Plain Land Snail were recorded during the targeted survey as shown on Figure 7. The potential habitat includes the vegetation to the far south of the proposal area as shown on Figure 10, given this area contains a known population of the species.</p> <p>The potential habitat comprises of about:</p> <ul style="list-style-type: none"> - 0.19 hectares of PCT 835 low - 1.13 hectares of PCT 835 medium - 0.41 hectares of PCT 849 low - 1.59 hectares of PCT 849 medium - 0.13 hectares of PCT 1800 medium. 	3.46
Southern Myotis	<p>The Southern Myotis was recorded at the location shown on Figure 8.</p> <p>In order to determine the area of potential habitat for the species, the TBDC states that <i>'all habitat on the subject land where the subject land is within 200m of a waterbody with pools/ stretches 3m or wider including rivers, creeks, billabongs, lagoons, dams and other waterbodies on the subject land must be mapped. Use aerial imagery to map waterbodies with pools/ stretches 3m or wider on or within 200m of the subject land. Species polygon boundaries should align with PCTs on the subject land to which the species is associated that are within 200m of waterbodies mapped.'</i></p> <p>This assessment has therefore mapped all habitat within 200 metres of a waterbody as shown on Figure 9. We have determined suitable habitat to include the following vegetation types within the proposal area:</p> <ul style="list-style-type: none"> -1.25 hectares of PCT 835 low -2.61 hectares of PCT 835 medium -0.08 hectares of PCT 849 low -1.53 hectares of PCT 849 medium - 0.47 hectares of PCT 1800 medium. 	5.94

4.3 Aquatic ecology

4.3.1 Aquatic survey

Aquatic habitat assessments were completed in September 2020 at the waterways that intersected the proposal area. These waterways were streams that drained towards South Creek and Blaxland Creek to the west of Mamre Road. These streams flowed through the vegetation communities at the northern, south-western and south-eastern sections of the proposal and were assessed for habitat features and quality during the vegetation surveys.

The survey entailed collection of water depth, basic flow and substrate of banks and bed of the watercourse. General condition of the riparian area was also noted.

The purpose of the survey was to assist in determining the likelihood for fish movement throughout the watercourse, and to determine the presence/absence for threatened fish Macquarie Perch and Australian Grayling.

4.3.2 Aquatic results

South Creek generally flows from south to north, alongside the proposal area.

Two unnamed tributaries of South Creek, flowing north westerly traverse the proposal boundary (Figure 2). Several other local drainage lines also traverse the proposal area.

The depth of each waterway recorded were less than 50 centimetres at the time of survey, with bed substrates of sands and gravels. Aquatic flora species recorded at these streams included *Alisma plantago aquatica* (Common Water-Plantain), *Centella asiatica* (Indian Pennywort), and *Myriophyllum aquaticum* (Parrot's Feather).

The field survey confirmed the presence of heavy rubbish and debris within the watercourse, which created barriers and small pools.

During the field survey, a Shortfin Eel and Mosquito Fish were recorded in one of the larger pools at South Creek, adjacent to the proposal area.

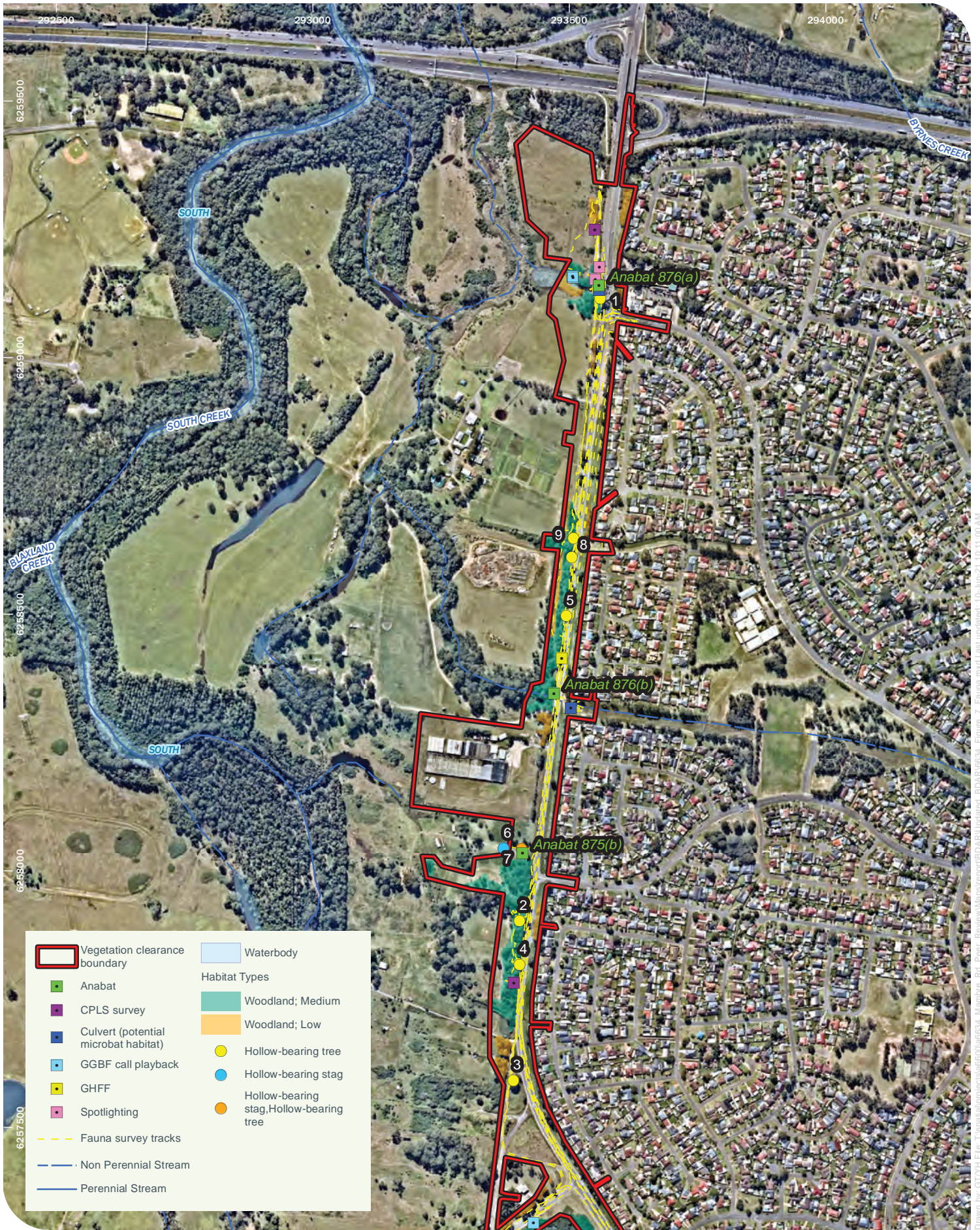
South Creek has been mapped as Key Fish Habitat, and it is categorised as Type-1 Highly Sensitive Key Fish habitat as it meets the following criteria (DPI 2013):

'Freshwater habitats that contain in-stream gravel beds, rocks greater than 500 mm in two dimensions, snags greater than 300 mm in diameter or 3 metres in length, or native aquatic plants'.

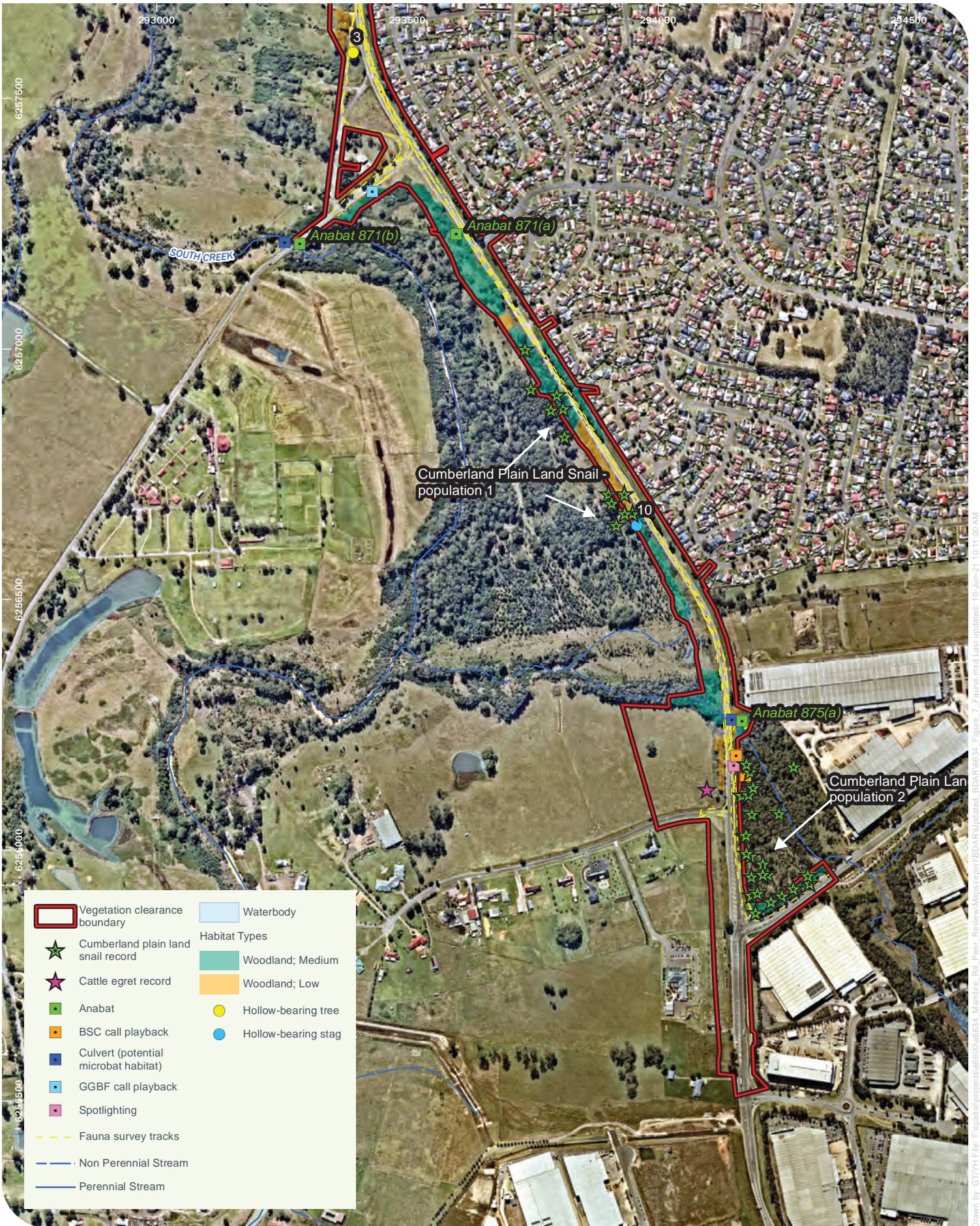
The Waterway classification of South Creek is regarded as a Class 1 Major Key Fish Habitat as it is a permanent flowing waterway and considered for fish movement (DPI 2013).

South Creek therefore has the potential to be habitat for a freshwater fish community. However, the creek contains barriers from existing culverts, rubbish dumping and sediment build up in areas, which would limit fish movements in times of low flow.

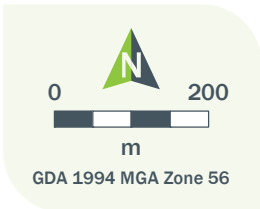
Both Macquarie Perch and the Australian Grayling have not been recorded within South Creek. It is highly unlikely both species would occur within South Creek in the proposal area given the degraded condition of the waterway and lack of historical records.



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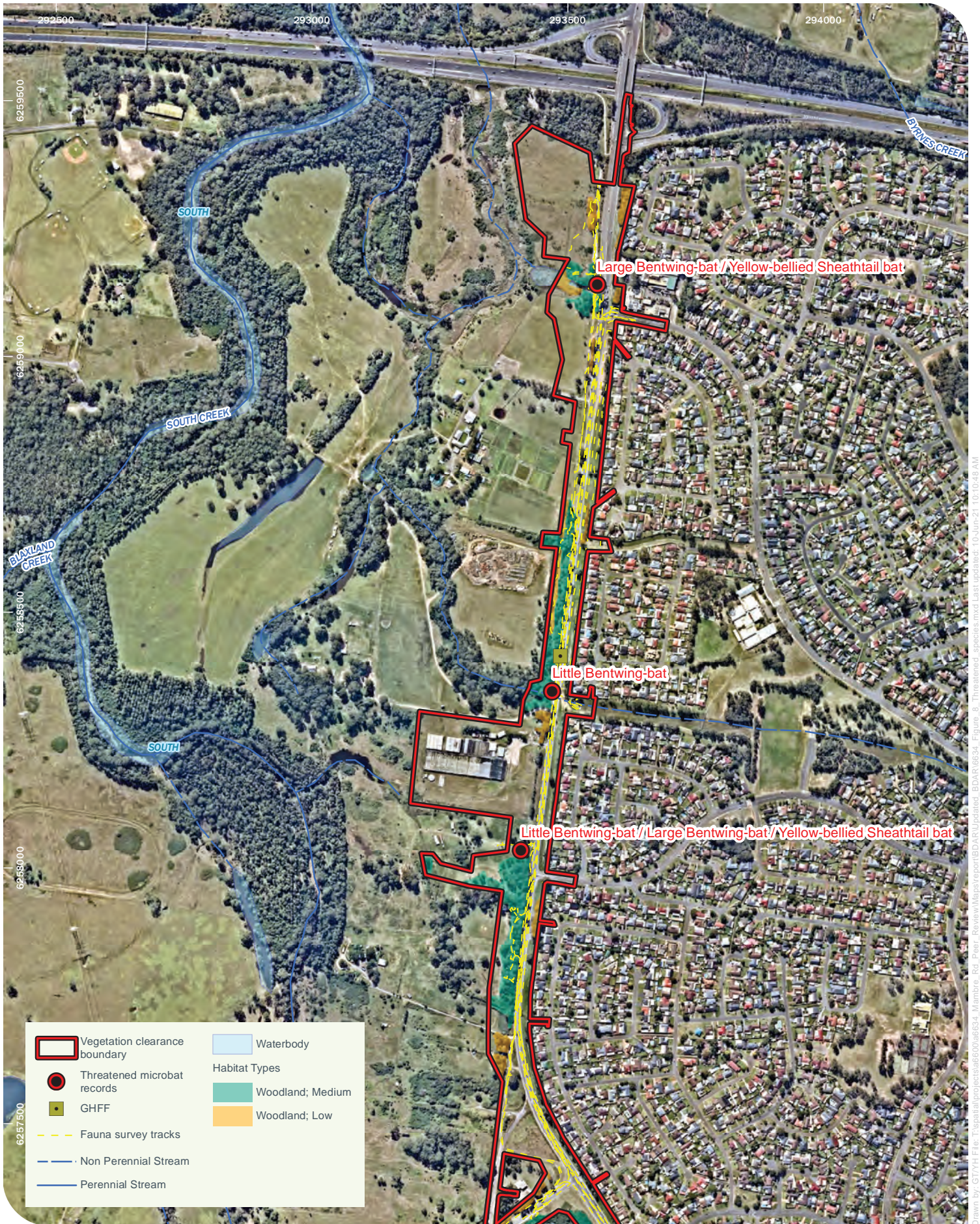
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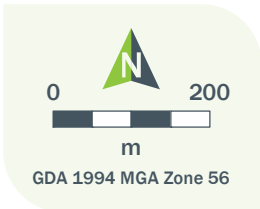
Threatened fauna survey effort
 Mamre Road Upgrade – Stage 1
 Biodiversity Development Assessment Report (BDAR)

Niche PM: Luke Baker
 Niche Proj. #: 6634
 Client: Transport for NSW / Aurecon

Figure 7.3



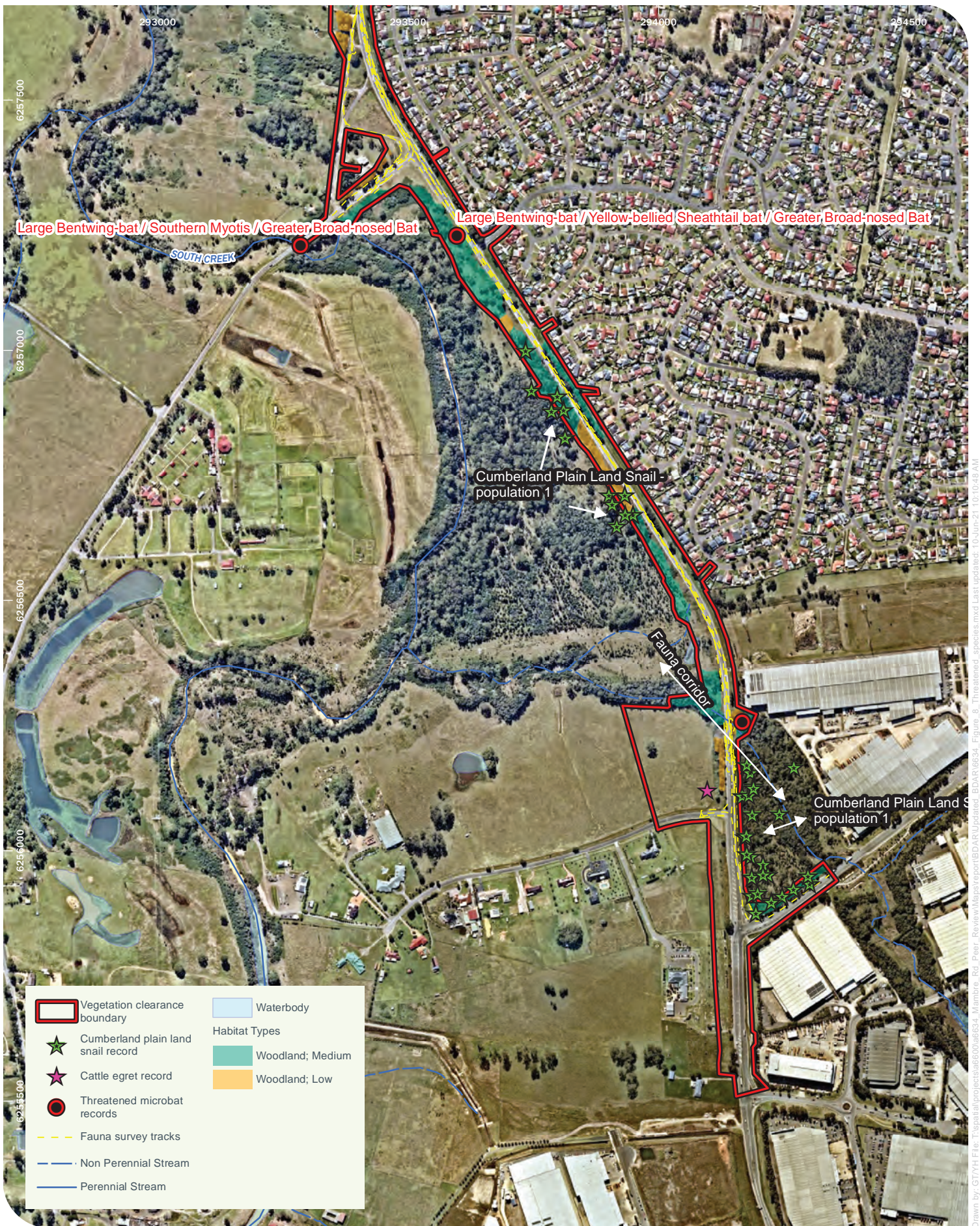
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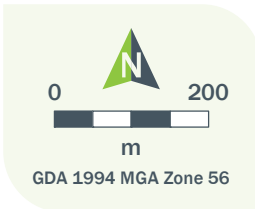
Threatened species survey results
Mamre Road Upgrade – Stage 1
Biodiversity Development Assessment Report (BDAR)

Niche PM: Luke Baker
 Niche Proj. #: 6634
 Client: Transport for NSW / Aurecon

Figure 8.1



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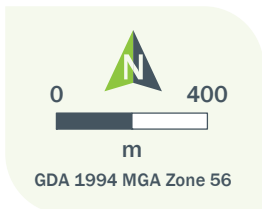
Threatened species survey results
Mamre Road Upgrade – Stage 1
Biodiversity Development Assessment Report (BDAR)

Niche PM: Luke Baker
 Niche Proj. #: 6634
 Client: Transport for NSW / Aurecon

Figure 8.3



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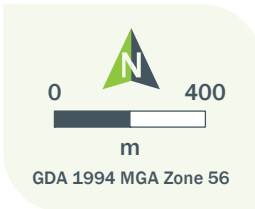
Southern Myotis species polygon
Mamre Road Upgrade – Stage 1
Biodiversity Development Assessment Report (BDAR)

Niche PM: Luke Baker
 Niche Proj. #: 6634
 Client: Transport for NSW / Aurecon

Figure 9



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Niche PM: Luke Baker
Niche Proj. #: 6634
Client: Transport for NSW / Aurecon

Cumberland Plain Land Snail - species polygon
Mamre Road Upgrade - Stage 1
Biodiversity Development Assessment Report (BDAR)

Figure 10

5 Matters of National Environmental Significance

5.1 EPBC Act listed Threatened Ecological Communities

The Protected Matters Search Tool (PMST) listed seven TECs that may occur in or nearby the proposal area (Annexure D). As discussed in section 3.4, the proposal area contains two PCTs that meet the description of TECs under the EPBC Act:

- PCT 849 Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion meets the definition of the CEEC Cumberland Plain Woodland in the Sydney Basin Bioregion. About 3.68 hectares of the Commonwealth TEC occurs within the proposal area.
- PCT 835 Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion meets the definition of the CEEC River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions. About 2.97 hectares of the Commonwealth TEC occurs within the proposal area.

The impacts to both Commonwealth listed TECs are discussed in section 5, and a Commonwealth Assessment of Significance has been provided in Annexure E for both TECs.

5.2 EPBC Act listed threatened flora

The PMST listed 22 threatened species that may have habitat within the proposal area and locality. As discussed in section 4.1.3, the field survey did not record any threatened flora within the proposal area. The field survey and analysis of the habitat requirements associated with each threatened flora determined a low likelihood for threatened flora to occur within the proposal area. As such, no further consideration of threatened flora under the Commonwealth EPBC Act is required.

5.3 EPBC Act listed threatened fauna

The PMST listed 45 threatened fauna species and 15 migratory species that may have habitat within the proposal area and locality.

The field survey confirmed the presence of one Commonwealth listed threatened fauna: Grey-headed Flying Fox (Vulnerable), and the Cattle Egret which is listed as a 'Marine' species. The proposal area was also considered to have some moderate likelihood of habitat for the Yellow Wagtail (Migratory) given the species can occupy relatively open/cleared environments. The proposal area would provide foraging potential for the species, and is unlikely to be breeding habitat.

No other threatened fauna listed on the EPBC Act are likely to occur within the proposal area as detailed in Annexure A.

The impacts to Commonwealth listed fauna species are described in section 5, and a Commonwealth Assessment of Significance for the species has been provided in Annexure E.

6 Avoid and minimise impacts

This section details how the proposal would in the first instance avoid impacts to biodiversity, then use mitigation measures where avoidance is not possible.

6.1 Avoidance and minimisation

In accordance with the BAM, proponents must demonstrate the measures employed to avoid, mitigate and offset impacts of a proposal on biodiversity values. This section of the report outlines the details from the REF associated with avoidance and planning that TfNSW has incorporated into the proposal design or would employ during construction or operation of the proposal to reduce impacts on biodiversity values. Mitigation measures have also been detailed in section 8 to further reduce impacts.

6.1.1 Avoid or minimise biodiversity impacts when locating the proposal

As detailed in the REF, the NSW Government has identified the need to progressively upgrade arterial roads in Western Sydney to deliver a more efficient, reliable network. This has been driven by the need for sufficient road infrastructure to support predicted future economic and residential growth in the area. As part of this, an upgrade of Mamre Road was identified to be required.

Four strategic options were identified for the proposal: a 'do nothing' option, widening along the western side, widening along the eastern side and a new alignment option.

With the exception of the 'do nothing' option, all proposed strategic options that were considered would have impacts to threatened biodiversity, given Mamre Road is surrounded by several areas of native vegetation that comprise threatened and endangered ecological communities (refer to Section 3.4). Some of this vegetation has been specifically identified for conservation, including vegetation within the biobank site south of Luddenham Road, areas zoned for environmental conservation on the Penrith Local Environmental Plan 2010 and a potential future biobank site proposed near Mamre House.

Widening Mamre Road along the western side was determined as the preferred option due to:

- the reduced amount of private property that would require acquisition compared to widening to the east or a new alignment
- the established development on the eastern side of Mamre Road, which would result in more amenity impacts (e.g. noise and visual impacts) and constrain the design
- the ability for a widening to the west to provide improved access to future parkland
- the potential for a new alignment option to result in greater environmental impacts than the road widening options, as widening would follow an existing area of disturbance
- the inability for the 'do nothing' option to provide sufficient capacity to support future economic growth or development in the surrounding area
- the inability of the 'do nothing' option and 'new alignment' option to improve the road safety or experience or access along the existing Mamre Road corridor.

Overall, the preferred option would likely result in less impacts to biodiversity than a completely new road alignment. However, it would result in a larger unavoidable biodiversity impact compared to the 'do nothing' option or widening along the eastern side of Mamre Road.

6.1.2 Design the proposal to avoiding or minimising impacts to biodiversity

Following identification of the preferred option, the design of the proposal and indicative construction methodology were developed. The design refinement process sought to avoid or minimise biodiversity impacts as much as practical by focusing on:

- reducing vegetation clearing by locating temporary infrastructure and compound sites in cleared areas, where possible
- limiting vegetation clearing only to areas that are considered necessary for construction and operational purposes
- reducing biodiversity impacts to the Luddenham Road BioBank site by refining the design of the road and associated drainage and water quality infrastructure
- minimising impacts within riparian areas as far as practical, while balancing the need to implement measures to manage water quality runoff and drainage from the road.

During concept design development for the preferred option, design refinements considered those listed in section 7.1.2 of the BAM (addressed in Table 6-1 below) to minimise biodiversity impacts.

A key refinement was associated with identification of a 'vegetation clearance boundary' within the larger proposal area, beyond which no vegetation clearance would be permitted. The area between the vegetation clearance boundary and the proposal area is considered a 'no-go' zone for construction activities.

The process of developing the vegetation clearance boundary involved optioneering to refine the footprint of permanent aspects of the design with an aim to reduce biodiversity impacts. This particularly focused on refinement and optioneering of the tail-out channel work and proposed locations of water quality basins and swales to minimise removal of vegetation, where possible. This was because these were the aspects of the design that most influenced the vegetation clearing requirements beyond the proposed widened road footprint.

For example, the design reduced impacts to the Luddenham BioBank site by moving the original location of a proposed water quality basin from the vegetated area south of Luddenham Road, to a cleared area north of Luddenham Road near Erskine Park Rural Fire Service, away from the BioBank site. The remaining swales along the road verge south of Luddenham Road have been designed to minimise vegetation clearing as far as practical along the edge of the BioBank site. These swales were not removed from the design completely, as they were considered important to capture road runoff prior to discharge into South Creek. The refined design resulted in a minor impact (about 0.14 ha) to the far northern edge of the BioBank site.

Table 6-1. Designing proposal – avoiding and minimising direct and indirect impacts on native vegetation, threatened species, threatened ecological communities and their habitats

Avoidance	Proposal
<p>Reducing the proposal's clearing footprint by minimising the number and type of ancillary facilities</p>	<p>Vegetation clearing for the proposal is unavoidable, given the location of the native vegetation immediately adjacent to Mamre Road.</p> <p>The direct impacts have been reduced as far as practical through refinement and optioneering of the tail-out channel work and proposed locations of water quality basins and swales.</p> <p>Temporary compound sites for construction of the proposal have been located within cleared areas to avoid additional vegetation and habitat disturbance.</p> <p>All areas outside of the vegetation clearance boundary are considered 'no go' zones for construction activities, and would be suitability demarcated prior to construction works commencing, and communicated to all staff and contractors.</p>
<p>Locating ancillary facilities in areas that have no biodiversity values</p>	<p>The proposal area consists predominately of cleared land, which accounts for about 79 per cent of the proposal area.</p> <p>Temporary compound sites have been located within previously cleared areas within the proposal area to reduce impacts to biodiversity values.</p>
<p>Locating ancillary facilities in areas where the native vegetation or threatened species habitat is in the poorest condition (i.e. areas with the lowest vegetation integrity scores)</p>	<p>As above, temporary compound sites have been proposed within cleared areas to avoid impacts to biodiversity.</p>

Avoidance	Proposal
<p>Locating ancillary facilities in areas that avoid habitat for species and vegetation that has a high threat status (e.g. an endangered ecological community (EEC) or critically endangered ecological community (CEEC) or is an entity at risk of a serious and irreversible impact (SAIL))</p>	<p>The proposal would result in an unavoidable impact to TECs. In particular, the proposal would have an impact to about 4.61 ha of Cumberland Plain Woodland which is regarded as a SAIL Candidate entity (Section 7.4).</p> <p>All impacts to TECs have been reduced as far as practical during the design process. Key measures to maximise avoidance of impacts to TECs include:</p> <ul style="list-style-type: none"> • Placement of temporary infrastructure within cleared areas. • Reduction of vegetation clearing within the Luddenham Road BioBank site. The design has avoided impacts to biodiversity as much as practical in this area, thus now only resulting in an impact to less than 0.14 ha of the BioBank site which supports both Cumberland Plain Woodland and River-Flat Eucalypt Forest TECs. • Area of TECs to be impacted is subject to existing edge effects from the existing road, including weed occurrence, sedimentation, erosion and some debris. • The design minimises impacts to Commonwealth TECs as the lower condition zones of Cumberland Plain Woodland and River-flat Eucalypt Forest do not meet the Commonwealth definition (section 3.4).
<p>Actions and activities that provide for rehabilitation, ecological restoration and/or ongoing maintenance of retained areas of native vegetation, threatened species, threatened ecological communities and their habitat on the subject land.</p>	<p>The construction and operation activities associated with the proposal would be carried out using best practice guidelines as detailed in section 8.</p> <p>Tubestock would be planted within the proposal area as per the Aurecon (2021b) Mamre Road Upgrade, Stage 1 Between M4 Motorway & Erskine Park Road, NSW Urban design report including landscape character and visual impact assessment. The planting would support local fauna habitat and connectivity for fauna.</p>

6.1.3 Avoid or minimise prescribed biodiversity impacts when locating the proposal

Prescribed biodiversity impacts are impacts on biodiversity values in addition to, or instead of, impacts from clearing vegetation and/or loss of habitat. This can include impacts on geological features (karst, caves, cliffs etc), human-made structures, connectivity of habitat, water quality and hydrological processes, and vehicle strike.

The proposal area is located away from karsts, caves, and cliff lines. Such features would therefore not be impacted by the proposal.

Prescribed impacts that are applicable to the proposal area include human made structures (i.e. houses, culverts), connectivity of habitat and water quality and hydrological processes. The widening of Mamre Road along the western side was determined as the preferred option for the proposal based on the reasons provided in section 6.1.2. Avoiding the impacts to the human made structures, connectivity and water quality were not possible.

To minimise prescribed biodiversity impacts, the location of the proposal considered the following:

- refinement and optioneering of the tail-out channel work and proposed locations of water quality basins and swales to minimise the removal of vegetation. These were the aspects of the design most influenced the vegetation clearing requirements beyond the proposed widened road footprint
- locating the vegetation clearing to the edge of Mamre Road as far as practical, to minimise impacts to habitat connectivity
- locating temporary infrastructure and compound sites in cleared areas, where possible to reduce impacts to habitat and connectivity

6.1.4 Design the proposal to avoid or minimise prescribed biodiversity impacts

The design of the proposal has implemented the following to avoid or minimise prescribed biodiversity impacts:

- minimising impacts within riparian areas as far as practical, while balancing the need to implement measures to manage water quality runoff and drainage from the road. Limiting vegetation clearing within close proximity to watercourses minimises potential impacts to foraging habitat for the Southern Myotis, and assists in preventing erosion of creekline habitat.
- maintain the existing hydrological flows within the watercourses of the proposal area through a suitable culvert and gross pollutant trap design
- replace fencing to the north of the Luddenham BioBank site to minimise potential for vehicle strikes.

The proposal would also employ a microbat management plan (section 8.1) to minimise potential impacts to roosting habitat during the culvert construction process.

Furthermore, the design criteria provided in section 7.2.2 of the BAM, has been addressed in Table 6-2 below to demonstrate proposal avoidance or minimisation to prescribed impacts.

Table 6-2. Designing the proposal to avoid or minimise prescribed impacts

Design measures that can avoid and minimise prescribed impacts	Proposal
<p>a. Engineering solutions, such as proven techniques to:</p> <ul style="list-style-type: none"> i. minimise fracturing of bedrock underlying features of geological significance, or groundwater-dependent communities and their supporting aquifers ii. restore connectivity and movement corridors 	<ul style="list-style-type: none"> i. The proposal is not located within an area that contains Coastal Upland Swamps, or other important Groundwater dependent ecosystems. As discussed in section 7.7, the potential for impacts to groundwater dependent ecosystems are minor in nature, which is supported by the <i>Aurecon (2021) Water quality and soil impact assessment</i> for the proposal. ii. The Aurecon (2021b) Mamre Road Upgrade, Stage 1 Between M4 Motorway & Erskine Park Road, NSW Urban design report including landscape character and visual impact assessment for the proposal would include the planting of native tubestock throughout the proposal area which would provide habitat and increase connectivity for fauna.

Design measures that can avoid and minimise prescribed impacts	Proposal
<p>b. Design elements that minimise interactions with threatened entities, such as:</p> <ul style="list-style-type: none"> i. designing turbines to dissuade perching and minimise the diameter of the rotor swept area ii. designing fencing to prevent animal entry to transport corridors iii. providing vegetated buffers rehabilitated with native species 	<ul style="list-style-type: none"> i. Not applicable ii. Fauna proof fencing has not been proposed along the edge of the proposal area. This was not considered necessary given the lack of habitat availability on the eastern side of Mamre Road. A portion of fencing to the north of the Luddenham BioBank site would need to be removed and replaced given the impacts associated with the proposal. The remaining fence line would be maintained along the edge of the Luddenham BioBank site. iii. The proposal would include the implementation of the Aurecon (2021b) Mamre Road Upgrade, Stage 1 Between M4 Motorway & Erskine Park Road, NSW Urban design report including landscape character and visual impact assessment. This would include the planting of native tubestock, including eucalypts and casuarina throughout the proposal area, which would ultimately provide fauna foraging and habitat resources.
<p>c. Maintaining environmental processes that are critical to the formation and persistence of habitat features not associated with native vegetation</p>	<p>The proposal would result in the upgrade of the existing culverts within the proposal area. The proposed culverts have been designed to maintain hydrological flow to be similar to that of the natural flow regime, where possible. Maintaining the hydrological flow would continue to support foraging habitat for the Southern Myotis which is known to occur in the locality.</p>
<p>d. Maintaining hydrological processes that sustain threatened entities</p>	<p>As per above, the natural flow regime of the watercourses would not be significantly altered due to the proposal. As such, foraging habitat for the Southern Myotis that occurs downstream of the watercourses, would not be significantly impacted by the proposal.</p> <p>The proposal has been designed to improve drainage. Swales and water quality basins have been proposed in several areas to assist with minimising impacts to water quality from road runoff.</p>
<p>e. Controlling the quality of water released from the site, to avoid or minimise downstream impacts on threatened entities.</p>	<p>The proposal has incorporated swales and water quality basins to improve water quality released from the proposal area and minimise impacts on downstream threatened entities (section 7.5.3).</p>

7 Impact assessment

7.1 Direct impacts on native vegetation and habitat

The proposal would have unavoidable impacted to biodiversity, including threatened biodiversity through both direct and indirect impacts during construction and operation.

The direct and indirect impacts associated with the proposal and measures to offset and manage biodiversity in the long term are outlined in the following sections.

The proposal would result in the clearing of 9.30 hectares of vegetation regarded as 'native vegetation,' as defined in the BAM. The majority of vegetation likely to be affected by the proposal has been subject to historic clearing, grazing, and other agricultural activities, and is therefore thinned in areas, and dominated in areas by a range of introduced species. This is evident in all condition classes of the vegetation to be impacted.

The area of impact including the vegetation integrity score has been provided in Table 7-1 below.

Table 7-1: Direct impacts to native vegetation

Vegetation zone	PCT	Status (BC Act)	Area to be impacted (ha)	Future value	Change (loss) in vegetation integrity score	Number of hollow bearing trees impacted
849_Moderate	849 - Cumberland shale plains woodland	CEEC	3.68	0	-48.6	0
849_Low	849 - Cumberland shale plains woodland	CEEC	0.93	0	-7.6	0
835_Moderate	835 - Cumberland riverflat forest	EEC	2.97	0	-72.4	0
835_Low	835 - Cumberland riverflat forest	EEC	1.25	0	-27.6	0
1800_Moderate	1800 - Cumberland Swamp Oak riparian forest	EEC	0.47	0	-36.1	0

7.2 Indirect impacts on native vegetation and habitat

Indirect impacts occur when the proposal or activities relating to the construction or operation of the proposal affect native vegetation, threatened ecological communities and threatened species habitat beyond the proposal area.

A range of indirect impacts are likely to or could occur as a result of the proposal, including:

- increased noise, dust and light from the construction and operational activities
- loss of connectivity and fragmentation of habitats at a regional scale through clearing of native vegetation within the proposal area
- erosion or sedimentation in areas adjoining construction and operational activities
- increased spreading of weed propagules
- increased edge-effects for surrounding vegetated areas.

Such impacts would generally have a short to medium timeframe (i.e. the construction phase) and will be minimised through management procedures and processes.

The indirect impacts described above are variable in terms of the distance they may extend from the proposal area, and in many cases, due to mitigation measures, indirect impacts would be completely contained within the proposal area.

The area of indirect impact without mitigation measures has been attributed to a 50 metre area around the boundary of the site, which is consistent with the TfNSW indirect impact guidelines (TfNSW 2021) (Figure 3). This buffer would likely encapsulate the potential spread of weeds, edge effects in surrounding vegetated areas, erosion, dust, intensive light spill, and sedimentation during construction and operation.

Within the 50 metre indirect impact buffer area, there is about 14.40 hectares of native vegetation that is of a similar condition to that of the proposal area ie. scattered patches of native vegetation subject to edge effects and weed incursion. The operation of the proposal would result in edge effects in already fragmented native vegetation within the indirect impact buffer area.

The specific indirect impacts and how they relate to the ecology of the proposal area, along with corresponding mitigation measures are discussed in detail in Table 8-1.

The area associated with indirect impacts on the PCTs and associated habitat surrounding the proposal area has been detailed in Table 7-2. Mitigation measures to minimise identified impacts, are discussed in section 8.

Table 7-2. Area of potential indirect impact

PCT	TEC	Condition identified (Used in BAM-C)	Direct Impact (ha)	Indirect Impact (ha)
849	Yes aligns to the CEEC Cumberland Plain Woodland (BC and EPBC Act)	Medium	3.68	3.89
849	Yes aligns to the CEEC Cumberland Plain Woodland (BC Act)	Low	0.93	0.87
835	Yes aligns to River-Flat Eucalypt Forest (a CEEC under the BC Act and a EEC under the EPBC Act)	Medium	2.97	7.71
835	Yes aligns to River-Flat Eucalypt Forest (a CEEC under the BC Act)	Low	1.25	0.60
1800	Yes aligns to the EEC Swamp Oak Floodplain Forest (BC Act)	Medium	0.47	1.33
Total			9.30	14.40

7.3 Impacts to threatened species

The proposal would have a direct impact to two threatened biodiversity that are regarded as 'species credits' as per the requirements of the BAM: Cumberland Plain Land Snail and Southern Myotis (Table 7-3).

A further 35 threatened fauna species are predicted in the BAM-C to have foraging habitat within the PCTs of the proposal area (Table 4-6). Such species are regarded as 'ecosystem credit' fauna that do not require any further consideration in a BDAR.

In accordance with the BAM, further consideration is required for Southern Myotis and Cumberland Plain Land Snail given the species was recorded during the field survey, and habitat to be impacted fits the species habitat requirements.

As discussed in section 4.2.7 in relation to the Southern Myotis, all PCTs within the proposal area that are associated with the species (as per the TBDC), and within 200 meters of any medium to large permanent creeks, rivers, lakes or other waterways (i.e. with pools/ stretches 3m or wider) (Anderson et al. 2005), are regarded as habitat for the species. The total area of habitat for the Southern Myotis habitat impacted by the proposal is about 5.94 hectares (Figure 9).

As for the Cumberland Plain Land Snail, the area of potential habitat was mapped according to the detailed targeted survey. The area of potential habitat occupies the two populations that were recorded during the field survey as shown on Figure 10.

Table 7-3: Threatened species impacts

Threatened species	Status (BC Act)	Habitat or individuals to be impacted
Southern Myotis	Vulnerable	5.94 ha of potential roosting/foraging habitat
Cumberland Plain Land Snail	Vulnerable	3.46 ha of potential habitat

7.4 Serious and irreversible impacts

The BC Act and the *Local Land Services Act 2013* (LLS Act) imposes various obligations on decision-makers in relation to impacts on biodiversity values that are at risk of Serious and Irreversible Impacts (SII). These obligations generally require a decision-maker to determine whether the residual impacts of a proposed development on biodiversity values (that is, the impacts that would remain after any proposed avoid or mitigate measures have been implemented) are serious and irreversible.

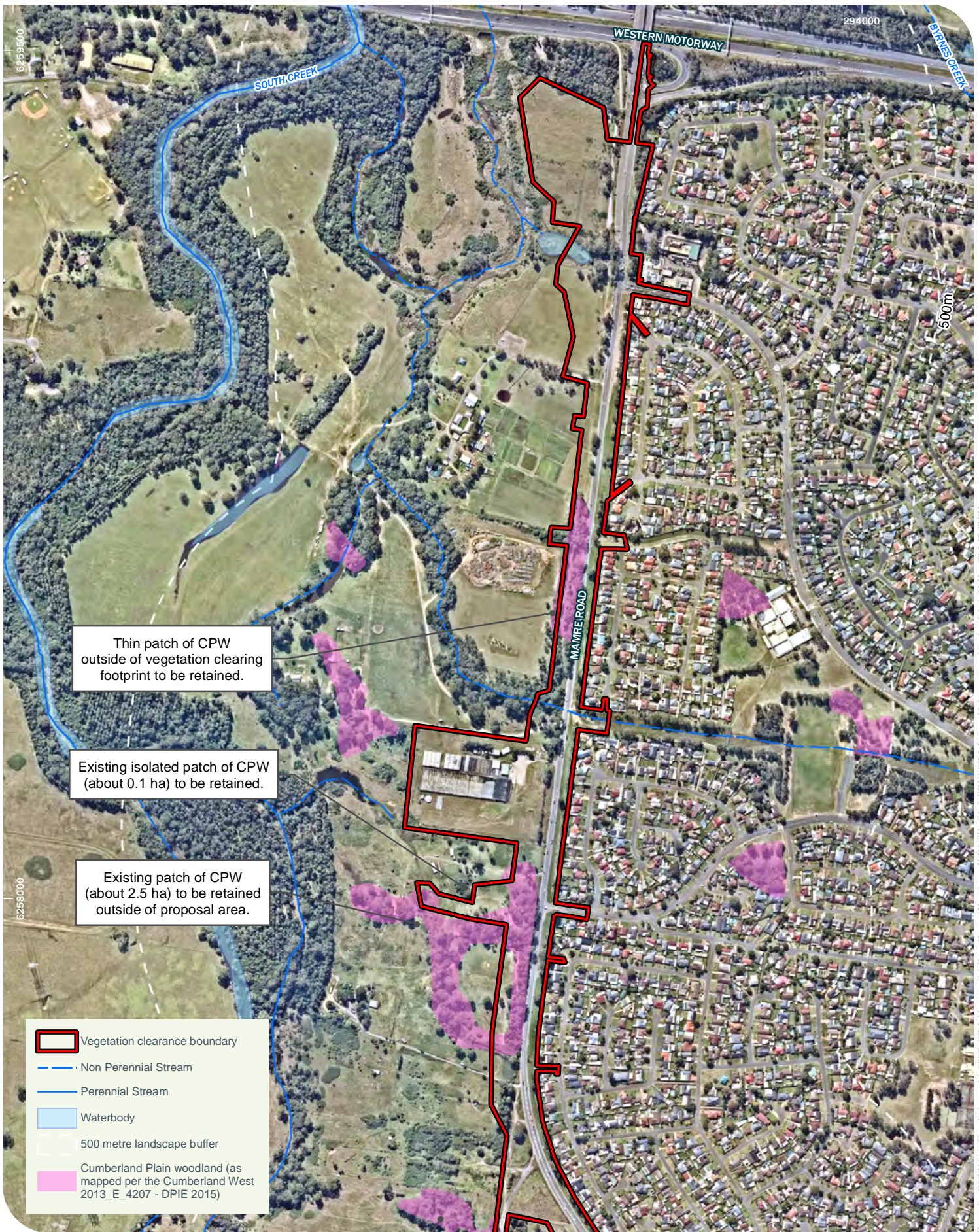
Cumberland Plain Woodland is listed as threatened biodiversity at risk of SII. As such, the BAM requires the SII assessment requirements to be addressed in a BDAR, which has been provided in Table 7-4. Figure 11 provides context on the extent of Cumberland Plain Woodland within the locality.

Table 7-4: SII Assessment for Cumberland Plain Woodland

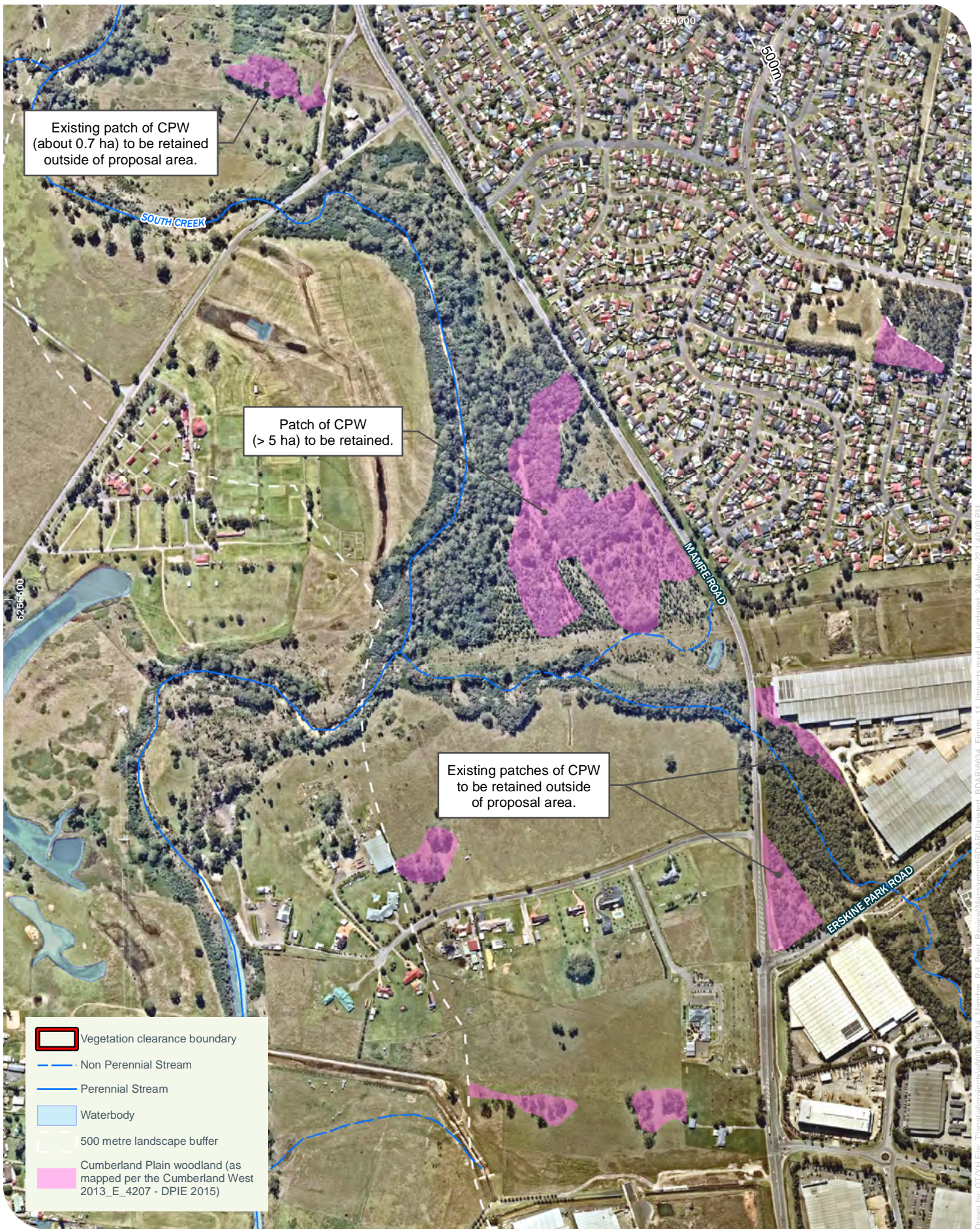
Assessment requirement	Assessment
Impacts of the proposal on the TEC, including: <ol style="list-style-type: none"> 1. Impact on the geographic extent of the TEC <ol style="list-style-type: none"> a. In hectares, and b. As a percentage of the current geographic extent of the TEC in NSW 	<ol style="list-style-type: none"> a. The proposal would remove up to 4.61 ha of Cumberland Plain Woodland TEC. i. The current extent of the TEC in NSW is 6,500 ha (Bionet Vegetation Classification Database). The direct impact from the proposal represents around 0.06% of the estimated current extent of the TEC in NSW. Within the locality (within 10 km of the proposal) about 79 ha of the TEC has been mapped by OEH (2013). The proposal represents 5% of the TEC within the locality.

Assessment requirement	Assessment
<p>2. The extent that the proposed impacts are likely to contribute to further environmental degradation or the disruption of biotic processes by:</p> <ul style="list-style-type: none"> i. estimating the size of any remaining, but now isolated, areas of the TEC; including areas of the TEC within 500 m of the development footprint or equivalent area for other types of proposals ii. describing the impacts on connectivity and fragmentation of the remaining areas of TEC measured by: iii. distance between isolated areas of the TEC, presented as the average distance if the remnant is retained AND the average distance if the remnant is removed as proposed, and iv. estimated maximum dispersal distance for native flora species characteristic of the TEC, and v. other information relevant to describing the impact on connectivity and fragmentation, such as the area to perimeter ratio for remaining areas of the TEC as a result of the development 	<ul style="list-style-type: none"> i. Within 500 m of the proposal, about 21.09 ha of the TEC is estimated to occur based off OEH (2013) vegetation mapping and aerial interpretation (see Figure 11). <ul style="list-style-type: none"> The 21.09 ha of TEC occurs as scattered patches ranging in size of about 0.02 ha to greater than 5 ha. Those patches immediately adjacent the proposal area have been shown on Figure 11, along with the corresponding area of each patch that would be retained. The TEC within the proposal area predominately consists of scattered patches along Mamre Road. The vegetation clearing would result in an increased distance between the fragmented patches immediately adjacent to the proposal area, rather than the creation of isolated patches. ii. Clearing under the proposal would create edge effects on the local occurrence of the TEC. Fragmentation of the TEC currently exists as scattered patches within the proposal area. The proposal would increase the distance between the already fragmented patches as shown on Figure 11. iii. As shown on Figure 11 the proposal would result in a greater distance between already fragmented patches of Cumberland Plain Woodland. iv. Characteristic native flora within the patches of Cumberland Plain Woodland in the proposal area is likely to be dispersed by birds, animals, and wind. Each flora species would have differing dispersal distances due to seed. It could be reasonable to assume that the maximum dispersal for some plants is about 300 metres. This would likely be more related to bird dispersal. v. The proposal for the most part, is proposed within a highly fragmented and impacted environment. The Cumberland Plain Woodland in its current form, would likely further decline without sufficient remediation work due to the on-going edge effects.

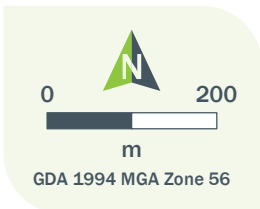
Assessment requirement	Assessment
<p>vi. iii) describing the condition of the TEC according to the vegetation integrity score for the relevant vegetation zone(s). The assessor must also include the relevant composition, structure and function condition scores for each vegetation zone.</p>	<p>vii. Area of the TEC have been significantly impacted by historic logging, grazing, weed invasion, and feral animal impacts, and as such, no portions of the TEC within the proposal area are in a benchmark condition. Based on the plot surveys within and surrounding the development envelope, two vegetation condition classes were attributed to the TEC:</p> <p>viii. Medium which had a vegetation integrity score of 48.6</p> <p>ix. Low which had a vegetation integrity score of 7.6.</p>
<p>Proposed measures to avoid direct and indirect impacts</p>	<p>Proposed measures to mitigate impacts of the proposal are discussed in Section 8.</p>



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Serious and Irreversible impacts – Cumberland Plain Woodland
Mamre Road Upgrade – Stage 1
Biodiversity Development Assessment Report (BDAR)

Niche PM: Luke Baker
 Niche Proj. #: 6634
 Client: Transport for NSW / Aurecon

Figure 11b

7.5 Prescribed biodiversity impacts

Prescribed biodiversity impacts are impacts on biodiversity values in addition to, or instead of, impacts from clearing vegetation and/or loss of habitat. This can include impacts on geological features (karst, caves, cliffs etc), human-made structures, connectivity of habitat, water quality and hydrological processes, and vehicle strike.

If human-made structures (e.g. bridges, culverts, abandoned buildings) and non-native vegetation (e.g. camphor laurel trees) provide habitat for threatened species, the assessor must:

- a. provide a description of the type of human-made structure or non-native vegetation habitat
- b. prepare a list of threatened species that use these features as habitat
- c. describe how each threatened species could, or does, use the human-made structure or non-native vegetation as habitat (based on published literature and other reliable sources).

An assessment for each of the relevant prescribed biodiversity impacts have been completed in the following sections.

7.5.1 Human made structures and non-native vegetation

The proposal will result in the upgrade to a number of culverts. As discussed in section 4.2.5, based on field observations, the concrete box girder bridge spanning South Creek appeared to have potential for roosting bats, and has been indicated on Figure 8 as an area of ‘fauna corridor’. The threatened bats that could possibly roost within this structure has been summarised in Table 7-5, and include: Southern Myotis, Large Bentwing-bat and Little Bentwing-bat.

To provide further mitigation towards the potential for roosting habitat to be present, we have provided recommendations in section 8.

Table 7-5: Potential impacts on species and ecological communities associated with human-made structures and non-native vegetation

Species or ecological community	Human-made structures and/or non-native vegetation with potential to be habitat	Nature, extent and duration of short and long-term impacts due to removal of structures and/or non-native vegetation	Importance within the bioregion of the habitat to these species or ecological communities	Consequences of the impacts for the local and bioregional persistence
Southern Myotis and other threatened culvert roosting bats (such as Large Bentwing-bat and Little Bentwing-bat)	Culverts within the subject area were considered potential habitat for roosting bats at different times of the year. Removal of culverts is listed as a prescribed impact and therefore, will require further consideration in accordance with the BAM.	Upgrade of the existing culverts which may displace roosting habitat if present. The potential impact may occur during the construction phase of the culverts.	Low- artificial habitat in the form of culverts and other man-made structures are prevalent throughout Greater Sydney.	Low – minor impact on a regional scale

7.5.2 Connectivity and movement

The proposal would result in the removal of native vegetation along the existing Mamre Road corridor (referred to as the vegetation clearance boundary) (Figure 3). The removal of native vegetation along a tributary of South Creek to the far south of the proposal area would result in an increased distance between two patches of native vegetation on the east and west of Mamre Road (see Figure 8). The two patches are currently separated by about 20 metres. The proposal would result in an increase of 80 metres between the two patches. The potential impacts to this corridor are discussed in the Table below.

Table 7-6: Potential impacts associated with loss of connectivity

Area of connectivity	Species	Movement patterns key to the life cycle of the species	Nature, extent and duration of short and long-term impacts to connectivity	Importance of the area of connectivity within the bioregion and to the lifecycle of the species	Consequences of the impacts for the local and bioregional persistence
<p>Fauna corridor identified on Figure 8.</p> <p>The distance between the two patches of vegetation (east and west of Mamre Road) is currently about 20 metres. The proposal would result in an increase in the distance between the two patches by about 100 metres.</p>	<p>All fauna species</p>	<p>The increased distance between the two patches (from 20 metres to 100 metres) may result in some degree of obstruction of fauna movement along this portion of the Mamre Road.</p> <p>The eastern patch is approximately five hectares in size, whilst the western patch is greater than 100 hectares.</p> <p>Given the size of the eastern patch, it is unlikely to provided important habitat for most threatened fauna (such as threatened mammals, birds and microbats). However such species may use this area on occasion for foraging.</p> <p>The increase in distance is unlikely to impact upon species such as Microbats and birds given their mobility.</p> <p>The increased distance may impact upon the movement of mammals through this portion of the South Creek tributary, that may use the eastern patch for foraging.</p> <p>Molluscs, such as the Cumberland Plain Land Snail are unlikely be significantly impacted by the increased distance. The existing distance separated by Mamre Road is likely to be an existing barrier to connect the east and west populations of the species (see Figure 8 for population locations).</p>	<p>Permanent increase in distance between two patches of native vegetation along a tributary of South Creek.</p>	<p>All riparian corridors should be given importance to facilitate fauna movement throughout the region.</p> <p>The increased distance is unlikely to impact the lifecycle of mobile species (such as microbats and birds).</p> <p>The barrier may result in movement for some non-threatened mammals (such as Eastern Pygmy possums) across this area. However, the reliance on the five hectare patch of native vegetation on the eastern side of Mamre Road for species survival and important lifecycle is unlikely.</p> <p>The impact on the Cumberland Plain Land Snail population that occurs within this area has been offset (section 9).</p>	<p>The increased distance is unlikely to substantially impact upon threatened biodiversity, based on the following:</p> <ul style="list-style-type: none"> - the eastern patch is about 5 hectares in size and is unlikely to contain important limited habitat (eg. Bushrock, large tree hollows, stags, caves etc.), - lack of threatened species (mammals, birds, reptiles, flora) records within this area. - Cumberland Plain Land Snail populations are already fragmented.

7.5.3 Water quality and hydrology

The potential changes to hydrology and water quality have been addressed in Aurecon (2021) *Water quality and soil impact assessment*. There is potential for erosion to occur during construction leading to sedimentation and water quality impacts in South Creek, and the potential for an increase in pollutant load due to an increase in pavement footprint. The potential impacts to PCTs and species that utilise South Creek are discussed in the Table below.

Table 7-7: Potential impacts to water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities

Species or ecological communities	Waterbodies impacted	Nature, extent and duration of short and long-term impacts on water quality and hydrological process	Nature, extent and duration of short and long-term impacts on habitat and life cycle	Importance within the bioregion of the waterbody or hydrological process	Consequences of the impacts for the local and bioregional persistence
PCTs and associated fauna habitat that occur next adjacent to South Creek (towards far South of proposal area)	South Creek	<p>Impacts to water quality are discussed in Aurecon (2021).</p> <p>South Creek is currently subject to a range of pollutants and pressures that have reduced water quality.</p> <p>The proposal would result in a minor, permanent impact to water quality within South Creek through the construction of drainage works/culverts and trenches. The on-going operation of the road would also result in an increase in pollutants from surface water runoff. Mitigation measures are proposed to reduce the impact.</p>	<p>Unlikely to result in any long-term impacts to biodiversity lifecycle. The proposal is unlikely to result in such an impact to South Creek, that would substantially change any threatened flora or fauna or TEC.</p> <p>No threatened aquatic species are likely to occur in South Creek.</p>	<p>South Creek is an important waterbody in the Hawkesbury Nepean region. The impact to South Creek however, would be marginal, and would not an important hydrological process from being significantly altered.</p>	<p>Low – unlikely to result in any substantial change to local and bioregional significant.</p>

7.5.4 Vehicle strike

Given the proposal area is located immediately adjacent to some patches of native vegetation (Figure 4 and Figure 5) there is the potential for vehicle interactions with fauna. The likelihood and assessment of the potential impacts are provided in Table 7-8.

Table 7-8: Potential impacts of vehicle strikes on threatened species of animals or on animals that are part of a TEC

Species at risk of vehicle strike	Likelihood of vehicle strike	Estimate vehicle strike rates	Consequences of the impacts for the local and bioregional persistence of the species
All threatened fauna species with moderate to high likelihood to occur.	<p>Low. The proposal area generally occurs within a cleared landscape with native vegetation scattered across the existing road corridor.</p> <p>The key area for fauna movement is to the far south of the proposal area (Figure 8). The likelihood of fauna interactions within this portion would be greater than the rest of the proposal area. A mitigation measure proposed is to install a new fence along the northern boundary of the Luddenham BioBank site to reflect the proposal area. The remaining fence of the BioBank site would be retained.</p>	<p>It is estimated that vehicle strike rates would be low. This is supported by only a few (<5) historic records of vehicle collision along Mamre Road within the proposal area, and within 5km to the south of the proposal area (mainly to kangaroos/wallabies) as reported on Bionet.</p> <p>Overall, the fauna survey did not detect a high abundance of fauna utilising the general proposal area.</p>	<p>The proposal has the potential to result in fauna vehicle strikes. However, it seems unlikely that the proposal would result in a significant increase in vehicle interactions with native fauna, such that it would significantly impact upon local populations.</p>

7.6 Aquatic impacts

The proposal has been designed to minimise environmental impacts to aquatic habitats where possible, with the majority of works being undertaken away from watercourses.

As discussed in section 4.3.2, the proposal will not have an impact on habitat suitable for the Macquarie Perch, Australian Grayling or any other threatened fish.

Impacts as a result of construction and operation have been detailed in the Aurecon (2021) *Water quality and soil impact assessment*. The assessment concluded that the proposed channel works would permanently alter the bed and bank of watercourses within proposal area. There is potential for erosion to occur during construction leading to sedimentation and

water quality impacts in the watercourse until the works area is suitably stabilised, however mitigation measures are proposed to reduce such impacts (section 8.1).

The proposal has the potential to increase the pollutant load being released from the proposal area, due to the proposed increase in pavement footprint (Aurecon 2021).

The key pollutants contained in road runoff include:

- suspended solids due to pavement wear, tyre wear, atmospheric deposition and deposition from vehicles
- heavy metals bound to dust particles washed off pavement surface
- oil and grease and other hydrocarbons deposited by vehicles
- nutrients due to atmospheric deposition.

The increase in pollutant load could potentially result in water quality impacts such as sedimentation, reduced water clarity, increased toxicant and nutrient concentrations and lower dissolved oxygen levels within the local tributaries and South Creek. Such impacts are determined in the Aurecon (2021) assessment to be permanent and minor.

Regardless of potential impacts, the proposal is unlikely to have a significant impact on any threatened species, communities or populations listed on the FM Act given the temporary nature of the construction works and the mitigation measures that would be employed. The proposal is also unlikely to result in a substantial long-term impact to mapped Key Fish Habitat along South Creek. Additionally, fish passage will be maintained in accordance with relevant guidelines (ie. DPI 2013).

A permit under the Part 7 of the FM Act may be required for the proposal given the works have the potential obstruct the free passage of fish whether permanently or temporarily in TYPE 1 habitats.

7.7 Groundwater dependent ecosystems

Potential impacts to groundwater have been assessed in the Aurecon (2021) *Water quality and soil impact assessment* for the proposal. The assessment concludes ‘impacts to terrestrial and aquatic groundwater dependant ecosystems within proximity to the proposal as a result of changes in groundwater level are likely to be minor’ (Aurecon 2021). This conclusion is attributed to the following:

- Groundwater has been intercepted at between 0.7 metres and 4.9 metres below ground level (m BGL) within the proposal area. Earthworks associated with road construction are generally likely to be shallow and include shaping of the upper soil profile so groundwater is unlikely to be intercepted during most construction activities.
- Slightly deeper excavations may be required for utility and service trenches, construction of drainage infrastructure and piling for construction of the noise walls. There is potential for some minor volumes of groundwater to enter trenches and drainage works excavations however these excavations would be temporary and localised and given the low permeability of the local clay soils, inflow volumes are likely to be low.
- Similarly piling works are only likely to require minor volumes of groundwater to be extracted. Where groundwater is intercepted, the quality of the groundwater must be considered during groundwater dewatering, management and release.
- Large volumes of dewatering or groundwater extraction is unlikely to be required, so groundwater flows and quality are unlikely to be significantly impacted by the proposed earthworks (Aurecon 2021).

7.8 Areas of Outstanding Biodiversity Value

Areas of Outstanding Biodiversity Value are special areas with irreplaceable biodiversity values that are important to the whole of New South Wales, Australia or globally.

The BC Act gives the Minister for Energy and Environment (E&E) the power to declare Areas of Outstanding Biodiversity Value.

Area of Outstanding Biodiversity Value declarations in New South Wales include:

- Gould's Petrel – critical habitat declaration
- Little penguin population in Sydney's North Harbour – critical habitat declaration
- Mitchell's Rainforest Snail in Stotts Island Nature Reserve – critical habitat declaration
- Wollemi Pine – critical habitat declaration

None of these areas would be impacted by the proposal.

7.9 Matters of National Environmental Significance

Impacts to threatened biodiversity listed on the EPBC Act have been avoided where practical through the design of the proposal (section 6) and will be further reduced through a series of mitigation measures discussed in section 8.

The unavoidable impacts to Commonwealth threatened biodiversity include the following:

- Direct impact to about 3.68 hectares of Cumberland Plain Woodland, which meets the Commonwealth CEEC definition
- Direct impact to about 2.97 hectares of River-Flat Eucalypt Forest, which meets the Commonwealth CEEC definition.
- Direct impacts to about 9.30 hectares of potential habitat for the Yellow Wagtail.

Assessments of Significance for the above threatened biodiversity were completed, and have been provided in Appendix E. The results of the Assessments of Significance conclude that the proposal may have a significant impact to Cumberland Plain Woodland. The proposal is unlikely to have a significant impact on the remaining threatened biodiversity listed under the EPBC Act.

Whilst it is not a requirement for the proposal to provide a specific offset for significantly impacted Commonwealth matters (1.4.3), it should be noted that the proposal will result in a biodiversity offset for Cumberland Plain Woodland and River-flat Eucalypt Forest (section 9), which in turn will ensure the in-perpetuity management of the EPBC Act listed TECs.

7.10 Cumulative impacts

The potential for cumulative impacts due to the proposal has been considered. The proposal occurs within an area identified as the Western Sydney Employment Area, and would provide transportation connections to the Western Sydney Employment Area. Other planned and potential infrastructure developments in the locality include:

- M12 Motorway: A new dual-carriageway motorway to connect the M7 Motorway with the Western Sydney Airport and The Northern Road, which would pass over Mamre Road. Construction expected 2022 – 2025.
- Sydney Metro Western Sydney Airport: Construction and operation of a new metro railway around 23 kilometres in length between the existing Sydney Trains suburban rail network at St Marys in the north and the Western Sydney Aerotropolis Core precinct in the south, via Western Sydney airport. Construction expected 2021 – 2026.
- Western Sydney Airport: Construction of Western Sydney airport to provide additional aviation capacity in Sydney. At the time of writing, construction was in progress, due for completion in 2026.
- M4 Roper Road Westbound On Ramp: Construction and operation of a new west facing ramp, providing direct access onto the M4 Motorway from traffic travelling north from St Clair. Construction expected 2021 – 2022.
- M4 Smart Motorways: Introduction of intelligent technology to the M4 Motorway between Pitt Street, Parramatta and Mulgoa Road, Penrith. Completion expected in 2021.
- Western Sydney Employment Area: Western Sydney Employment Area (WSEA) was developed to provide businesses with land for industrial and employment purposes, close to major road transport corridors. The southern portion of the proposal area is

located within the Erskine Park Employment Lands precinct, Mamre West precinct and Broader Western Sydney Employment Area precinct of the WSEA.

- Altis Warehouse and Logistics Hub: Altis Property Partners propose to construct and operate a warehouse and logistics hub in Orchard Hills. Construction beginning in 2021.
- Upper South Creek Advanced Water Recycling Centre: Sydney Water is planning to build and operate a wastewater treatment plant in Western Sydney. Construction expected 2022 – 2025.

The Western Sydney Aerotropolis occurs about 10 kilometres to the south of the proposal area, and has undergone extensive biodiversity survey. The Western Sydney Airport EIS, prepared for the Department of Infrastructure and Regional Development (GHD, 2016) has identified the following impacts to biodiversity:

- Construction for stage 1 development would impact about 318.5 hectares of native vegetation, including 104.9 hectares of Cumberland Plain Woodland and 42.1 hectares of River-flat Eucalypt Forest
- Removal of habitat for threatened flora, including *Pultenaea parviflora*, *Cynanchum elegans*, *Pimelea spicata*, *Grevillea parviflora subsp. parviflora* and *Thesium australe*.
- Removal of habitat for a range of threatened fauna, including Grey-headed Flying Fox, Swift Parrot and Cumberland Plain Snail.
- Operation for stage 1 development would pose a risk of fauna strike from contact with aircraft and ground transportation vehicles.

The proposal will marginally increase the amount of native vegetation and habitat removal (about 9.30 hectares) within the wider locality.

The proposal area is located within land identified in the proposed Cumberland Plain Conservation Plan (DPIE 2020d). The Cumberland Plain Conservation Plan is one of the largest strategic conservation plans to be undertaken in Australia and is the first strategic biodiversity certification to be undertaken under the BC Act. It is currently in draft form, and awaiting formal approval.

The Draft Cumberland Plain Conservation Plan aims to protect TEC that would be impacted by development in the nominated development areas. The Plan would result in 4,795 hectares being zoned for environmental conservation (DPIE 2020e), which would include conservation sites for the TECs impacted by the proposal (River-flat Eucalypt Forest, Cumberland Plain Woodland and Swamp Oak Floodplain), and associated threatened species habitat (eg. Southern Myotis habitat).

8 Mitigation

8.1 Mitigation measures

The specific indirect impacts and how they relate to the ecology of the proposal area, along with corresponding mitigation measures are discussed in detail in Table 8-1. The mitigation measures provided would be consistent with industry best practice to ensure that mitigation is effective. Monitoring of the effectiveness of the mitigation measures would be incorporated as part of the management actions associated with the proposal.

Construction and operation of the proposal will be undertaken in accordance with TfNSW's Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects (RMS, 2011):

- Guide 1. Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects
- Guide 2. Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects
- Guide 3. Re-establishment of native vegetation of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects
- Guide 4. Clearing of vegetation and removal of bushrock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects
- 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
- Guide 6. Weed management of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects
- Guide 7. Pathogen management of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects.
- Guide 9. Fauna handling of the Biodiversity Guidelines: Protecting and managing biodiversity
- Guide 10. Aquatic habitats and riparian zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects

It is recommended that a project specific Flora and Fauna Management Plan (FFMP) be prepared to reflect biodiversity management measures associated with the proposal in order to protect and manage important biodiversity values, and discusses key commitments relating to threatened species management, pest and weed management, and site hygiene practices.

The FFMP would be consistent with the current TfNSW Biodiversity Guidelines and include specific protocols dealing with any potential interaction between the proposal activities and threatened flora or fauna species during the construction and operational phase.

The FFMP will include directions for survey, monitoring and management of key threatened species known or considered to be potentially impacted by the project and protocols for reporting and managing any unforeseen threatened species occurrences within the proposal area.

In summary, mitigation measures to be undertaken during construction and post construction include:

Fencing and signposting

Fencing and/or the use of highly visible rope or tape boundaries will be used to delineate the boundary of vegetation clearing at the edge of the proposal area.

Signposting will be used to inform project personnel and site visitors of areas of conservation value to restrict entry or inform behaviour that will reduce incidental interactions with fauna.

Employee Education and General Environmental Controls

Employees and contractors would be educated on and required to implement the following controls, to avoid or at least minimise potential environmental impacts associated with the proposal:

- Minimise dust generation by minimising the extent and time that bare sand is exposed and by appropriate sand suppression.
- Procedures for the management of hydrocarbon and/or chemical spills including the requirements for vehicles to carry spill kits.
- Ensuring vehicles remain on designated roads and tracks and abide by site speed limits, through use of signposting and driver education during the induction process and in on-going project discussions.
- Management and removal of all rubbish from the site.

Microbat Pre-construction Protocol

A microbat management plan is recommended. Prior to demolition, the culverts should be surveyed for the presence of threatened bats. Ecologists are to visually inspect features (culverts, bridges etc) using a handheld torch, binoculars, digital zoom camera, a handheld ultrasonic device to identify any microbat roost points and any direct and/or indirect signs of occupancy (i.e., physical presence, guano, staining, ammonia-like odours, evidence of roost points, exit/entry points). If threatened bats are recorded, further assessment by a microbat expert and preparation of a management plan would be required to allow the safe demolition of the culvert. If exclusion of microbats has been determined, then demolition can occur at any time of the year.

After the pre-demolition inspection, if roosting habitat is likely, TfNSW would assign a microbat expert to recommend habitat replacement options/exclusion measure options (if required) to be installed at least a month prior to works.

Prior to construction/demolition works, a microbat expert is to be engaged to supervise the demolition of culverts and bridge infrastructure that has been identified as potential roosting habitat during the pre-demolition inspection.

In regard to the removal of hollow-bearing trees, these would be checked and identified fauna relocated as per the TfNSW Biodiversity guidelines.

Any fauna displaced during clearing are to be captured where possible and relocated to pre-planned areas (microbats to be captured and handled only by a vaccinated and qualified handler).

In an event that fauna are injured works, the NSW Wildlife Information, Rescue and Education Service (WIRES) will be contacted to handle and collect for appropriate care and rehabilitation.

Vegetation Clearance Protocol

The FFMP will refer to the current TfNSW Vegetation Clearing Protocol, which in summary includes the following:

- Prior to clearing of native vegetation, ecologists are to survey for ground dwelling fauna and to remove any fauna/ fauna habitats to adjacent areas that would not be further disturbed.
- Prior to clearing of remnant hollow-bearing trees or habitat trees, ecologists are to be engaged to supervise felling. All hollow-bearing trees that are accessible safely from the ground are to be checked and identified fauna relocated. Hollows higher up and not accessible from the ground are to be identified and trees felled gently by an excavator or dozer and left overnight to allow fauna to relocate.
- Any fauna displaced during clearing are to be captured where possible and relocated to pre-planned areas (fauna to be captured and handled only by personnel trained to do so).

- In an event that fauna are injured during clearing, the NSW Wildlife Information, Rescue and Education Service (WIRES) will be contacted to handle and collect for appropriate care and rehabilitation.

Table 8-1: Mitigation measures

Impact	Mitigation measure	Timing and duration	Likely efficacy	Residual impacts anticipated	Responsibility
Removal of native vegetation	Measures to further avoid and minimise the area of native vegetation or habitat removal will be investigated during detailed design and implemented where practicable and feasible.	Detailed design phase	Effective in reducing area of impact	Indirect impacts to remaining patches are discussed in section 7.2.	TfNSW
	Pre-clearing surveys will be undertaken in accordance with <i>Guide 1: Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	Prior to construction	Effective	Unlikely	Ecologist / Contractor
	Develop and implement a Flora and Fauna Management Plan as part of the Construction Environmental Management Plan (CEMP).	Prior to construction	Proven	Unlikely	TfNSW/ Ecologist
	Vegetation removal will be undertaken in accordance with <i>Guide 4: Clearing of vegetation and removal of bushrock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	During construction	Effective	Unlikely	Contractor / TfNSW
	Native vegetation will be re-established in accordance with <i>Guide 3: Re-establishment of native vegetation of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	Post construction	Effective	Unlikely	Contractor
	The unexpected species find procedure is to be followed under <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011) if threatened ecological communities, not assessed in the biodiversity assessment, are identified in the proposal site.	During construction	Proven	Unlikely	Contractor
Removal of threatened species habitat	Habitat removal minimised through detailed design.	Detailed design	Effective	Avoidance discussed in section 6	TfNSW

Impact	Mitigation measure	Timing and duration	Likely efficacy	Residual impacts anticipated	Responsibility
and habitat features	Develop and implement a Flora and Fauna Management Plan as part of the CEMP.	Prior to construction	Proven	Unlikely	TfNSW/ Ecologist
	Fauna will be managed in accordance with <i>Guide 9: Fauna handling of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011)</i> .	During construction	Effective	Unlikely	Ecologist
	Habitat removal will be undertaken in accordance with <i>Guide 4: Clearing of vegetation and removal of bushrock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011)</i> .	During construction	Effective	Unlikely	Contractor
	Habitat will be replaced or re-instated in accordance with <i>Guide 5: Re-use of woody debris and bushrock</i> and <i>Guide 8: Nest boxes of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011)</i> .	During construction	Proven	Unlikely	Contractor
	The unexpected species find procedure is to be followed under <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011)</i> if threatened fauna, not assessed in the biodiversity assessment, are identified in the proposal site.	During construction	Proven	Unlikely	Contractor
Removal of threatened plants	Pre-clearing surveys will be undertaken in accordance with <i>Guide 1: Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011)</i> .	During construction	Proven	Unlikely	Contractor / Ecologist
	The unexpected species find procedure is to be followed under <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011)</i> if threatened flora species, not assessed in the biodiversity assessment, are identified in the proposal area.	During construction	Proven	Unlikely	TfNSW / Contractor

Impact	Mitigation measure	Timing and duration	Likely efficacy	Residual impacts anticipated	Responsibility
Changes to hydrology	Changes to existing surface water flows would be minimised through detailed design.	Detailed design	Effective	Unlikely – hydrology impacts assessed in Aurecon (2021)	Design team / TfNSW
Indirect impacts on native vegetation and habitat	Exclusion zones will be set up at the limit of clearing in accordance with <i>Guide 2: Exclusion zones</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	During construction	Effective	Unlikely	Contractor
Injury and mortality of fauna	Fauna will be managed in accordance with <i>Guide 9: Fauna handling</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	During construction	Effective	Unlikely	Contractor / Ecologist
Invasion and spread of weeds	Weed species will be managed in accordance with <i>Guide 6: Weed management</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	During construction	Effective	Unlikely	Contractor / TfNSW
Invasion and spread of pathogens and disease	Pathogens will be managed in accordance with <i>Guide 2: Exclusion zones</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	During construction	Effective	Unlikely	All contractors
Noise, light and vibration	Shading and artificial light impacts minimised through detailed design, particularly adjacent to the BA408 Luddenham BioBank site.	Detailed design	Effective	Unlikely – road lighting and noise currently operating.	Design team
Impacts to habitat in human made structures	Microbat pre-demolition inspections, toolbox talks, ecological supervision and habitat replacement options.	Detailed design and during construction	Effective	Unlikely if appropriately mitigated.	Contractor / ecologist

Impact	Mitigation measure	Timing and duration	Likely efficacy	Residual impacts anticipated	Responsibility
Vehicle strike	<p>It is recommended that TfNSW monitor road kills along Mamre Road.</p> <p>The northern portion of the Luddenham BioBank site would require the existing fence to be removed to account for the proposal area. A new fence is to be installed at the northern portion of Luddenham BioBank site to assist in minimising fauna movement across Mamre Road.</p>	Detailed design	Effective	Unlikely	Design team
Aquatic impacts	<p>Aquatic habitat will be protected in accordance with <i>Guide 10: Aquatic habitats and riparian zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011)</i> and Section 3.3.2 Standard precautions and mitigation measures of the Policy and <i>guidelines for fish habitat conservation and management Update 2013 (DPIE 2013)</i>.</p> <p>Culverts will be installed in accordance with the DPIE (2013) guidelines.</p> <p>Implement and regularly maintain erosion and sediment controls for the duration of construction and landscaping works as per Landcom (2004), which will be detailed in a Soil and Water Management Plan.</p>	During construction	Effective	Unlikely	Design team and construction

9 Offsetting

9.1 Ecosystem credits

The BAM identifies the BAM-C as the appropriate tool for quantifying the offsets required, which is expressed as numbers of ecosystem and species credits. A calculation of the nature and extent of biodiversity credits required due to ecological impacts associated with the proposal has been undertaken using the BAM-C.

The results of the BAM-C, ecosystem offset credit requirements, including current, future and change in vegetation integrity scores are shown in Table 9-1.

Impacts to native vegetation communities within the development site generate a requirement for 245 ecosystem credits. The 245 ecosystem credits also cover the credit requirement for ecosystem credit species. The full BAM-C biodiversity credit report is provided in Annexure F.

Table 9-1: Ecosystem credits

PCT	Vegetation zone	Impact area (ha) ³	Current Vegetation Integrity score	Future Vegetation Integrity score	Change in Vegetation Integrity Score	Biodiversity risk weighting	Required credits
PCT 835 Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	835_Moderate	2.97	72.4	0	72.4	2	108
	835_Low	1.25	27.6	0	27.6	2	17
PCT 849 Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	849_Moderate	3.68	48.6	0	48.6	2.5	112
	849_Low	0.93	7.6	0	7.6	2.5	0
PCT 1800 Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley.	1800_Moderate	0.47	36.1	0	36.1	2	8
Total							245

9.2 Species credits

The results of the BAM-C species offset credit requirements are shown in Table 9-2. Threatened species identified or assumed to be present within the development site and likely to be impacted by the proposal generate a requirement for a total of 244 species credits. The full BAM-C biodiversity credit report is provided in Annexure F.

³ Note that the BAM-C rounds the impact area to the nearest decimal place in some cases.

Table 9-2: Species credits required

Species	Habitat impacted	Credits required
Southern Myotis	5.94	157
Cumberland Plain Land Snail	3.46	87

9.3 Credits matching the ‘like for like’ and credit variation rules

The BAM allows for certain PCT’s to be offset with other PCTs where the ‘like for like’ rule can be met. The BAM also puts restrictions on where credits can be sourced and whether hollow-bearing trees must be present at the offset site.

Where ‘like for like’ credits cannot be sourced, the BAM also allows for other credit types to be sourced subject to the variation rules contained in the BC Regulations.

The like-for-like and variation offset options for ecosystem credits are listed in Table 9-3.

Table 9-3. ‘Like for like’ and variation offset options for ecosystem credits

PCT	Hollow bearing trees required	PCTs matching ‘like for like’ requirements	Variation options
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions / PCT 835 Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	No	686, 828, 835, 839, 941, 971, 1064, 1108, 1109, 1212, 1228, 1232, 1293, 1318, 1326, 1386, 1504, 1522, 1556, 1594, 1618, 1646, 1648, 1720, 1794.	42, 835, 1232.
Cumberland Plain Woodland in the Sydney Basin Bioregion /PCT 849 Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	No	849, 850	201, 266, 277, 282, 303, 312, 654, 677, 680, 705, 849, 1191, 1295, 1326, 1330, 1332
Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions / PCT 1800 Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley.	No	915, 916, 917, 918, 919, 1125, 1230, 1232, 1234, 1235, 1236, 1726, 1727, 1728, 1729, 1731, 1800, 1808	1064, 1106, 1227, 1230, 1232, 1234, 1235, 1318, 1386, 1716, 1717, 1718, 1720, 1723, 1727, 1728, 1730, 1731.

9.4 Offsetting strategy

To satisfy the offset requirement, TfNSW will pay the offset requirement into the Biodiversity Conservation Fund. The Biodiversity Conservation Trust (BCT) will source the required biodiversity offset, which in turn will contribute to in-perpetuity protection and enhancement of the TECs, Cumberland Plain Land Snail and the Southern Myotis.

10 Conclusion

TfNSW have aimed to avoid and minimise environmental impacts from the proposal as far as practical, and have proposed a series of mitigation measures to manage potential indirect impacts from the proposal.

The unavoidable impacts of the proposal on ecological values includes the clearing of 9.30 ha of vegetation regarded as 'native vegetation,' as defined in the BAM. Associated fauna habitat would also be directly impacted.

Through the application of the BAM, associated guidelines and the BAM-C, the following biodiversity credit offset is required for the proposal:

- 125 credits for PCT 835 Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion
- 112 credits for PCT 849 Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
- 8 credits for PCT 1800 Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley
- 157 credits for Southern Myotis
- 87 credits for Cumberland Plain Land Snail.

Assessments of significance under the EPBC Act were also completed for threatened biodiversity (Cumberland Plain Woodland, River-flat Eucalypt Forest, Yellow Wagtail, and Grey-headed Flying-fox) impacted by the proposal. Given the proposal is being undertaken by TfNSW under Division 5.1 of the EP&A Act, the strategic assessment applies, and no further Referral under the Commonwealth is required.

11 References

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Annexure A

Habitat suitability assessment table

A list of subject threatened flora and fauna and threatened ecological communities within the locality (10 km radius) was determined from database searches. The list of potentially impacted species is determined from consideration of this list. In order to adequately determine the relevant level of assessment to apply to potentially affected species, further analysis of the likelihood of those species occurring within the proposal area was completed.

Five categories for 'likelihood of occurrence' were attributed to species after consideration of criteria such as known records, presence or absence of important habitat features on the proposal area, results of the field surveys and professional judgement. This process was completed on an individual species basis.

Species considered further in formal assessments of significance (EPBC Act) were those in the 'Known', 'High' or 'Moderate' categories and where adverse impacts for the species could reasonably occur from the development. Species listed as a 'Low' or 'None' likelihood of occurrence are those for which there is limited or no habitat present within the proposal area.

Likelihood rating	Threatened flora criteria	Threatened and migratory fauna criteria
Known	The species was observed within the proposal area.	The species was observed within the proposal area.
High	It is likely that a species inhabits or utilises habitat within the proposal area.	It is likely that a species inhabits or utilises habitat within the proposal area.
Moderate	Potential habitat for a species occurs on the site. Adequate field survey would determine if there is a 'high' or 'low' likelihood of occurrence for the species within the proposal area.	Potential habitat for a species occurs on the site and the species may occasionally utilise that habitat. Species unlikely to be wholly dependent on the habitat present within the proposal area.
Low	It is unlikely that the species inhabits the proposal area.	It is unlikely that the species inhabits the proposal area. If present at the site the species would likely be a transient visitor. The site contains only very common habitat for this species which the species would not rely on for its on-going local existence.
None	The habitat within the proposal area is unsuitable for the species.	The habitat within the proposal area is unsuitable for the species.

Likelihood of occurrence – Threatened flora and fauna

Scientific Name	Common Name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Credit type
Fish							
<i>Macquaria australasica</i>	Macquarie Perch	E	E	Species or species' habitat may occur within 10km (DAWE 2021a)	<p>The Macquarie Perch is known only from scattered localities in the cool upper reaches of the Murray-Darling system of New South Wales, including the Hawkesbury-Nepean and Shoalhaven catchments, Victoria and the Australian Capital Territory. Also found in man-made lakes on the NSW coast. The species inhabits cool, clear freshwaters of rivers with deep holes and shallow riffles. They are also found in lakes and reservoirs, where adults aggregate in small shoals during the spawning season.</p> <p>The proposal area does not contain suitable permanent watercourses for the species.</p>	None – habitat within the tributaries that cross the proposal area are not suitable given lack of permanent water.	N/A
<i>Prototroctes maraena</i>	Australian Grayling	-	V	Species or species' habitat may occur within 10km (DAWE 2021a)	<p>The Australian Grayling occurs in streams and rivers on the eastern and southern flanks of the Great Dividing Range, from Sydney, southwards to the Otway Ranges of Victoria and in Tasmania. The species is found in fresh and brackish waters of coastal lagoons, from Shoalhaven River in NSW to Ewan Ponds in South Australia.</p> <p>The proposal area does not contain suitable permanent watercourses for the species.</p>	Low – shallow and highly disturbed drainage lines and farm dams present do not provide suitable habitat for this species.	N/A
Amphibians							
<i>Litoria aurea</i>	Green and Golden Bell Frog	E	V	16 records within 10km (DPIE 2021a); Species or species' habitat known to occur within 10km (DAWE 2021a)	<p>Since 1990 there have been about 50 recorded locations of Green and Golden Bell Frog in NSW, most of which are small, coastal, or near coastal populations. These locations occur over the species' former range, however they are widely separated and isolated. Large populations in NSW are located around the metropolitan areas of Sydney, Shoalhaven and mid north coast (one an island population). There is only one known population on the NSW Southern Tablelands. The species inhabits marshes, dams and stream-sides, particularly those containing bullrushes (<i>Typha</i> spp.) or spikerushes (<i>Eleocharis</i> spp.). Optimal habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (<i>Gambusia holbrooki</i>), have a grassy area nearby and diurnal sheltering sites available. Some sites the species has been recorded in, occur in highly disturbed areas.</p>	<p>Low – Targeted survey confirmed the species is unlikely to use the proposal area.</p> <p>The habitat along the tributaries of South Creek that occur within the proposal area are less than ideal for the Green and Golden Bell Frog.</p>	Species

Scientific Name	Common Name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Credit type
<i>Litoria raniformis</i>	Southern Bell Frog	E	V	Species or species' habitat may occur within 10km (DAWE 2021a)	Currently, the Growling Grass Frog is known to exist only in isolated populations in the Coleambally Irrigation Area, the Lowbidgee floodplain and around Lake Victoria. A few yet unconfirmed records have also been made in the Murray Irrigation Area in recent years. The species is usually found in or around permanent or ephemeral Black Box/Lignum/Nitre Goosefoot swamps, Lignum/Typha swamps and River Red Gum swamps or billabongs along floodplains and river valleys. They are also found in irrigated rice crops, particularly where there is no available natural habitat. Breeding occurs during the warmer months and is triggered by flooding or a significant rise in water levels. The species has been known to breed anytime from early spring through to late summer/early autumn.	None –The species has not been recorded within 10 km of the proposal area. The proposal area is also not located within an area of known distribution (Bionet).	Species
<i>Heleioporus australiacus</i>	Giant Burrowing Frog	V	V	Species or species' habitat likely to occur within 10km (DAWE 2021a)	The Giant Burrowing Frog is distributed in south eastern NSW and Victoria, and appears to exist as two distinct populations: a northern population largely confined to the sandstone geology of the Sydney Basin and extending as far south as Ulladulla, and a southern population occurring from north of Narooma through to Walhalla, Victoria. It is found in heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based. The Giant Burrowing Frog has been recorded breeding in a range of water bodies associated with sandy environments of the coast and adjacent ranges from the Sydney Basin south the eastern Victoria. It breeds in hanging swamps, perennial non-flooding creeks and occasionally permanent pools, but permanent water must be present to allow its large tadpoles time to reach metamorphosis.	None – no suitable habitat is present.	N/A
Moluscs							
<i>Meridolum corneovirens</i>	Cumberland Plain Land Snail	E	-	529 records within 10km (DPIE 2021a)	Lives in small areas on the Cumberland Plain west of Sydney, from Richmond and Windsor south to Picton and from Liverpool west to the Hawkesbury and Nepean Rivers at the base of the Blue Mountains. The species primarily inhabits Cumberland Plain Woodland (a critically endangered ecological community). This community is a grassy, open woodland with occasional dense patches of shrubs. It is also known from Shale Gravel Transition Forests, Castlereagh Swamp Woodlands and the margins of River-flat Eucalypt Forest, which are also listed communities. It lives under litter of bark, leaves and logs, or shelters in loose soil around grass clumps. Occasionally shelters under rubbish.	Known – recorded in proposal area by Aurecon in September 2020.	Species

Scientific Name	Common Name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Credit type
<i>Pommerhelix duralensis</i>	Dural Land Snail	E	E	1 record within 10km (DPIE 2021a)	The Dural Land Snail is a shale-influenced-habitat specialist, which occurs in low densities along the western and northwest fringes of the Cumberland IBRA subregion on shale-sandstone transitional landscapes. The species is definitely found within the Local Government Areas of The Hills Shire, Hawkesbury Shire and Hornsby Shire. Records from the Blue Mountains City, Penrith City and Parramatta City may represent this species. Occurrence in Wollondilly Shire is considered unlikely in light of current knowledge. It favours sheltering under rocks or inside curled-up bark, it does not burrow nor climb.	Low – The proposal area does contain habitat that fits the description for the species, however the Dural Land Snail was not recorded during extensive targeted survey.	N/A
Birds							
<i>Actitis hypoleucos</i>	Common Sandpiper	-	M, MA, C, J, K	1 record within 10km, last recorded 1981 (DPIE 2021a)	Does not breed in Australia. When in Australia it is found on all coastlines and in inland areas, but is concentrated in the north and west with important areas in WA, the NT and Qld. Utilises a wide range of coastal and inland wetlands with varying salinity levels.	Low – farm dams are present immediately adjacent to the proposal area, however no preferred types such as mangroves, or rivers with pebbles occur. Unlikely to be present.	N/A
<i>Anthochaera phrygia</i>	Regent Honeyeater	CE	E,M	18 records within 10km (DPIE 2021a); Species or species' habitat known to occur within 10km (DAWE 2021a)	The Regent Honeyeater mainly inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. Birds are also found in drier coastal woodlands and forests in some years. Once recorded between Adelaide and the central coast of Queensland, its range has contracted dramatically in the last 30 years to between north-eastern Victoria and south-eastern Queensland. There are only three known key breeding regions remaining: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley and the Bundarra-Barraba region. In NSW the distribution is very patchy and mainly confined to the two main breeding areas and surrounding fragmented woodlands. In some years flocks converge on flowering coastal woodlands and forests. The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Regent Honeyeaters inhabit woodlands that support a significantly high abundance and species richness of bird species. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes.	Regarded in the BAM Calculator as a 'predicted - ecosystem credit species'. Therefore, the species is presumed to be present. The proposal area whoever, does not occur within the 'important Regent Honeyeater' map as per the BAM Important Areas Map. Therefore the 'species credit' component associated with Regent Honeyeater breeding habitat is not triggered.	Species/ ecosystem
<i>Apus pacificus</i>	Fork-tailed Swift	-	M	3 records within 10km (DPIE	The Fork-tailed Swift is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher. In Australia, they mostly occur over inland	Low – no nests found in proposal area during field survey. May fly over	N/A

Scientific Name	Common Name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Credit type
				2021a); Species or species' habitat likely to occur within 10km (DAWE 2021a)	plains but sometimes above foothills or in coastal areas. They often occur over cliffs and beaches and also over islands and sometimes well out to sea. They also occur over settled areas, including towns, urban areas and cities. They mostly occur over dry or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh. They are also found at treeless grassland and sandplains covered with spinifex, open farmland and inland and coastal sand-dunes. The sometimes occur above rainforests, wet sclerophyll forest or open forest or plantations of pines.	proposal area on occasion, however has a low likelihood of presence.	
<i>Ardea ibis</i>	Cattle Egret	-	M	Species or species' habitat may occur within 10km (DAWE 2021a)	The Cattle Egret is found in grasslands, woodlands and wetlands, and is not common in arid areas. It also uses pastures and croplands, especially where drainage is poor.	Known – recorded in proposal area by Niche ecologists in April 2021.	N/A
<i>Artamus cyanopterus cyanopterus</i>	Dusky Woodswallow	V	-	28 records within 10km (DPIE 2021a)	The Dusky Woodswallow is widespread from the coast to inland, including the western slopes of the Great Dividing Range and farther west. It is often recorded in woodlands and dry open sclerophyll forests, and has also been recorded in shrublands, heathlands regenerating forests and very occasionally in moist forests or rainforests. The understorey is typically open with sparse eucalypt saplings, acacias and other shrubs, often with coarse woody debris. It is also recorded in farmland, usually at the edges of forest or woodland or in roadside remnants or wind breaks with dead timber. The nest is an open shallow untidy cup frequently built in an open hollow, crevice or stump. Although Dusky Woodswallows have large home ranges, individuals may spend most of their time in about a 2 ha range and defend an area about 50 m around the nest. Dusky Woodswallows prefer larger remnants over smaller remnants. Competitive exclusion by Noisy Miners (<i>Manorina melanocephala</i>) is a significant threat to this species.	Regarded in the BAM Calculator as a 'predicted - ecosystem credit species'. Therefore, the species is presumed to be present.	Ecosystem
<i>Botaurus poiciloptilus</i>	Australasian Bittern	E	E	Species or species' habitat known to occur within 10km (DAWE 2021a)	Australasian Bitterns are widespread but uncommon over south-eastern Australia. In NSW they may be found over most of the state except for the far north-west. The Species favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (<i>Typha</i> spp.) and spikerushes (<i>Eleocharis</i> spp.), it hides during the day amongst dense reeds or rushes and feed mainly at night on frogs, fish, yabbies, spiders, insects and snails. The species may construct feeding platforms over deeper water from	Low – Farm dams are present immediately adjacent to proposal area however, vegetation is not dense and tall and no records occur nearby.	N/A

Scientific Name	Common Name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Credit type
					reeds trampled by the bird; platforms are often littered with prey remains.		
<i>Burhinus grallarius</i>	Bush Stone-curlew	E	-	2 records within 10km, last recorded 1996 (DPIE 2021a)	The Bush Stone-curlew is found throughout Australia except for the central southern coast and inland, the far south-east corner, and Tasmania. Only in northern Australia is it still common however and in the south-east it is either rare or extinct throughout its former range. It inhabits open forests and woodlands with a sparse grassy groundlayer and fallen timber, it's diet consists of insects and small vertebrates, such as frogs, lizards and snakes. It is largely nocturnal, being especially active on moonlit nights and nests on the ground in a scrape or small bare patch.	Low – limited areas of open woodlands with fallen timber occur within the proposal area. The species was not recorded during field surveys, nor has it been recorded within immediately surrounding area. The species is unlikely to use the proposal area as habitat.	Species
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	-	M, MA	1 record within 10km (DPIE 2021a)	Spends the non-breeding season in Australia with small numbers occurring regularly in New Zealand. Most of the population migrates to Australia, mostly to the south-east and are widespread in both inland and coastal locations and in both freshwater and saline habitats. Many inland records are of birds on passage. In Australasia, prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. Breeds in northern Siberia.	Low – the proposal area does not contain extensive areas of wetland habitat. There are a number of farm dams and small areas consisting of native flora that prefer wetter environments, that occur immediately adjacent to the proposal area. It is however, unlikely that such habitat presents important foraging and breeding habitat for the species.	N/A
<i>Calidris ferruginea</i>	Curlew Sandpiper	E	CE, M, MA	Species or species' habitat may occur within 10km (DAWE 2021a)	It occurs along the entire coast of NSW, particularly in the Hunter Estuary, and sometimes in freshwater wetlands in the Murray-Darling Basin. It generally occupies littoral and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats of sheltered coasts. It also occurs in non-tidal swamps, lakes and lagoons on the coast and sometimes the inland. Northern hemisphere breeding.	Dual credit species in the TBDC. Dual credit species in the TBDC. Regarded in the BAM Calculator as a 'predicted - ecosystem credit species'. Therefore, foraging habitat for the species is presumed to be present, however it should be noted that the proposal area does not	Species/ecosystem (SAll breeding/foraging)

Scientific Name	Common Name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Credit type
						contain preferred habitat (such as freshwater wetlands and estuaries not in proposal area). It therefore has a low likelihood of occurrence.	
<i>Calidris melanotos</i>	Pectoral Sandpiper	-	M, MA	Species or species' habitat may occur within 10km (DAWE 2021a)	Prefers shallow fresh to saline wetlands, found at coastal lagoons, estuaries, bays, swamps, inundated grasslands, saltmarshes and artificial wetlands. Northern hemisphere breeding.	Low – habitat preferences such as freshwater wetlands and estuaries not in proposal area.	N/A
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	V	-	1 record within 10km (DPIE 2021a)	In summer, occupies tall montane forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. Also occur in subalpine snow gum woodland and occasionally in temperate or regenerating forest. In winter, occurs at lower altitudes in drier, more open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry forest in coastal areas. It requires tree hollows in which to breed.	Dual credit species in the TBDC. Regarded in the BAM Calculator as a 'predicted - ecosystem credit species'. Therefore, foraging habitat for the species is presumed to be present. Breeding habitat (which constitutes the 'species credit' component does not occur within the proposal area given hollows are not of suitable size as per the TBDC.	Species/ ecosystem
<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo	V	-	2 records within 10km (DPIE 2021a)	The species is uncommon although widespread throughout suitable forest and woodland habitats, from the central Queensland coast to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW, with a small population in the Riverina. It inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur. Black Sheoak (<i>Allocasuarina littoralis</i>) and Forest Sheoak (<i>A. torulosa</i>) are important foods. Inland populations feed on a wide range of sheoaks, including Drooping Sheoak, <i>Allocasuarina diminuta</i> , and <i>A. gymnathera</i> . Belah is also utilised and may be a critical food source for some populations. The species is dependent on large hollow-bearing eucalypts for nest sites.	Dual credit species in the TBDC. Regarded in the BAM Calculator as a 'predicted - ecosystem credit species'. Therefore, foraging habitat for the species is presumed to be present. Breeding habitat (which constitutes the 'species credit' component does not occur within the proposal area given	Species/ ecosystem

Scientific Name	Common Name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Credit type
						hollows are not of suitable size as per the TBDC.	
<i>Chthonicola sagittata</i>	Speckled Warbler	V	-	19 records within 10km (DPIE 2021a)	The Speckled Warbler has a patchy distribution throughout south-eastern Queensland, the eastern half of NSW and into Victoria, as far west as the Grampians. The species is most frequently reported from the hills and tablelands of the Great Dividing Range, and rarely from the coast. There has been a decline in population density throughout its range, with the decline exceeding 40% where no vegetation remnants larger than 100ha survive. The Speckled Warbler lives in a wide range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies, typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an area.	Regarded in the BAM Calculator as a 'predicted - ecosystem credit species'. Therefore, foraging habitat for the species is presumed to be present.	Ecosystem
<i>Circus assimilis</i>	Spotted Harrier	V	-	-	The Spotted Harrier occurs throughout the Australian mainland, except in densely forested or wooded habitats of the coast, escarpment and ranges, and rarely in Tasmania. Individuals disperse widely in NSW and comprise a single population. The species occurs in grassy open woodland including Acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands.	Regarded in the BAM Calculator as a 'predicted - ecosystem credit species'. Therefore, foraging habitat for the species is presumed to be present.	Ecosystem
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subspecies)	V	-	1 record within 10km (DPIE 2021a)	The western boundary of the range of the Brown Treecreeper runs about through Corowa, Wagga Wagga, Temora, Forbes, Dubbo and Inverell and along this line the subspecies intergrades with the arid zone subspecies of Brown Treecreeper which then occupies the remaining parts of the state. The species is often found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species; also found in mallee and River Red Gum (<i>Eucalyptus camaldulensis</i>) Forest bordering wetlands with an open understorey of acacias, saltbush, lignum, cumbungi and grasses; usually not found in woodlands with a dense shrub	Regarded in the BAM Calculator as a 'predicted - ecosystem credit species'. Therefore, foraging habitat for the species is presumed to be present.	Ecosystem

Scientific Name	Common Name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Credit type
					layer; fallen timber is an important habitat component for foraging; also recorded, though less commonly, in similar woodland habitats on the coastal ranges and plains.		
<i>Cuculus optatus</i>	Oriental Cuckoo	-	M, MA	Species or species' habitat known to occur within 10km (DAWE 2021a)	This species migrates to northern and eastern Australia in the warmer months. Occurs south to the Shoalhaven area. Occurs in a range of habitats, including monsoon forest, rainforest edges, leafy trees in paddocks, river flats, roadsides and mangroves.	Low – habitat preferences not in proposal area.	N/A
<i>Daphoenositta chrysoptera</i>	Varied Sittella	V	-	40 records within 10km (DPIE 2021a)	The Varied Sittella is sedentary and inhabits most of mainland Australia except the treeless deserts and open grasslands. Distribution in NSW is nearly continuous from the coast to the far west. The species inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland.	Regarded in the BAM Calculator as a 'predicted - ecosystem credit species'. Therefore, foraging habitat for the species is presumed to be present.	Ecosystem
<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork	E	-	2 records within 10km (DPIE 2021a)	In Australia, Black-necked Storks are widespread in coastal and subcoastal northern and eastern Australia, as far south as central NSW (although vagrants may occur further south or inland, well away from breeding areas). In NSW, the species becomes increasingly uncommon south of the Clarence Valley, and rarely occurs south of Sydney. Since 1995, breeding has been recorded as far south as Buladelah. Floodplain wetlands (swamps, billabongs, watercourses and dams) of the major coastal rivers are the key habitat in NSW for the Black-necked Stork. Secondary habitat includes minor floodplains, coastal sandplain wetlands and estuaries.	Regarded in the BAM Calculator as a 'predicted - ecosystem credit species'. Therefore, foraging habitat for the species is presumed to be present.	Ecosystem
<i>Falco hypoleucos</i>	Grey Falcon	E	V	Species or species' habitat likely to occur within 10km (DAWE 2021a)	The Grey Falcon is sparsely distributed in NSW, chiefly throughout the Murray-Darling Basin, with the occasional vagrant east of the Great Dividing Range. The species is usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions, although it is occasionally found in open woodlands near the coast. It also occurs near wetlands where surface water attracts prey.	Regarded in the BAM Calculator as a 'predicted - ecosystem credit species'. However, it should be noted that the proposal area does not occur within the range for the threatened species. It is therefore highly unlikely to be present.	Ecosystem
<i>Gallinago hardwickii</i>	Latham's Snipe	-	M,MA	11 records within 10km	Latham's Snipe is a non-breeding migrant to the south east of Australia including Tasmania, passing through the north and	Low – habitat preferences are not	N/A

Scientific Name	Common Name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Credit type
				(DPIE 2021a)	New Guinea on passage. Latham's Snipe breed in Japan and on the east Asian mainland. Latham's Snipe are seen in small groups or singly in freshwater wetlands on or near the coast, generally among dense cover. They are found in any vegetation around wetlands, in sedges, grasses, lignum, reeds and rushes and also in saltmarsh and creek edges on migration. They also use crops and pasture.	ideal in the proposal area. The proposal area lacks suitable inundation areas.	
<i>Glossopsitta pusilla</i>	Little Lorikeet	V	-	8 records within 10km (DPIE 2021a)	The Little Lorikeet is distributed widely across the coastal and Great Divide regions of eastern Australia from Cape York to South Australia. NSW provides a large portion of the species' core habitat, with lorikeets found westward as far as Dubbo and Albury. Nomadic movements are common, influenced by season and food availability, although some areas retain residents for much of the year and 'locally nomadic' movements are suspected of breeding pairs. The species forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in Angophora, Melaleuca and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity.	Regarded in the BAM Calculator as a 'predicted - ecosystem credit species'. Therefore, the species is presumed to be present.	Ecosystem
<i>Grantiella picta</i>	Painted Honeyeater	V	V	Species or species' habitat likely to occur within 10km (DAWE 2021a)	The Painted Honeyeater is nomadic and occurs at low densities throughout its range. The greatest concentrations of the bird and almost all breeding occurs on the inland slopes of the Great Dividing Range in NSW, Victoria and southern Queensland. During the winter it is more likely to be found in the north of its distribution. The species inhabits Boree/ Weeping Myall (<i>Acacia pendula</i>), Brigalow (<i>A. harpophylla</i>) and Box-Gum Woodlands and Box-Ironbark Forests. It is a specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus <i>Amyema</i> .	Regarded in the BAM Calculator as a 'predicted - ecosystem credit species'. However, it should be noted that the proposal area occurs towards its far eastern distribution, and does not contain suitable habitat (ie. Box Gum Woodland and Myall Woodland. The species therefore has a low likelihood to occur in the proposal area.	Ecosystem
<i>Haliaeetus leucogaster</i>	White-bellied Sea Eagle	-	M	15 records within 10km (DPIE 2021a)	The White-bellied Sea-eagle is widespread along the New South Wales coast, and along all major inland rivers and waterways. The species habitats are characterised by the presence of large areas of open water including larger rivers, swamps, lakes, and the sea. It occurs at sites near the sea or sea-shore, such as around bays and inlets, beaches, reefs, lagoons, estuaries and mangroves; and at, or in the vicinity of freshwater swamps, lakes, reservoirs, billabongs and saltmarsh. The terrestrial habitats the species has been	Dual credit species in the TBDC. Regarded in the BAM Calculator as a 'predicted - ecosystem credit species'. Therefore, foraging habitat for the species is presumed to be present.	Species/ecosystem

Scientific Name	Common Name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Credit type
					recorded in, include coastal dunes, tidal flats, grassland, heathland, woodland, and forest (including rainforest).	Breeding habitat (which constitutes the 'species credit' component) is the presence of nests. The field survey confirmed that the proposal area does not contain nests for the species.	
<i>Hieraaetus morphnoides</i>	Little Eagle	V	-	21 records within 10km (DPIE 2021a)	The Little Eagle is found throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment. It occurs as a single population throughout NSW. The species occupies open eucalypt forest, woodland or open woodland. Sheoak or Acacia woodlands and riparian woodlands of interior NSW are also used. It nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter.	Dual credit species in the TBDC. The species is regarded in the BAM Calculator as a 'predicted - ecosystem credit species'. Therefore, foraging habitat for the species is presumed to be present. Breeding habitat (which constitutes the 'species credit' component) is the presence of nests. The field survey confirmed that the proposal area does not contain nests for the species.	Species/ecosystem
<i>Hirundapus caudacutus</i>	White-throated Needletail	-	M	Species or species' habitat known to occur within 10km (DAWE 2021a)	White-throated Needletails often occur in large numbers over eastern and northern Australia. White-throated Needletails are aerial birds and for a time it was commonly believed that they did not land while in Australia. It has now been observed that birds will roost in trees, and radio-tracking has since confirmed that this is a regular activity. White-throated Needletails are non-breeding migrants in Australia. Breeding takes place in northern Asia.	Low – may fly over the site on occasion but highly unlikely to rely on the habitat features of the site for migration and foraging.	-
<i>Ixobrychus flavicollis</i>	Black Bittern	V	-	2 records within 10km (DPIE 2021a)	In NSW, records of the Black Bittern are scattered along the east coast, with individuals rarely being recorded south of Sydney or inland. The species inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. Where permanent water is present, the species may occur in flooded grassland, forest, woodland, rainforest and mangroves.	Regarded in the BAM Calculator as a 'predicted - ecosystem credit species'. Therefore, the species is presumed to be present.	Ecosystem
<i>Lathamus discolor</i>	Swift parrot	E	E	40 records within 10km	The Swift Parrot breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-	Dual credit species in the TBDC. The species	Species/ecosystem (SAI)

Scientific Name	Common Name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Credit type
				(DPIE 2021a); Species or species' habitat known to occur within 10km (DAWE 2021a)	eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. In NSW mostly occurs on the coast and south west slopes. On the mainland the species occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Their favoured feed trees include winter flowering species such as Swamp Mahogany Eucalyptus robusta, Spotted Gum Corymbia maculata, Red Bloodwood C. gummifera, Forest Red Gum E. tereticornis, Mugga Ironbark E. sideroxylon, and White Box E. albens.	is regarded in the BAM Calculator as a 'predicted - ecosystem credit species'. Therefore, foraging habitat for the species is presumed to be present. The 'species credit' component is triggered if the proposal area occurs in an area mapped as 'important Swift Parrot habitat. The proposal areas does not occur within this mapped area of important habitat and thus the species credit component does not apply.	breeding/foraging)
<i>Lophoictinia isura</i>	Square-tailed Kite	V	-	4 records within 10km (DPIE 2021a)	The Square-tailed Kite ranges along coastal and subcoastal areas from south-western to northern Australia, Queensland, NSW and Victoria. In NSW, scattered records of the species throughout the state indicate that the species is a regular resident in the north, north-east and along the major west-flowing river systems. It is a summer breeding migrant to the south-east, including the NSW south coast, arriving in September and leaving by March. The species is found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses. In arid north-western NSW, it has been observed in stony country with a ground cover of chenopods and grasses, open acacia scrub and patches of low open eucalypt woodland.	Dual credit species in the TBDC. Regarded in the BAM Calculator as a 'predicted - ecosystem credit species'. Therefore, the species is presumed to be present. Breeding habitat is defined in the TBDC as ' <i>live large old trees within suitable vegetation and the presence of a male and female; or female with nesting material; or an individual on a large stick nest in the top half of the tree canopy</i> '. The proposal area does not contain any significantly large trees that would offer suitable habitat for the species,	Species/ecosystem

Scientific Name	Common Name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Credit type
						nor do any stick nests occur. Furthermore, the species was not detected during the field campaign.	
<i>Melanodryas cucullata cucullata</i>	Hooded Robin (south-eastern form)	V	-	-	The Hooded Robin is widespread, found across Australia, except for the driest deserts and the wetter coastal areas - northern and eastern coastal Queensland and Tasmania. However, it is common in few places, and rarely found on the coast. It is considered a sedentary species, but local seasonal movements are possible. The south-eastern form (subspecies <i>cucullata</i>) is found from Brisbane to Adelaide and throughout much of inland NSW, with the exception of the extreme north-west, where it is replaced by subspecies <i>picata</i> . The species prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. It also requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses.	Regarded in the BAM Calculator as a 'predicted - ecosystem credit species'. Therefore, the species is presumed to be present.	Ecosystem
<i>Melithreptus gularis gularis</i>	Black-chinned Honeyeater	V	-	1 record within 10km (DPIE 2021a)	In NSW the Black-chinned Honeyeater is widespread, with records from the tablelands and western slopes of the Great Dividing Range to the north-west and central-west plains and the Riverina. It is rarely recorded east of the Great Dividing Range, although regularly observed from the Richmond and Clarence River areas. It has also been recorded at a few scattered sites in the Hunter, Central Coast and Illawarra regions, though it is very rare in the latter. The species occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (<i>Eucalyptus sideroxylon</i>), White Box (<i>E. albens</i>), Inland Grey Box (<i>E. microcarpa</i>), Yellow Box (<i>E. melliodora</i>), Blakely's Red Gum (<i>E. blakelyi</i>) and Forest Red Gum (<i>E. tereticornis</i>). It also inhabits open forests of smooth-barked gums, stringybarks, ironbarks, river sheoaks (nesting habitat) and tea-trees.	Regarded in the BAM Calculator as a 'predicted - ecosystem credit species'. Therefore, the species is presumed to be present.	Ecosystem
<i>Monarcha melanopsis</i>	Black-faced Monarch	-	M	Species or species' habitat known to occur within 10km	The Black-faced Monarch is found along the coast of eastern Australia, becoming less common further south. It is found in rainforests, eucalypt woodlands, coastal scrub and damp gullies. It may be found in more open woodland when migrating.	Low – habitat preferences not in proposal area. While remnant and regenerating Eucalypt woodlands are present, they consist of highly disturbed roadside	N/A

Scientific Name	Common Name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Credit type
				(DAWE 2021a)		patches. No rainforests, coastal scrub or damp gullies occur within the proposal area.	
<i>Motacilla flava</i>	Yellow Wagtail	-	M, MA	Species or species' habitat likely to occur within 10km (DAWE 2021a)	The Yellow Wagtail breeds in temperate Europe and Asia. They occur within Australia in open country habitat with disturbed ground and some water. Recorded in short grass and bare ground, swamp margins, sewage ponds, saltmarshes, playing fields, airfields, ploughed land and town lawns.	Moderate – Disturbed areas containing grass occur within the proposal area, and waterbodies occur nearby however, no records of this species occur nearby with the nearest record being over 23km from the proposal area.	N/A
<i>Myiagra cyanoleuca</i>	Satin Flycatcher	-	M	Species or species' habitat known to occur within 10km (DAWE 2021a)	The Satin Flycatcher is found along the east coast of Australia from far northern Queensland to Tasmania, including south-eastern South Australia. It is also found in New Guinea. The Satin Flycatcher is not a commonly seen species, especially in the far south of its range, where it is a summer breeding migrant. The Satin Flycatcher is found in tall forests, preferring wetter habitats such as heavily forested gullies, but not rainforests.	Low – habitat preferences (such as gullies, wetter habitat types, tall forest and rainforest) are not present in proposal area.	N/A
<i>Neophema pulchella</i>	Turquoise Parrot	V	-	-	The Turquoise Parrot's range extends from southern Queensland through to northern Victoria, from the coastal plains to the western slopes of the Great Dividing Range. The species typically lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland.	Regarded in the BAM Calculator as a 'predicted - ecosystem credit species'. Therefore, the species is presumed to be present.	Ecosystem
<i>Ninox connivens</i>	Barking Owl	V	-	-	The Barking Owl is found throughout continental Australia except for the central arid regions. The owls sometimes extend their home range into urban areas, hunting birds in garden trees and insects attracted to streetlights. Extensive wildfires in 2019-20 reduced habitat quality further, burnt many old, hollow-bearing trees needed as refuge by prey species and reduced the viability of some regional owl populations. The species inhabit woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas. Sometimes able to successfully breed along timbered watercourses in heavily cleared habitats (e.g. western NSW) due to the higher density of prey found on these fertile riparian soils. The species	Dual credit species listed in the TBDC. The species is regarded in the BAM Calculator as a 'predicted - ecosystem credit species'. Therefore, foraging habitat for the species is presumed to be present. The 'species credit' component is triggered if the proposal area	Ecosystem/ species

Scientific Name	Common Name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Credit type
					typically roost in shaded portions of tree canopies, including tall midstorey trees with dense foliage such as Acacia and Casuarina species.	contains known nest tree(s) Potential nest trees are living or dead trees with hollows greater than 20 cm diameter and greater than 4 m above the ground. The proposal area did not contain a living or dead tree with a hollow greater than 20 cm diameter and greater than 4m above the ground. Breeding habitat is therefore unlikely to be present.	
<i>Ninox strenua</i>	Powerful Owl	V	-	10 records within 10km (DPIE 2021a)	"The Powerful Owl is endemic to eastern and south-eastern Australia, mainly on the coastal side of the Great Dividing Range from Mackay to south-western Victoria. In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered records on the western slopes and plains suggesting occupancy prior to land clearing. Now at low densities throughout most of its eastern range, rare along the Murray River and former inland populations may never recover. The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest.	Dual credit species listed in the TBDC. Regarded in the BAM Calculator as a 'predicted - ecosystem credit species'. Therefore, foraging habitat for the species is presumed to be present. The 'species credit' component is triggered if the proposal area contains known nest tree(s) Potential nest trees are living or dead trees with hollows greater than 20 cm diameter and greater than 4 m above the ground. The proposal area did not contain a living or dead tree with a hollow	Ecosystem/species

Scientific Name	Common Name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Credit type
						greater than 20 cm diameter and greater than 4m above the ground. Breeding habitat is therefore unlikely to be present.	
<i>Numenius madagascariensis</i>	Eastern Curlew	-	CE, MA, M	Species or species' habitat may occur within 10km (DAWE 2021a)	The Eastern Curlew is widespread in coastal regions in the north-east and south of Australia, including Tasmania, and scattered in other coastal areas. It is rarely seen inland. It breeds in Russia and north-eastern China. On passage, they are commonly seen in Japan, Korea and Borneo. Small numbers visit New Zealand. The Eastern Curlew is found on intertidal mudflats and sandflats, often with beds of seagrass, on sheltered coasts, especially estuaries, mangrove swamps, bays, harbours and lagoons.	Low – habitat preferences (such as estuaries, mudflats, wetter habitat types, etc.) are not present in proposal area.	N/A
<i>Pandion cristatus</i>	Eastern Osprey	V	M, MA	-	Found right around the Australian coast line, except for Victoria and Tasmania. They are common around the northern coast, especially on rocky shorelines, islands and reefs. The species is uncommon to rare or absent from closely settled parts of south-eastern Australia. Favour coastal areas, especially the mouths of large rivers, lagoons and lakes. Feed on fish over clear, open water.	Dual credit species in the TBDC. Regarded in the BAM Calculator as a 'predicted - ecosystem credit species'. Therefore, the species is presumed to be present. Breeding habitat is defined in the TBDC as nests. The proposal area does not contain any stick nests occur. Furthermore, the species was not detected during the field campaign.	Species/ecosystem
<i>Petroica boodang</i>	Scarlet Robin	V	-	4 records within 10km (DPIE 2021a)	In NSW, the Scarlet Robin from the coast to the inland slopes. After breeding, some Scarlet Robins disperse to the lower valleys and plains of the tablelands and slopes. Some birds may appear as far west as the eastern edges of the inland plains in autumn and winter. The Scarlet Robin lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. This species lives in both mature and regrowth vegetation. It occasionally occurs in mallee or wet forest communities, or in	Regarded in the BAM Calculator as a 'predicted - ecosystem credit species'. Therefore, the species is presumed to be present.	Ecosystem

Scientific Name	Common Name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Credit type
					wetlands and tea-tree swamps. The species habitat usually contains abundant logs and fallen timber: these are important components of its habitat.		
<i>Petroica phoenicea</i>	Flame Robin	V	-	4 records within 10km (DPIE 2021a)	In NSW, the Flame Robin breeds in upland areas and in winter, many birds move to the inland slopes and plains. It is likely that there are two separate populations in NSW, one in the Northern Tablelands, and another ranging from the Central to Southern Tablelands. The species breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes, it prefers clearings or areas with open understoreys.	Regarded in the BAM Calculator as a 'predicted - ecosystem credit species'. Therefore, the species is presumed to be present.	Ecosystem
<i>Rhipidura rufifrons</i>	Rufous Fantail	-	M	Species or species' habitat known to occur within 10km (DAWE 2021a)	The Rufous Fantail is found along NSW coast and ranges. Inhabits rainforest, dense wet forests, swamp woodlands and mangroves. During migration, it may be found in more open habitats or urban areas.	Low – habitat preferences not in proposal area. No rainforests, dense wet forests, swamp woodlands or mangroves occur within the proposal area. This species sometimes occurs in more urban areas during migration so may fly through the site on occasion however, no records of this species occur nearby.	N/A
<i>Rostratula australis</i>	Australian Painted Snipe	E	E, M, MA	1 record within 10km (DPIE 2021a); Species or species' habitat known to occur within 10km (DAWE 2021a)	In NSW many records of the Australian Painted Snipe are from the Murray-Darling Basin including the Paroo wetlands, Lake Cowal, Macquarie Marshes, Fivebough Swamp and more recently, swamps near Balldale and Wanganella. Other important locations with recent records include wetlands on the Hawkesbury River and the Clarence and lower Hunter Valleys. The species prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber.	Regarded in the BAM Calculator as a 'predicted - ecosystem credit species'. Therefore, the species is presumed to be present.	Ecosystem
<i>Stagonopleura guttata</i>	Diamond Firetail	V	-	3 records within 10km	The Diamond Firetail is endemic to south-eastern Australia, extending from central Queensland to the Eyre Peninsula in South Australia. It is widely distributed in NSW, with a concentration of records from the Northern, Central and	Regarded in the BAM Calculator as a 'predicted - ecosystem credit species'.	Ecosystem

Scientific Name	Common Name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Credit type
				(DPIE 2021a)	Southern Tablelands, the Northern, Central and South Western Slopes and the North West Plains and Riverina. Not commonly found in coastal districts, though there are records from near Sydney, the Hunter Valley and the Bega Valley. This species has a scattered distribution over the rest of NSW, though is very rare west of the Darling River. The species is found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum Eucalyptus pauciflora Woodlands. It also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities, and often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland.	Therefore, the species is presumed to be present.	
<i>Stictonetta naevosa</i>	Freckled Duck	V	-	3 records within 10km (DPIE 2021a)	The Freckled Duck is found primarily in south-eastern and south-western Australia, occurring as a vagrant elsewhere. It breeds in large temporary swamps created by floods in the Bulloo and Lake Eyre basins and the Murray-Darling system, particularly along the Paroo and Lachlan Rivers, and other rivers within the Riverina. The duck is forced to disperse during extensive inland droughts when wetlands in the Murray River basin provide important habitat. The species may also occur as far as coastal NSW and Victoria during such times. The species prefer permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds.	Regarded in the BAM Calculator as a 'predicted - ecosystem credit species'. Therefore, the species is presumed to be present.	Ecosystem
<i>Tringa glareola</i>	Wood Sandpiper	-	M, MA	2 records within 10km, last recorded 1988 (DPIE 2021a)	Breeds in Northern Hemisphere. In Australia the Wood Sandpiper shuns coastal mudflats, instead occurring in shallow, freshwater wetlands, usually where there is grass or aquatic plants protruding above the water, and often with trees and much fallen timber. The species occurs in largest numbers in NW Australia, with all sites of national importance within WA. In NSW there are records east of the Divide north from Nowra, and inland from the upper and lower Western regions. Uses well-vegetated, shallow, freshwater wetlands and are typically associated with wetlands supporting emergent aquatic plants or grass and taller fringing vegetation such as dense reeds/rushes, shrubs or trees. Also frequent flooded grasslands and irrigated crops. Rarely in brackish wetlands or saltmarsh. Known from artificial wetlands.	Low –Dense reeds and rushes are absent for the proposal area. The species has not been recorded in the area for the past 30 years.	N/A

Scientific Name	Common Name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Credit type
<i>Tringa nebularia</i>	Common Greenshank	-	M,MA	1 record within 10km (DPIE 2021a)	The Common Greenshank breeds in the Palaearctic regions and is widespread in Africa, Coastal Asia, the Indian subcontinent, the Philippines and southern New Guinea. They are common throughout Australia in the summer. Common Greenshanks are found both on the coast and inland, in estuaries and mudflats, mangrove swamps and lagoons, and in billabongs, swamps, sewage farms and flooded crops.	Low – habitat preferences not in proposal area.	N/A
<i>Tyto novaehollandiae</i>	Masked Owl	V	-	5 records within 10km (DPIE 2021a)	The Masked Owl occurs from the coast where it is most abundant to the western plains. Overall records for this species fall within about 90% of NSW, excluding the most arid north-western corner. There is no seasonal variation in its distribution. This species lives in dry eucalypt forests and woodlands from sea level to 1100 m and often hunts along the edges of forests, including roadsides. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting.	<p>Dual credit species listed in the TBDC.</p> <p>Regarded in the BAM Calculator as a 'predicted - ecosystem credit species'. Therefore, foraging habitat for the species is presumed to be present.</p> <p>The 'species credit' component is triggered if the proposal area contains known nest tree(s)</p> <p>Potential nest trees are living or dead trees with hollows greater than 20 cm diameter and greater than 4 m above the ground.</p> <p>The proposal area did not contain a living or dead tree with a hollow greater than 20 cm diameter and greater than 4m above the ground. Breeding habitat is therefore unlikely to be present.</p>	Species/ecosystem
<i>Tyto tenebricosa</i>	Sooty Owl	V	-	1 record within 10km (DPIE 2021a)	The Sooty Owl occupies the easternmost one-eighth of NSW, occurring on the coast, coastal escarpment and eastern tablelands. This species occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests. Sooty Owls roost by day in the	<p>Dual credit species listed in the TBDC.</p> <p>Regarded in the BAM Calculator as a</p>	N/A

Scientific Name	Common Name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Credit type
					hollow of a tall forest tree or in heavy vegetation and nest in very large tree hollows. This species hunts by night for small ground mammals or tree-dwelling mammals such as the Common Ringtail Possum (<i>Pseudocheirus peregrinus</i>) or Sugar Glider (<i>Petaurus breviceps</i>).	<p>'predicted - ecosystem credit species'. Therefore, foraging habitat for the species is presumed to be present.</p> <p>The 'species credit' component is triggered if the proposal area contains known nest tree(s)</p> <p>Potential nest trees are living or dead trees with hollows greater than 20 cm diameter and greater than 4 m above the ground.</p> <p>The 'species credit' component may also be triggered if the site contains cliffs and overhangs.</p> <p>The proposal area did not contain a living or dead tree with a hollow greater than 20 cm diameter and greater than 4m above the ground. Nor does the site contain cliffs and overhangs. Breeding habitat is therefore unlikely to be present.</p>	
Mammals							
<i>Cercartetus nanus</i>	Eastern Pygmy Possum	V	-		The Eastern Pygmy-possum is found in south-eastern Australia, from southern Queensland to eastern South Australia and in Tasmania. In NSW it extends from the coast inland as far as the Pilliga, Dubbo, Parkes and Wagga Wagga on the western slopes. The species is found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred, except in north-eastern NSW where they are most frequently	Low – The field survey did not detect the Eastern Pygmy Possum. The proposal area also does not occur within a location that fits the distribution of the species as described in the Scientific	Species

Scientific Name	Common Name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Credit type
					encountered in rainforest. It feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes and is an important pollinator of heathland plants such as banksias; soft fruits are eaten when flowers are unavailable.	Determination for the species - 'In New South Wales the species is found in coastal areas and at higher elevation in the south, but north of Newcastle at higher elevation only'. This is supported by the closest record for the Eastern Pygmy Possum, occurring 12.6 km to the west of the proposal area in the Blue Mountains area.	
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	1 record within 10km (DPIE 2021a); Species or species' habitat known to occur within 10km (DAWE 2021a)	The Large-eared Pied Bat is found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW. There are scattered records from the New England Tablelands and North West Slopes. The species roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (<i>Petrochelidon ariel</i>), frequenting low to mid-elevation dry open forest and woodland close to these features. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves and overhangs. It is found in well-timbered areas containing gullies.	Low – the species was not detected during Anabat analysis, and furthermore, the site does not occur within 2km of cliffines.	Species
<i>Dasyurus maculatus</i>	Spotted-tail Quoll	V	E	4 records within 10km (DPIE 2021a); Species or species' habitat known to occur within 10km (DAWE 2021a)	The range of the Spotted-tailed Quoll has contracted considerably since European settlement. It is now found in eastern NSW, eastern Victoria, south-east and north-eastern Queensland, and Tasmania. Only in Tasmania is it still considered relatively common. The species has been recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock outcrops and rocky-cliff faces as den sites. Females occupy home ranges of 200-500 hectares, while males occupy very large home ranges from 500 to over 4000 hectares. Are known to traverse their home ranges along densely vegetated creeklines.	Regarded in the BAM Calculator as a 'predicted - ecosystem credit species'. Therefore, the species is presumed to be present. Low likelihood to utilise the proposal area on a regular basis. This is supported by the small number of records which occur in the locality, and the lack of connectivity to nearby bushland.	Ecosystem

Scientific Name	Common Name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Credit type
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V	-	13 records within 10km (DPIE 2021a)	The Eastern False Pipistrelle is found on the south-east coast and ranges of Australia, from southern Queensland to Victoria and Tasmania. The species prefer moist habitats, with trees taller than 20 m.	Regarded in the BAM Calculator as a 'predicted - ecosystem credit species'. Therefore, the species is presumed to be present. Moderate – not recorded during anabat analysis however may forage in the proposal area however, no breeding habitat.	Ecosystem
<i>Micronomus norfolkensis</i>	Eastern Freetail-bat	V	-	43 records within 10km (DPIE 2021a)	The Eastern Freetail-bat is found along the east coast from south Queensland to southern NSW. The species typically inhabit dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. It roosts mainly in tree hollows but will also roost under bark or in man-made structures.	Regarded in the BAM Calculator as a 'predicted - ecosystem credit species'. Therefore, the species is presumed to be present. Moderate – not recorded during anabat analysis however may forage in the proposal area however, no breeding habitat.	Ecosystem
<i>Miniopterus australis</i>	Little Bentwing-bat	V	-	7 records within 10km (DPIE 2021a)	The Little Bentwing-bat occurs along the east coast and ranges of Australia from Cape York in Queensland to Wollongong in NSW. It prefers moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas. The species roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats.	Dual credit species listed in the TBDC. Regarded in the BAM Calculator as a 'predicted - ecosystem credit species'. Therefore, foraging habitat for the species is presumed to be present. The 'species credit' component is triggered if the proposal area contains breeding habitat (defined in TBDC as - Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding	Species/ecosystem (SAll breeding)

Scientific Name	Common Name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Credit type
						<p><i>including species records in BioNet with microhabitat code 'IC – in cave'; observation type code 'E nest-roost'; with numbers of individuals >500; or from the scientific literature".</i></p> <p>The species was recorded during the anabat analysis – and discussed in section 4.2.6.</p>	
<i>Miniopterus orianaes oceanensis</i>	Large Bent-winged Bat	V	-	63 records within 10km (DPIE 2021a)	Large Bentwing-bats occur along the east and north-west coasts of Australia. The species use caves as the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures.	<p>Dual credit species listed in the TBDC.</p> <p>Regarded in the BAM Calculator as a 'predicted - ecosystem credit species'. Therefore, foraging habitat for the species is presumed to be present.</p> <p>The 'species credit' component is triggered if the proposal area contains breeding habitat (defined in TBDC as - <i>Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records in BioNet with microhabitat code 'IC – in cave'; observation type code 'E nest-roost'; with numbers of individuals >500; or from the scientific literature".</i></p> <p>The species was recorded during the anabat analysis – and</p>	Species/ ecosystem

Scientific Name	Common Name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Credit type
						discussed in section 4.2.6.	
<i>Myotis macropus</i>	Southern Myotis	V	-	48 records within 10km (DPIE 2021a)	The Southern Myotis is mainly coastal but may occur inland along large river systems. Usually associated with permanent waterways at low elevations in flat/undulating country, usually in vegetated areas. Forages over streams and watercourses feeding on fish and insects from the water surface. Roosts in a variety of habitats including caves, mine shafts, hollow-bearing trees, stormwater channels, buildings, under bridges and in dense foliage, typically in close proximity to water.	Species recorded during field survey on anabat device. The species is discussed in section 4.2.6.	Species
<i>Petauroides volans</i>	Greater Glider	-	V	Species or species' habitat likely to occur within 10km (DAWE 2021a)	The greater glider is restricted to eastern Australia, occurring from the Windsor Tableland in north Queensland through to central Victoria (Wombat State Forest), with an elevational range from sea level to 1200 m above sea level. It prefers taller montane, moist eucalypt forest with relatively old trees and abundant hollows.	Low – Not recorded during field survey and no suitable habitat present.	-
<i>Petaurus australis</i>	Yellow-bellied Glider	V	-	1 record within 10km (DPIE 2021a)	The Yellow-bellied Glider is found along the eastern coast to the western slopes of the Great Dividing Range, from southern Queensland to Victoria. The species occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. Vegetation preferences vary with latitude and elevation; mixed coastal forests to dry escarpment forests in the north; moist coastal gullies and creek flats to tall montane forests in the south.	Regarded in the BAM Calculator as a 'predicted - ecosystem credit species'. Therefore, the species is presumed to be present.	Ecosystem
<i>Petaurus norfolcensis</i>	Squirrel Glider	V	-	2 records within 10km (DPIE 2021a)	The Squirrel Glider is widely though sparsely distributed in eastern Australia, from northern Queensland to western Victoria. The species inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas.	Low - Not detected during spotlighting, nor has the species been recorded within the South Creek corridor during surveys for the Growth Centres, including the Airport which occurs greater habitat to that of the proposal area. The proposal area is a highly disturbed roadside areas subject to noise and light pollution.	Species

Scientific Name	Common Name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Credit type
						The species relies on large old trees with hollows for breeding and nesting. Such trees were relatively absent within the proposal area.	
<i>Petrogale penicillata</i>	Brush-tailed Rock-wallaby	E	V	Species or species' habitat may occur within 10km (DAWE 2021a)	In NSW the Brush-tailed Rock-wallaby occurs from the Queensland border in the north to the Shoalhaven in the south, with the population in the Warrumbungle Ranges being the western limit. The species occupy rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north. It typically shelters or basks during the day in rock crevices, caves and overhangs and are most active at night when foraging.	None – no suitable habitat present. According to the TBDC, the species utilised 'Land within 1 km of rocky escarpments, gorges, steep slopes, boulder piles, rock outcrops or clifflines'. The proposal area does not occur within 1 km of such features.	Species
<i>Phascolarctos cinereus</i>	Koala	V	V	5 records within 10km (DPIE 2021a); Species or species' habitat known to occur within 10km (DAWE 2021a)	The Koala has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. In New South Wales, koala populations are found on the central and north coasts, southern highlands, southern and northern tablelands, Blue Mountains, southern coastal forests, with some smaller populations on the plains west of the Great Dividing Range. The species inhabit eucalypt woodlands and forests, and feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species.	Dual credit species listed in the TBDC. Regarded in the BAM Calculator as a 'predicted - ecosystem credit species'. Therefore, the species is presumed to be present. Low likelihood to utilise the proposal area on a regular basis. This is supported by the SAT and spotlighting survey which did not detect any usage of the proposal area by Koalas. Given the small number of records which occur in the locality, the presence of predominately younger trees, and the lack of connectivity to nearby bushland, it is unlikely that this species occurs	Species/ecosystem

Scientific Name	Common Name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Credit type
						within the proposal area. Furthermore, if Koalas were in the area, it would be highly likely that there would be numerous records from passing motorists and residents.	
<i>Pseudomys novaehollandiae</i>	New Holland Mouse	-	V	Species or species' habitat known to occur within 10km (DAWE 2021a)	The New Holland Mouse has a fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. The species is known to inhabit open heathlands, woodlands and forests with a heathland understorey and vegetated sand dunes	Low – habitat preferences not in proposal area. No records within the proposal area nor in the wider locality.	N/A
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	V	404 records within 10km (DPIE 2021a); Species roosting habitat known to occur within 10km (DAWE 2021a)	Grey-headed Flying-foxes are generally found within 200 km of the eastern coast of Australia, from Rockhampton in Queensland to Adelaide in South Australia. In times of natural resource shortages, they may be found in unusual locations. The species occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy.	Dual credit species listed in the TBDC. Regarded in the BAM Calculator as a 'predicted - ecosystem credit species'. Therefore, the species is presumed to be present. The 'species credit' component is associated with the presence of camp sites. No camp sites were recorded in the proposal area, and thus the species is regarded as an ecosystem credit species for this assessment. The species was recorded flying over the proposal area however, no breeding habitat in proposal area.	Species/ecosystem

Scientific Name	Common Name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Credit type
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheathtail-bat	V	-	4 records within 10km (DPIE 2021a)	The Yellow-bellied Sheathtail-bat is a wide-ranging species found across northern and eastern Australia. In the most southerly part of its range - most of Victoria, south-western NSW and adjacent South Australia - it is a rare visitor in late summer and autumn. There are scattered records of this species across the New England Tablelands and North West Slopes. It forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory.	The species was recorded within the proposal area during anabat analysis. Regarded in the BAM Calculator as a 'predicted - ecosystem credit species'. Therefore, the species is presumed to be present.	Ecosystem
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V	-	16 records within 10km (DPIE 2021a)	The Greater Broad-nosed Bat is found mainly in the gullies and river systems that drain the Great Dividing Range, from north-eastern Victoria to the Atherton Tableland. It extends to the coast over much of its range. In NSW it is widespread on the New England Tablelands, however does not occur at altitudes above 500 m. The species utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest.	The species was recorded within the proposal area during anabat analysis. Regarded in the BAM Calculator as a 'predicted - ecosystem credit species'. Therefore, the species is presumed to be present.	Ecosystem
Flora							
<i>Acacia bynoeana</i>	Bynoe's Wattle	E	V	Species or species' habitat known to occur within 10km (DAWE 2021a)	Endemic to central eastern NSW, known a limited number of locations, often comprising populations of few plants. Grows mainly in heath/ dry sclerophyll forest on sandy soils, prefers open, sometimes slightly disturbed sites such as trail margins, road edges, and in recently burnt open patches. Flowers September to March, and fruit matures in November.	Low – not recorded during targeted survey. Relatively conspicuous species even when it is not flowering. Unlikely to remain undetected during field survey. The Team has extensive experience with this particular species.	Species
<i>Acacia pubescens</i>	Downy Wattle	V	V	56 records within 10km (DPIE 2021a); Species or species' habitat known to occur within	Occurs mainly in Bankstown-Fairfield-Rookwood and Pitt Town areas, with outliers at Barden Ridge, Oakdale and Mountain Lagoon. Grows on alluviums, shales and shale/sandstone intergrades. Soils characteristically gravely, often with ironstone. Occurs in open woodland and forest, in communities including Cooks River/ Castlereagh Ironbark Forest, Shale/ Gravel Transition Forest and Cumberland Plain Woodland. Flowers from August to October.	Low – not recorded during targeted survey. Relatively conspicuous species even when it is not flowering. Unlikely to remain undetected during field survey.	Species

Scientific Name	Common Name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Credit type
				10km (DAWE 2021a)			
<i>Allocasuarina glareicola</i>	Allocasuarina glareicola	E	E	2 records within 10km (DPIE 2021a); Species or species' habitat known to occur within 10km (DAWE 2021a)	"Primarily found in Richmond district; although outlier populations exist in Voyager Point, Liverpool. Found in open castlereagh woodland on lateritic soil. The species is associated with the following species: Parramatta Red Gum, Red Ironbark, Narrow-leaved Apple, Hard-leaved Scribbly Gum and Melaleuca decora. Common associated understorey species include Prickly-leaved Paperbark, Finger Hakea, Needlebush, Dillwynia tenuifolia, Micromyrtus minutiflora, Swamp Wattle, Acacia brownei, Themeda australis and Xanthorrhoea minor.	Low – not recorded during targeted survey. Relatively conspicuous species even when it is not flowering. Vegetation types within the proposal area are not of Castlereagh woodland. Unlikely to remain undetected during field survey.	Species
<i>Caladenia tessellata</i>	Thick Lip Spider Orchid	E	V		Occurs from Central Coast NSW to southern Victoria. Mostly coastal but extends inland to Braidwood in southern NSW. In NSW grows in grassy dry sclerophyll woodland on clay loam or sandy soils, and less commonly in heathland on sandy loam soils. There are 'old records' for the species within the Sydney Region near Hunters Hill in 1876. Flowers between September and November.	Low – not recorded during targeted survey in correct survey period. Furthermore the species has not been recorded in the region historically, nor has it been recorded in field surveys from the Growth Centre Projects which were relatively extensive.	Species
<i>Callistemon lineariifolius</i>	Netted Bottle Brush	V	-	1 record within 10km (DPIE 2021a)	Recorded from the Georges to Hawkesbury Rivers in Sydney, and north to Nelson Bay. There is also a recent record from the northern Illawarra. Grows in dry sclerophyll forest on the coast and adjacent ranges. Flowers from spring to summer	Low – not recorded during targeted survey. Relatively conspicuous species even when it is not flowering. Unlikely to remain undetected during field survey.	Species
<i>Cynanchum elegans</i>	White-flowered Wax Plant	E	E	1 record within 10km (DPIE 2021a)	Recorded from the Georges to Hawkesbury Rivers in Sydney, and north to Nelson Bay. There is also a recent record from the northern Illawarra. Grows in dry sclerophyll forest on the coast and adjacent ranges. Flowers from spring to summer	Low – not recorded during targeted survey. Relatively conspicuous species even when it is not flowering. Unlikely to remain undetected during field survey.	Species

Scientific Name	Common Name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Credit type
<i>Deyeuxia appressa</i>	Deyeuxia appressa	E	E	None since 1942	Known only from two pre-1942 records in Sydney, at Saltpan Creek and Killara. May be extinct in the wild. Thought to occur in moist conditions.	Low – Whilst the survey was not completed during December, the likelihood for the presence of this species is very low. The species has not been recorded since 1942 in Sydney, and the areas of previous occupancy are not near the proposal area. Furthermore, the site does not contain 'moist' conditions.	Species
<i>Dillwynia tenuifolia</i>	Dillwynia tenuifolia	V	-	1129 records within 10km (DPIE 2021a)	Occurs in western Sydney, predominately the Cumberland Plain as well as the Lower Blue Mountains and north to Yengo. Grows in scrubby/dry heath areas of Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays, and associated transitional communities including Castlereagh Scribbly Gum Woodland.	Low – not recorded during targeted survey. Relatively conspicuous species even when it is not flowering. Unlikely to remain undetected during field survey.	Species
<i>Dillwynia tenuifolia</i>	Dillwynia tenuifolia, Kemps Creek	EP	-	92 records within 10km (DPIE 2021a)	Occurs in western Sydney, predominately the Cumberland Plain as well as the Lower Blue Mountains and north to Yengo. Grows in scrubby/dry heath areas of Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays, and associated transitional communities including Castlereagh Scribbly Gum Woodland.	None – the proposal area does not occur in Kemps Creek.	Species
<i>Eucalyptus benthamii</i>	Camden White Gum	V	V		Occurs on the alluvial flats of the Nepean River and its tributaries. Known distribution from The Oaks (south) to Grose Wold (north) and Kedumba Valley (west). Two major subpopulations in Kedumba Valley and Bents Basin State Recreation Area. Occurs in wet open forest on alluvial flats, in well drained alluvial sands and gravels to 1 m deep. Requires a combination of deep alluvial sands and a flooding regime that permits seedling establishment.	Low – not recorded during targeted survey. Relatively conspicuous species even when it is not flowering. Unlikely to remain undetected during field survey.	Species
<i>Genoplesium baueri</i>	Bauer's Midge Orchid	E	E	Species or species' habitat may occur within 10km (DAWE 2021a)	Occurs from Ulladulla to Port Stephens, with only 13 known extant populations. Grows in sparse sclerophyll forest and moss gardens over sandstone. Flowers from February to March.	Low – The habitat present within the proposal area is not located within an area of a known population; does not contain sandstone habitat types.	Species

Scientific Name	Common Name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Credit type
<i>Grevillea juniperina</i> subsp. <i>juniperina</i>	Juniper – Leaved Grevillea	V	-	3038 records within 10km (DPIE 2021a)	Occurs only within western Sydney in an area bounded by Blacktown, Erskine Park, Londonderry and Windsor. Outlier populations also at Kemps Creek and Pitt Town. Grows on reddish clay to sandy soils derived from Wianamatta Shale and Tertiary alluvium, typically containing lateritic gravels. Occurs in association with Cumberland Plain Woodland, Castlereagh Ironbark Woodland, Castlereagh Scribbly Gum Woodland and Shale/Gravel Transition Forests.	Low – not recorded during targeted survey. Relatively conspicuous species even when it is not flowering. Unlikely to remain undetected during field survey.	Species
<i>Grevillea parviflora</i> subsp. <i>parviflora</i>	Small-flowered Grevillea	V	V	18 records within 10km (DPIE 2021a); Species or species' habitat known to occur within 10km (DAWE 2021a)	Occurs between Moss Vale/Bargo and lower Hunter Valley, with most occurrences in Appin, Wedderburn, Picton and Bargo. Broad habitat range including heath, shrubby woodland and open forest on light clay or sandy soils, and often in disturbed areas such as on the fringes of tracks.	Low – not recorded during targeted survey. Relatively conspicuous species even when it is not flowering. Unlikely to remain undetected during field survey.	Species
<i>Gyrostemon thesioides</i>		E	-		Within NSW, has only ever been recorded at three sites, to the west of Sydney, near the Colo, Georges and Nepean Rivers. The most recent sighting was of a single male plant near the Colo River within Wollemi National Park. Despite searches, the species has not been recorded from the Nepean and Georges Rivers for 90 and 30 years respectively. Grows on hillsides and riverbanks and may be restricted to fine sandy soils.	Low – not recorded during targeted survey. Unlikely to remain undetected during field survey.	Species
<i>Haloragis exalata</i> subsp. <i>exalata</i>	Square Raspwort	V	V	Species or species' habitat may occur within 10km (DAWE 2021a)	Square Raspwort occurs in 4 widely scattered localities in eastern NSW. It is disjunctly distributed in the Central Coast, South Coast and North Western Slopes botanical subdivisions of NSW. Requires protected and shaded damp situations in riparian habitats.	Low – not recorded during targeted survey. Unlikely to remain undetected during field survey.	Species
<i>Hibbertia</i> sp. <i>Bankstown</i>		CE	CE		Listed under EPBC Act as <i>Hibbertia puberula</i> subsp. <i>glabrescens</i> . Known only from Bankstown airport. Habitat is very heavily modified, lacks canopy species and is currently a low grass/shrub association with many pasture grasses and other introduced herbaceous weeds. Soil at the site is a sandy (Tertiary) alluvium with a high silt content and is	Low – not recorded during targeted survey, and the proposal area does not occur in Bankstown.	Species

Scientific Name	Common Name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Credit type
					associated with Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion.		
<i>Hibbertia puberula</i>	Hibbertia puberula	E	-	3 records within 10km (DPIE 2021a)	Distribution extending from Wollemi National Park south to Morton National Park and the south coast near Nowra. It favours low heath on sandy soils or rarely in clay, with or without rocks underneath. Habitats are typically dry sclerophyll woodland communities, although heaths are also occupied. Flowers from October to January	Low – The habitat types are not suitable for this species given the species prefers sandy soils, whilst the proposal area contains clay and loam soils.	Species
<i>Isotoma fluviatilis subsp. fluviatilis</i>		-	Extinct	8 records within 10km (DPIE 2021a)	Currently known from only two adjacent sites on a single private property at Erskine Park in the Penrith LGA. Previous sightings are all from western Sydney, at Homebush and at Agnes Banks. Known to grow in damp places, on the Cumberland Plain, including freshwater wetland, grassland/alluvial woodland and an alluvial woodland/shale plains woodland (Cumberland Plain Woodland) ecotone. May be an early successional species that benefits from some disturbance. Possibly out competed when overgrown by some species such as Cyndon dactylon.	Low – not recorded during targeted survey. Unlikely to remain undetected during field survey.	-
<i>Macadamia integrifolia</i>	Macadamia Nut		V	4 records within 10km (DPIE 2021a)	The Macadamia Nut is found in remnant rainforest in northern NSW and south-east Queensland, preferring partially open areas such as rainforest edges. While specimens have been collected from the North Coast of NSW, this species is not known to occur naturally in NSW.	Low – not recorded during targeted survey. Relatively conspicuous species even when it is not flowering. Unlikely to remain undetected during field survey.	Species
<i>Marsdenia viridiflora subsp. viridiflora</i>	Marsdenia viridiflora R. Br. subsp. viridiflora population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas	EP	-	1258 records within 10km (DPIE 2021a)	Recent records are from Prospect, Bankstown, Smithfield, Cabramatta Creek and St Marys. Previously known north from Razorback Range. A climber that grows in vine thickets and open shale woodland.	Low – not recorded during targeted survey. Relatively conspicuous species even when it is not flowering. Unlikely to remain undetected during field survey.	Species
<i>Maundia triglochinos</i>	-	V	-		Restricted to coastal NSW current southern limit at Wyong. Grows on heavy clay, low nutrient soil in swamps, lagoons, dams, channels, creeks or shallow freshwater 30-60 cm depth.	Low – not recorded during targeted survey. Relatively conspicuous species even when it is	Species

Scientific Name	Common Name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Credit type
						not flowering. Unlikely to remain undetected during field survey. Field team is experience with this species given a experience with long-standing Maundia triglochinoides monitoring program for Pacific Highway Upgrade (Oxley to Kempsey).	
<i>Melaleuca deanei</i>	Deane's Paperbark	V	V	Species or species' habitat may occur within 10km (DAWE 2021a)	Occurs from Nowra to St Albans and west to the Blue Mountains, with most records in Ku-ring-gai/Berowra and Holsworthy/Wedderburn areas. Mostly grows on broad flat ridgetops, dry ridges and slopes and strongly associated with low nutrient sandy loam soils, sometimes with ironstone. Grows in heath- open forest, often in sandstone ridgetop woodland communities.	Low – not recorded during targeted survey. Relatively conspicuous species even when it is not flowering. Unlikely to remain undetected during field survey.	Species
<i>Micromyrtus minutiflora</i>		E	V	30 records within 10km (DPIE 2021a); Species or species' habitat known to occur within 10km (DAWE 2021a)	Occurs in Richmond and Penrith areas in western Sydney. Grows in Castlereagh Scribbly Gum Woodland, Ironbark Forest, Shale/Gravel Transition Forest, open forest on tertiary alluvium and consolidated river sediments.	Low – not recorded during targeted survey. Relatively conspicuous species even when it is not flowering. Unlikely to remain undetected during field survey.	Species
<i>Persicaria elatior</i>	Tall Knotweed	V	V	Species or species' habitat may occur within 10km (DAWE 2021a)	Tall Knotweed has been recorded in south-eastern NSW from Ulladulla to the Victorian border. In northern NSW it is known from Raymond Terrace and the Grafton area. This species normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance.	Low – not recorded during targeted survey. Relatively conspicuous species even when it is not flowering. Unlikely to remain undetected during field survey.	Species
<i>Persoonia bargoensis</i>	Bargo Geebung	E	V		Restricted to the western edge of the Woronora Plateau and the northern edge of the Southern Highlands, bounded by Picton, Douglas Park, Yanderra and the Cataract River. Occurs in woodland or dry sclerophyll forest on sandstone and clayey laterite on heavier, well drained, loamy, gravely	Low – not recorded during targeted survey. Relatively conspicuous species even when it is not flowering. Unlikely to	Species

Scientific Name	Common Name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Credit type
					soils of Hawkesbury Sandstone and Wianamatta Shale. Tends to occur in disturbed areas e.g. roadsides and trail margins. <i>pterostylis</i>	remain undetected during field survey. The proposal area is outside of the typical range for this species.	
<i>Persoonia hirsuta</i>	Hairy Geebung	E	E	Species or species' habitat likely to occur within 10km (DAWE 2021a)	Occurs within the Blue Mountains, Southern Highlands and Sydney coastal regions from Hilltop to Glen Davis and Royal NP to Gosford. Population within the Hills Shire particularly important due to high density of plants. Grows on sandy soils in dry sclerophyll open forest, woodland and heath on sandstone up to 600 m above sea level.	Low – not recorded during targeted survey. Relatively conspicuous species even when it is not flowering. Unlikely to remain undetected during field survey.	Species
<i>Persoonia nutans</i>	Nodding Geebung	E	E	32 records within 10km (DPIE 2021a); Species or species' habitat known to occur within 10km (DAWE 2021a)	Occurs from Richmond to Macquarie Fields on the Cumberland Plain. Grows only on aeolian and alluvial sediments in sclerophyll forest and woodland vegetation communities. Largest populations occur in Agnes Banks Woodland or Castlereagh Scribbly Gum Woodland.	Low – not recorded during targeted survey. Relatively conspicuous species even when it is not flowering. Unlikely to remain undetected during field survey.	Species
<i>Pilularia novae-hollandiae</i>	Austral Pillwort	E	-	1 record within 10km, last recorded 1966 (DPIE 2021a)	Only known extant populations in NSW are at Lake Cowal and Oolambeyan NP, but the species is obscure and may be overlooked elsewhere. Grows in shallow swamps and waterways, often among grasses and sedges. Previous records in Albury-Urana were from table drains beside roads, whereas the only record in the ACT was from a subalpine grassy plain.	Low – habitat is less than ideal throughout much of the proposal area. The only area of potential habitat is located within PCT 835 Low towards the north of the proposal area. This area contained some native sedges and rushes, and would offer a wetter environment which the species is associated with however the ground cover is highly dominated by introduced grasses which is quite reasonable to conclude would prevent <i>Pilularia</i>	Species

Scientific Name	Common Name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Credit type
						<i>novae hollandae</i> from occurring.	
<i>Pimelea curviflora</i> var. <i>curviflora</i>		V	V	2 records within 10km (DPIE 2021a); Species or species' habitat may occur within 10km (DAWE 2021a)	Confined to area between north Sydney in the south and Maroota in the north-west. Grows on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands. Often grows amongst dense grasses and sedges. Flowers October to May.	Low – habitat types is not suitable for this species given the proposal area is located away from ridgetops and upper slopes.	Species
<i>Pimelea spicata</i>	Spiked Rice-flower	E	E	452 records within 10km (DPIE 2021a); Species or species' habitat known to occur within 10km (DAWE 2021a)	Disjunct populations within the Cumberland Plain (Marayong and Prospect Reservoir south to Narellan and Douglas Park) and Illawarra (Landsdowne to Shellharbour to northern Kiama). In both the Cumberland Plain and Illawarra environments this species is found on well-structured clay soils. On the Cumberland Plain sites it is associated with Grey Box communities. In the coastal Illawarra it occurs commonly in Coast Banksia open woodland.	Low – not recorded during targeted survey. Relatively conspicuous species even when it is not flowering. Unlikely to remain undetected during field survey.	Species
<i>Pomaderris brunnea</i>	Brown Pomaderris	V	V	Species or species' habitat likely to occur within 10km (DAWE 2021a)	Brown Pomaderris is found in a very limited area around the Colo, Nepean and Hawkesbury Rivers, including the Bargo area and near Camden. Brown Pomaderris grows in moist woodland or forest on clay and alluvial soils of flood plains and creek lines.	Low – not recorded during targeted survey. Relatively conspicuous species even when it is not flowering. Unlikely to remain undetected during field survey.	Species
<i>Pterostylis gibbosa</i>		E	E	Species or species' habitat may occur within 10km (DAWE 2021a)	Known from a small number of populations in the Illawarra, Shoalhaven and Hunter regions. Grows in open forest or woodland, on flat or gently sloping land with poor drainage. In the Illawarra region, the species grows in woodland dominated by Forest Red Gum, Woollybutt and Melaleuca decora. Near Nowra, the species grows in an open forest of Spotted Gum, Forest Red Gum and Grey Ironbark. In the Hunter region, the species grows in open woodland dominated by Narrow-leaved Ironbark, Forest Red Gum and Black Cypress Pine.	Low – not recorded during targeted survey during correct survey month.	Species

Scientific Name	Common Name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Credit type
<i>Pterostylis saxicola</i>	Sydney Plains Greenhood	E	E	1 record within 10km, last recorded 1900 (DPIE 2021a); Species or species' habitat likely to occur within 10km (DAWE 2021a)	Occurs in western Sydney between Picton and Freemans Reach. Grows in small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines. Associated vegetation above these rock shelves is sclerophyll forest or woodland on shale or shale/sandstone transition soils.	Low – habitat types within the proposal area are not suitable for this species given the absence of sandstone rock shelves.	Species
<i>Pultenaea parviflora</i>		E	V	722 records within 10km (DPIE 2021a); Species or species' habitat known to occur within 10km (DAWE 2021a)	Occurs on the Cumberland Plain, with core distribution from Windsor to Penrith and east to Dean Park, and outliers in Kemps Creek and Wilberforce. Grows in dry sclerophyll woodlands, forest or in grasslands on Wianamatta Shale, laterite or Tertiary alluvium, on infertile sandy to clay soils. Associated communities include Castlereagh Ironbark Forest, Shale Gravel transition Forest and intergrade with Castlereagh Scribbly Gum Woodland.	Low – not recorded during targeted survey. Relatively conspicuous species even when it is not flowering. Unlikely to remain undetected during field survey.	Species
<i>Pultenaea pedunculata</i>	Matted Bush-pea	E	-		In NSW there are three disjunct populations in the Cumberland Plains in Sydney, the coast between Tathra and Bermagui and the Windellama area south of Goulburn. NSW populations typically among woodland vegetation but also found on road batters and coastal cliffs. In Windellama it is largely confined to loamy soils in dry gullies.	Low – not recorded during targeted survey. Relatively conspicuous species even when it is not flowering. Unlikely to remain undetected during field survey.	Species
<i>Rhizanthella slateri</i>	Eastern Australian Undergrown Orchid	V	E	Species or species' habitat may occur within 10km (DAWE 2021a)	Currently known only from 10 locations, including near Bulahdelah, the Watagan Mountains, the Blue Mountains, Wiseman's Ferry area, Agnes Banks and near Nowra. The species grows in eucalypt forest but no informative assessment of the likely preferred habitat for the species is available. Flowers September and November.	Low – not recorded during targeted survey completed during correct survey month.	Species
<i>Rhodamnia rubescens</i>	Scrub Turpentine	CE	-	Species or species' habitat may occur within 10km	Occurs in coastal districts north from Batemans Bay in New South Wales, to areas inland of Bundaberg in Queensland. Populations of <i>R. rubescens</i> typically occur in coastal regions and occasionally extend inland onto escarpments up to 600 m a.s.l. in areas with rainfall of 1,000 -1,600 mm. Found in	Low – not recorded during targeted survey.	Species

Scientific Name	Common Name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Credit type
				(DAWE 2021a)	littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils.		
<i>Syzygium paniculatum</i>	Magenta Lilly Pilly	E	V	1 record within 10km (DPIE 2021a); Species or species' habitat may occur within 10km (DAWE 2021a)	Occurs in narrow coastal strip from Upper Lansdowne to Conjola State Forest. Grows in rainforest on sandy soils or stabilised Quaternary sand dunes at low altitudes in coastal areas, often in remnant littoral or gallery rainforests.	Low – not recorded during targeted survey. Relatively conspicuous species even when it is not flowering. Unlikely to remain undetected during field survey.	Species
<i>Thesium australe</i>	Austral Toadlax	V	V	Species or species' habitat may occur within 10km (DAWE 2021a)	Found in small, scattered populations along the east coast, northern and southern tablelands. Occurs in grassland or grassy woodland, and is often found in association with Kangaroo Grass.	Low – not detected during survey	Species

Likelihood of occurrence – Threatened ecological communities

Threatened Ecological Community	Description	BC Act Status	EPBC Act Status	Likelihood of Occurrence within proposal area
Castlereagh Scribbly Gum and Agnes Banks Woodlands of the Sydney Basin Bioregion	<p>The Castlereagh Scribbly Gum and Agnes Banks Woodlands ecological community is located in the Sydney Basin Bioregion. It occurs primarily in the Castlereagh area in the north-west of the Cumberland Plain (also referred to as the Cumberland sub-region), with other known occurrences near Holsworthy (some patches at Holsworthy are just outside the Cumberland sub-region), Kemps Creek and Longneck Lagoon. The Castlereagh Scribbly Gum and Agnes Banks Woodlands ecological community is typically a low woodland, with canopy species reaching an average 15 m in height, but with some trees growing to around 20 m. The ecological community's understorey has a prominent and diverse mid-layer of sclerophyll shrubs. It typically has a patchy ground cover of sedges and grasses. However, in areas of poorly drained soil there may be less species diversity in the mid layer and the ground layer may contain a high diversity of sedges and grasses. The isolation of the alluvial deposits in the Hawkesbury-Nepean river valley and differences in the soil characteristics have led to the development of differences in species composition and abundance across the range of the ecological community. For example, this is expressed in differing abundance of <i>Melaleuca</i> and <i>Banksia</i> species in the mid stratum. In addition, the Agnes Banks vegetation occurs on aeolian sand and can contain a number of species reminiscent of communities closer to the coast, such as <i>Dillwynia glaberrima</i>, <i>Ricinocarpos pinifolius</i> (wedding bush) and <i>Banksia aemula</i> (wallum).</p>	Castlereagh Scribbly Gum Woodland in the Sydney Basin Bioregion - Vulnerable / Agnes Banks Woodland in the Sydney Basin Bioregion - Critically Endangered.	Endangered	Does not occur

Threatened Ecological Community	Description	BC Act Status	EPBC Act Status	Likelihood of Occurrence within proposal area
Coastal Swamp Oak (<i>Casuarina glauca</i>) Forest of New South Wales and South East Queensland	<p>Known from parts of the Local Government Areas of Tweed, Byron, Lismore, Ballina, Richmond Valley, Clarence Valley, Coffs Harbour, Bellingen, Nambucca, Kempsey, Hastings, Greater Taree, Great Lakes, Port Stephens, Maitland, Newcastle, Cessnock, Lake Macquarie, Wyong, Gosford, Pittwater, Warringah, Hawkesbury, Baulkham Hills, Hornsby, Lane Cove, Blacktown, Auburn, Parramatta, Canada Bay, Rockdale, Kogarah, Sutherland, Penrith, Fairfield, Liverpool, Bankstown, Wollondilly, Camden, Campbelltown, Wollongong, Shellharbour, Kiama, Shoalhaven, Eurobodalla and Bega Valley but may occur elsewhere in these bioregions. Major examples once occurred on the floodplains of the Clarence, Macleay, Hastings, Manning, Hunter, Hawkesbury, Shoalhaven and Moruya Rivers.</p> <p>Associated with grey-black clay-loams and sandy loams, where the groundwater is saline or sub-saline, on waterlogged or periodically inundated flats, drainage lines, lake margins and estuarine fringes associated with coastal floodplains. Generally occurs below 20 m (rarely above 10 m) elevation. The structure of the community may vary from open forests to low woodlands, scrubs or reedlands with scattered trees. This community is found on the coastal floodplains of NSW. It has a dense to sparse tree layer in which <i>Casuarina glauca</i> (swamp oak) is the dominant species northwards from Bermagui. Other trees including <i>Acmena smithii</i> (lilly pilly), <i>Glochidion</i> spp. (cheese trees) and <i>Melaleuca</i> spp. (paperbarks) may be present as subordinate species, and are found most frequently in stands of the community northwards from Gosford. Tree diversity decreases with latitude, and <i>Melaleuca ericifolia</i> is the only abundant tree in this community south of Bermagui. The understorey is characterised by frequent occurrences of vines, <i>Parsonsia straminea</i>, <i>Geitonoplesium cymosum</i> and <i>Stephania japonica</i> var. <i>discolor</i>, a sparse cover of shrubs, and a continuous groundcover of forbs, sedges, grasses and leaf litter. The composition of the ground stratum varies depending on levels of salinity in the groundwater. Under less saline conditions prominent ground layer plants include forbs such <i>Centella asiatica</i>, <i>Commelina cyanea</i>, <i>Persicaria decipiens</i> and <i>Viola banksii</i>; graminoids such as <i>Carex appressa</i>, <i>Gahnia clarkei</i>, <i>Lomandra longifolia</i>, <i>Oplismenus imbecillis</i>; and the fern <i>Hypolepis muelleri</i>. On the fringes of coastal estuaries, where soils are more saline, the ground layer may include the threatened grass species, <i>Alexfloydia repens</i>, as well as <i>Baumea juncea</i>, <i>Juncus kraussii</i>, <i>Phragmites australis</i>, <i>Selliera radicans</i> and other saltmarsh species.</p>	Endangered	Endangered	Low likelihood to occur

Threatened Ecological Community	Description	BC Act Status	EPBC Act Status	Likelihood of Occurrence within proposal area
Cooks River/Castlereagh Ironbark Forest of the Sydney Basin Bioregion	<p>Occurs in western Sydney, and the extent of intact remnants is now reduced to 1011 hectares, with the most extensive stands occurring in the Castlereagh and Holsworthy areas. Smaller remnants occur in the Kemps Creek area and in the eastern section of the Cumberland Plain. Good examples can be seen at the Castlereagh and Windsor Downs Nature Reserves. Has a very restricted natural distribution and mainly occurs on clay soils derived from the deposits of ancient river systems (alluvium), or on shale soils of the Wianamatta Shales. Can intergrade into Shale-Gravel Transition Forest (where the alluvium is shallow), Castlereagh Swamp Woodland (in moist depressions) and Castlereagh Scribbly Gum Woodland (on sandier soils). Most species in the community are able to regenerate from lignotubers and buds beneath the bark as well as seeds stored in the soil. Ranges from open forest to low woodland, with a canopy dominated by Broad-leaved Ironbark (<i>Eucalyptus fibrosa</i>) and Paperbark (<i>Melaleuca decora</i>). The canopy may also include other eucalypts such as Woollybutt (<i>E. longifolia</i>). The dense shrubby understorey consists of Prickly-leaved Paperbark (<i>Melaleuca nodosa</i>) and Peach Heath (<i>Lissanthe strigosa</i>), with a range of 'pea' flower shrubs, such as Dillwynia tenuifolia, Hairy Bush-pea (<i>Pultenaea villosa</i>) and Gorse Bitter Pea (<i>Daviesia ulicifolia</i>) (can be locally abundant). The sparse ground layer contains a range of grasses and herbs.</p>	Endangered	Critically Endangered	Does not occur
Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest	<p>Occurs on soils derived from Wianamatta Shale, and throughout the driest part of the Sydney Basin. Before European settlement, was extensive across the Cumberland Plain, western Sydney. Today, only 9 percent of the original extent remains intact, with the remnants scattered widely across the Cumberland Plain. Good examples can be seen at Scheyville National Park and Mulgoa Nature Reserve. Typically occurs on heavy clay soils derived from Wianamatta Shale. Well adapted to drought and fire, and the understorey plants often rely on underground tubers or profuse annual seed production to survive adverse conditions. Cumberland Plain Woodland is habitat for threatened species such as the Cumberland land snail (<i>Meridolum corneovirens</i>). The dominant canopy trees of Cumberland Plain Woodland are Grey Box (<i>Eucalyptus moluccana</i>) and Forest Red Gum (<i>E. tereticornis</i>), with Narrow-leaved Ironbark (<i>E. crebra</i>), Spotted Gum (<i>Corymbia maculata</i>) and Thin-leaved Stringybark (<i>E. eugenoides</i>) occurring less frequently. The shrub layer is dominated by Blackthorn (<i>Bursaria spinosa</i>), and it is common to find abundant grasses such as Kangaroo Grass (<i>Themeda australis</i>) and Weeping Meadow Grass (<i>Microlaena stipoides</i> var. <i>stipoides</i>).</p>	Endangered	Critically Endangered	Present

Threatened Ecological Community	Description	BC Act Status	EPBC Act Status	Likelihood of Occurrence within proposal area
River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria	<p>Known from parts of the Local Government Areas of Port Stephens, Maitland, Singleton, Cessnock, Lake Macquarie, Wyong, Gosford, Hawkesbury, Baulkham Hills, Blacktown, Parramatta, Penrith, Blue Mountains, Fairfield, Holroyd, Liverpool, Bankstown, Wollondilly, Camden, Campbelltown, Sutherland, Wollongong, Shellharbour, Kiama, Shoalhaven, Palerang, Eurobodalla and Bega Valley but may occur elsewhere in these bioregions. Given its habitat, the community has an important role in maintaining river ecosystems and riverbank stability. Associated with silts, clay-loams and sandy loams, on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains. Generally occurs below 50 m elevation, but may occur on localised river flats up to 250 m above sea level. The structure of the community may vary from tall open forests to woodlands, although partial clearing may have reduced the canopy to scattered trees. Typically form mosaics with other floodplain forest communities and treeless wetlands, and often fringe treeless floodplain lagoons or wetlands with semi-permanent standing water. River-Flat Eucalypt Forest on Coastal Floodplains provides habitat for a broad range of animals, including many that are dependent on trees for food, nesting or roosting. These include cormorants and egrets, the Osprey (<i>Pandion haliaetus</i>), Whistling Kite (<i>Haliastur sphenurus</i>), White-bellied Sea-eagle (<i>Haliaeetus leucogaster</i>), as well as the Brush-tailed Phascogale (<i>Phascogale tapoatafa</i>), Yellow-bellied Glider (<i>Petaurus australis</i>), Squirrel Glider (<i>Petaurus norfolcensis</i>), Sugar Glider (<i>Petaurus breviceps</i>) and Grey-headed Flying Fox (<i>Pteropus poliocephalus</i>). As the name suggests, this EEC is found on the river flats of the coastal floodplains. It has a tall open tree layer of eucalypts, which may exceed 40 m in height, but can be considerably shorter in regrowth stands or under conditions of lower site quality. While the composition of the tree stratum varies considerably, the most widespread and abundant dominant trees include <i>Eucalyptus tereticornis</i> (forest red gum), <i>E. amplifolia</i> (cabbage gum), <i>Angophora floribunda</i> (rough-barked apple) and <i>A. subvelutina</i> (broad-leaved apple). <i>Eucalyptus baueriana</i> (blue box), <i>E. botryoides</i> (bangalay) and <i>E. elata</i> (river peppermint) may be common south from Sydney, <i>E. ovata</i> (swamp gum) occurs on the far south coast, <i>E. saligna</i> (Sydney blue gum) and <i>E. grandis</i> (flooded gum) may occur north of Sydney, while <i>E. benthamii</i> is restricted to the Hawkesbury floodplain. A layer of small trees may be present, including <i>Melaleuca decora</i>, <i>M. styphelioides</i> (prickly-leaved teatree), <i>Backhousia myrtifolia</i> (grey myrtle), <i>Melia azaderach</i> (white cedar), <i>Casuarina cunninghamiana</i> (river oak) and <i>C. glauca</i> (swamp oak). Scattered shrubs include <i>Bursaria spinosa</i>, <i>Solanum prinophyllum</i>, <i>Rubus parvifolius</i>, <i>Breynia oblongifolia</i>, <i>Ozothamnus diosmifolius</i>, <i>Hymenanchera dentata</i>, <i>Acacia floribunda</i> and <i>Phyllanthus gunnii</i>. The groundcover is composed of abundant forbs, scramblers and grasses including <i>Microlaena stipoides</i>, <i>Dichondra repens</i>, <i>Glycine clandestina</i>, <i>Oplismenus aemulus</i>, <i>Desmodium gunnii</i>, <i>Pratia purpurascens</i>, <i>Entolasia marginata</i>, <i>Oxalis perennans</i> and <i>Veronica plebeian</i>. The composition and structure of the understorey is influenced by grazing and fire history, changes to hydrology and soil salinity and other disturbance, and may have a substantial component of exotic shrubs, grasses, vines and forbs.</p>	Endangered	Critically Endangered	Present

Threatened Ecological Community	Description	BC Act Status	EPBC Act Status	Likelihood of Occurrence within proposal area
Shale Sandstone Transition Forest of the Sydney Basin Bioregion	<p>Before European settlement, this community was extensive around the edges of the Cumberland lowlands throughout western Sydney, most particularly in the southern half. Today, only 9,950 ha remains intact (22.6% of its original extent) and the bulk of this occurs in the Hawkesbury, Baulkham Hills, Liverpool, Parramatta, Penrith, Campbelltown and Wollondilly local government areas. Good examples can be seen at Gulguer Nature Reserve, in the Wilton area and in the Sackville - Maroota area. Well adapted to fire, being often close to sandstone areas. Some species in areas with greater shale influence regenerate from profuse annual seeding and underground tubers. High-sandstone-influence sites have poor rocky soils, and many shrubs which rely on nitrogen-fixing root nodules and soil/root fungi to obtain nutrients. High-shale-influence sites often have a diverse and moderately dense groundcover stratum, with grasses a prominent and diverse component. Shrubs are usually less abundant and less diverse in shale sites. Occurs at the edges of the Cumberland Plain, where clay soils from the shale rock intergrade with earthy and sandy soils from sandstone, or where shale caps overlay sandstone. The boundaries are indistinct, and the species composition varies depending on the soil influences. The main tree species include Forest Red Gum (<i>Eucalyptus tereticornis</i>), Grey Gum (<i>E. punctata</i>), stringybarks (<i>E. globoidea</i>, <i>E. eugenioides</i>) and ironbarks (<i>E. fibrosa</i> and <i>E. crebra</i>). Areas of low sandstone influence (more clay-loam soil texture) have an understorey that is closer to Cumberland Plain Woodland.</p>	Critically Endangered	Critically Endangered	Does not occur
Western Sydney Dry Rainforest and Moist Woodland on Shale	<p>Very restricted and occurs most commonly in the far southern section of the Cumberland Plain, in the Razorback Range near Picton. Outlying occurrences have been recorded at Grose Vale and Cattai. There are 338 hectares remaining intact, the majority of these occurring in the Wollondilly local government area, but occurring to a lesser extent in the Baulkham Hills, Camden, Hawkesbury, Parramatta and Ryde local government areas. A small remnant can be seen in Fairfield City Farm. Restricted to hilly country where it occurs on the sheltered lower slopes and in gullies. Generally found at higher elevation, in areas receiving higher rainfall than much of the Cumberland Plain Woodland. Occurs on clay soils derived from Wianamatta shale. Rainforest plants within this vegetation are fire sensitive and dependent on the sheltered aspect and density of vegetation for protection. Vine thickets in Western Sydney Dry Rainforest provide good habitat for birds and mammals. Several species of plants (including <i>Spartothamnella juncea</i> and rare and threatened such as <i>Marsdenia viridiflora</i>) have their southern distribution limit within areas of Western Sydney Dry Rainforest. A dry vine scrub community of the Cumberland Plain, western Sydney. Canopy trees include Prickly Paperbark (<i>Melaleuca styphelioides</i>), Hickory Wattle (<i>Acacia implexa</i>) and Native Quince (<i>Alectryon subcinereus</i>). There are many rainforest species in the shrub layer, such as Mock Olive (<i>Notolaea longifolia</i>), Hairy Clerodendrum (<i>Clerodendrum tomentosum</i>) and Yellow Pittosporum (<i>Pittosporum revolutum</i>). The shrub layer combines with vines, such as Gum Vine (<i>Aphanopetalum resinosum</i>), Wonga Vine (<i>Pandorea pandorana</i>) and Slender Grape (<i>Cayratia clematidea</i>) to form dense thickets in sheltered locations. Contains many more species and other references should be consulted to identify these.</p>	Endangered	Critically Endangered	Does not occur

Annexure B

Species recorded

Recorded flora

Family	Scientific Name	Common Name	Threatened species ?		Cover								
			BC Act	EPBC Act	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8	Plot 9
Acanthaceae	<i>Brunoniella australis</i>	Blue Trumpet	-	-				0.1	0.1		0.1		
Alismataceae	<i>Sagittaria platyphylla</i>	Sagittaria	-	-		0.5							
Apiaceae	<i>Centella asiatica</i>	Indian Pennywort	-	-	0.1		0.1				0.1		0.1
Apocynaceae	<i>Araujia sericifera</i>	Moth Vine	-	-					0.1	0.2			0.1
Araliaceae	<i>Hydrocotyle ranunculoides</i>	N/A	-	-		0.1							
Asparagaceae	<i>Asparagus aethiopicus</i>	Asparagus Fern	-	-				0.1		0.1			
Asparagaceae	<i>Asparagus asparagoides</i>	Bridal Creeper	-	-			0.1	0.5	0.5	0.1		5	
Asparagaceae	<i>Asparagus officinalis</i>	Asparagus	-	-		0.1	0.2	0.1					
Asteraceae	<i>Ageratina adenophora</i>	Crofton Weed	-	-								0.1	
Asteraceae	<i>Bidens pilosa</i>	Cobbler's Pegs	-	-			0.1		0.1	0.1		0.1	
Asteraceae	<i>Cirsium vulgare</i>	Spear Thistle	-	-		0.1	0.5	0.1	0.1	0.1	0.1		
Asteraceae	<i>Conyza bonariensis</i>	Flaxleaf Fleabane	-	-			0.1					0.1	0.1
Asteraceae	<i>Euchiton sphaericus</i>	Star Cudweed	-	-			0.1						
Asteraceae	<i>Hypochaeris radicata</i>	Catsear	-	-	0.2		0.5				0.1		0.1

Family	Scientific Name	Common Name	Threatened species ?		Cover								
			BC Act	EPBC Act	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8	Plot 9
Asteraceae	<i>Senecio madagascariensis</i>	Fireweed	-	-			0.1	0.1		0.1	0.1		0.1
Asteraceae	<i>Soliva sessilis</i>	Bindyi	-	-		0.1							
Asteraceae	<i>Sonchus oleraceus</i>	Common Sowthistle	-	-			0.1						0.1
Campanulaceae	<i>Wahlenbergia gracilis</i>	Sprawling Bluebell	-	-			0.1	0.1					0.1
Casuarinaceae	<i>Casuarina glauca</i>	Swamp Oak	-	-						1		15	
Clusiaceae	<i>Hypericum gramineum</i>	Small St John's Wort	-	-	0.1		0.1						
Commelinaceae	<i>Commelina cyanea</i>	Native Wandering Jew	-	-					0.1	1			
Commelinaceae	<i>Tradescantia fluminensis</i>	Wandering Jew	-	-		0.1							
Convolvulaceae	<i>Convolvulus erubescens</i>	Pink Bindweed	-	-							0.2		
Convolvulaceae	<i>Dichondra repens</i>	Kidney Weed	-	-			0.5	0.1	5	5		0.1	
Cyperaceae	<i>Cyperus eragrostis</i>	Umbrella Sedge	-	-								1	
Cyperaceae	<i>Cyperus gracilis</i>	Slender Flat-sedge	-	-			0.1						0.1
Cyperaceae	<i>Fimbristylis dichotoma</i>	Common Fringe-sedge	-	-	0.1								

Family	Scientific Name	Common Name	Threatened species ?		Cover									
			BC Act	EPBC Act	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8	Plot 9	
Cyperaceae	<i>Gahnia aspera</i>	Rough Saw-sedge	-	-		5								
Cyperaceae	<i>Schoenoplectus validus</i>	N/A	-	-		5								
Dilleniaceae	<i>Hibbertia sp.</i>	N/A	-	-	0.5									
Ericaceae	<i>Astroloma humifusum</i>	Native Cranberry	-	-							0.1			
Fabaceae (Faboideae)	<i>Daviesia ulicifolia</i>	Gorse Bitter Pea	-	-	0.5									
Fabaceae (Faboideae)	<i>Glycine microphylla</i>	Small-leaf Glycine	-	-			0.1		0.1	0.1				0.1
Fabaceae (Faboideae)	<i>Glycine tabacina</i>	Variable Glycine	-	-	0.1		0.1	0.1		0.1	0.1			0.1
Fabaceae (Faboideae)	<i>Trifolium repens</i>	White Clover	-	-										0.1
Fabaceae (Faboideae)	<i>Vicia sativa</i>	Common vetch	-	-										0.1
Fabaceae (Mimosoideae)	<i>Acacia brownii</i>	Heath Wattle	-	-	5									
Fabaceae (Mimosoideae)	<i>Acacia decurrens</i>	Black Wattle	-	-							1			
Fabaceae (Mimosoideae)	<i>Acacia parramattensis</i>	Parramatta Wattle	-	-	1		0.5	1						
Fabaceae (Mimosoideae)	<i>Acacia podalyriifolia</i>	Queensland Silver Wattle	-	-	0.1		1							

Family	Scientific Name	Common Name	Threatened species ?		Cover									
			BC Act	EPBC Act	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8	Plot 9	
Gentianaceae	<i>Centaureum tenuiflorum</i>	Branched Centaury, Slender centaury	-	-								0.1		
Geraniaceae	<i>Geranium solanderi</i>	Native Geranium	-	-							0.1		1	
Goodeniaceae	<i>Goodenia sp.</i>	N/A	-	-				0.1						
Haloragaceae	<i>Myriophyllum aquaticum</i>	Parrots Feather	-	-		10								
Hydrocharitaceae	<i>Ottelia ovalifolia subsp. ovalifolia</i>	Swamp Lily	-	-		0.1								
Lauraceae	<i>Cinnamomum camphora</i>	Camphor Laurel	-	-		10	1							1
Lobeliaceae	<i>Lobelia purpurascens</i>	Whiteroot	-	-									0.1	
Lomandraceae	<i>Lomandra longifolia</i>	Spiny-headed Mat-rush	-	-							0.1	0.1		
Malvaceae	<i>Modiola caroliniana</i>	Red-flowered Mallow	-	-										0.1
Malvaceae	<i>Pavonia hastata</i>	N/A	-	-			0.5						0.1	
Malvaceae	<i>Sida rhombifolia</i>	Paddy's Lucerne	-	-			1	0.5	0.1	0.1			0.1	0.1
Malvaceae	<i>Sida trichopoda</i>	High Sida	-	-						0.5				0.1
Meliaceae	<i>Melia azedarach</i>	White Cedar	-	-						0.1				

Family	Scientific Name	Common Name	Threatened species ?		Cover									
			BC Act	EPBC Act	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8	Plot 9	
Myrsinaceae	<i>Lysimachia arvensis</i>	Scarlet Pimpernel	-	-										0.1
Myrtaceae	<i>Angophora floribunda</i>	Rough-barked Apple	-	-										10
Myrtaceae	<i>Corymbia maculata</i>	Spotted Gum	-	-				5						
Myrtaceae	<i>Eucalyptus fibrosa</i>	Red Ironbark	-	-										2
Myrtaceae	<i>Eucalyptus moluccana</i>	Grey Box	-	-				15	10					
Myrtaceae	<i>Eucalyptus tereticornis</i>	Forest Red Gum	-	-	15		30		20	35	1			10
Myrtaceae	<i>Melaleuca decora</i>	N/A	-	-	0.1									
Oleaceae	<i>Ligustrum lucidum</i>	Large-leaved Privet	-	-			5	1	1	0.1				0.1
Oleaceae	<i>Ligustrum sinense</i>	Small-leaved Privet	-	-			0.1	0.1	10	10			10	
Oleaceae	<i>Olea europaea subsp. cuspidata</i>	African Olive	-	-	0.1		15	20	10	0.1			5	0.1
Oxalidaceae	<i>Oxalis perennans</i>	N/A	-	-	0.1		0.1	0.1	0.1				0.1	0.1
Passifloraceae	<i>Passiflora morifolia</i>	N/A	-	-	0.1		5	5						
Phormiaceae	<i>Dianella caerulea</i>	Blue Flax-lily	-	-					0.1			0.1		
Phyllanthaceae	<i>Phyllanthus gunnii</i>	N/A	-	-	0.1									
Phyllanthaceae	<i>Poranthera microphylla</i>	Small Poranthera	-	-										0.1

Family	Scientific Name	Common Name	Threatened species ?		Cover									
			BC Act	EPBC Act	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8	Plot 9	
Pittosporaceae	<i>Bursaria spinosa</i>	Native Blackthorn	-	-						10				
Pittosporaceae	<i>Bursaria spinosa subsp. spinosa</i>	Native Blackthorn	-	-			0.1				10	10		
Plantaginaceae	<i>Plantago lanceolata</i>	Lamb's Tongues	-	-			0.1			0.1				0.5
Poaceae	<i>Aristida ramosa</i>	Purple Wiregrass	-	-			0.1							
Poaceae	<i>Bothriochloa decipiens var. decipiens</i>	Pitted Bluegrass	-	-	0.1									
Poaceae	<i>Bothriochloa macra</i>	Red Grass	-	-				0.2						
Poaceae	<i>Briza subaristata</i>	Quiver grass	-	-	0.1									
Poaceae	<i>Bromus diandrus</i>	Great Brome	-	-										1
Poaceae	<i>Cenchrus clandestinus</i>	Kikuyu	-	-		10								
Poaceae	<i>Chloris gayana</i>	Rhodes Grass	-	-				0.5				40		0.5
Poaceae	<i>Cynodon dactylon</i>	Common Couch	-	-	20		0.5	10				0.5		1
Poaceae	<i>Digitaria parviflora</i>	Small-flowered Finger Grass	-	-	0.1									
Poaceae	<i>Echinopogon ovatus</i>	Forest Hedgehog Grass	-	-							0.1			

Family	Scientific Name	Common Name	Threatened species ?		Cover								
			BC Act	EPBC Act	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8	Plot 9
Poaceae	<i>Ehrharta erecta</i>	Panic Veldtgrass	-	-						0.5		0.1	0.1
Poaceae	<i>Entolasia marginata</i>	Bordered Panic	-	-						0.1			
Poaceae	<i>Eragrostis curvula</i>	African Lovegrass	-	-	80		0.1	60	0.5		1		0.5
Poaceae	<i>Eragrostis leptostachya</i>	Paddock Lovegrass	-	-	0.1		0.1						
Poaceae	<i>Microlaena stipoides</i>	Weeping Grass	-	-					80	80			
Poaceae	<i>Microlaena stipoides</i> var. <i>stipoides</i>	Weeping Grass	-	-				10				0.1	
Poaceae	<i>Oplismenus aemulus</i>	Basket Grass	-	-						15			
Poaceae	<i>Oplismenus imbecillis</i>	Basket Grass	-	-								5	
Poaceae	<i>Paspalidium</i> sp.	N/A	-	-	0.1								
Poaceae	<i>Paspalum dilatatum</i>	Paspalum	-	-	5	0.5	5	0.5	1	0.1	40	1	5
Poaceae	<i>Poa labillardierei</i> var. <i>labillardierei</i>	Tussock	-	-						0.1			
Poaceae	<i>Setaria palmifolia</i>	Palm Grass	-	-			0.1						
Poaceae	<i>Setaria parviflora</i>	N/A	-	-	5		1	0.5	1	0.1	0.1		
Poaceae	<i>Sporobolus africanus</i>	Parramatta Grass	-	-			0.1						

Family	Scientific Name	Common Name	Threatened species ?		Cover									
			BC Act	EPBC Act	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8	Plot 9	
Poaceae	<i>Sporobolus creber</i>	Slender Rat's Tail Grass	-	-					0.1					
Poaceae	<i>Themeda triandra</i>	Kangaroo grass	-	-	0.1							5		
Polygonaceae	<i>Persicaria hydropiper</i>	Knotweed	-	-		0.1							5	
Polygonaceae	<i>Rumex crispus</i>	Curled Dock	-	-		10							2	0.1
Proteaceae	<i>Grevillea robusta</i>	Silky Oak	-	-					1					
Ranunculaceae	<i>Clematis aristata</i>	Old Man's Beard	-	-					0.1	5			5	
Rosaceae	<i>Rubus fruticosus sp. agg.</i>	Blackberry complex	-	-		10			0.1		1		5	0.1
Rubiaceae	<i>Asperula conferta</i>	Common Woodruff	-	-					0.1					
Rubiaceae	<i>Galium aparine</i>	Goosegrass	-	-		0.1							0.1	
Sapindaceae	<i>Cardiospermum grandiflorum</i>	Balloon Vine	-	-									0.1	
Sapindaceae	<i>Dodonaea viscosa</i>	Sticky Hop-bush	-	-	0.1									
Solanaceae	<i>Cestrum parqui</i>	Green Cestrum	-	-			0.1	0.1					5	
Solanaceae	<i>Solanum mauritianum</i>	Wild Tobacco Bush	-	-						0.1				
Solanaceae	<i>Solanum nigrum</i>	Black-berry Nightshade	-	-					0.1					

Family	Scientific Name	Common Name	Threatened species ?		Cover								
			BC Act	EPBC Act	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8	Plot 9
Solanaceae	<i>Solanum prinophyllum</i>	Forest Nightshade	-	-						0.1			
Solanaceae	<i>Solanum pseudocapsicum</i>	Madeira Winter Cherry	-	-				0.1		0.1		5	
Solanaceae	<i>Solanum sisymbriifolium</i>	N/A	-	-				0.1					
Ulmaceae	<i>Celtis occidentalis</i>	Hackberry	-	-			0.1						
Verbenaceae	<i>Verbena bonariensis</i>	Purpletop	-	-			0.1	0.1	0.1	0.1	2	0.1	

Recorded fauna

Taxa/Fauna group	Scientific Name	Common name	Status	
			BC Act	EPBC Act
Gastropoda	<i>Meridolum corneovirens</i>	Cumberland Plain Land Snail	P	E
Actinopterygii	<i>Anguilla</i> sp.	Shortfin Eel	P	-
• Actinopterygii	<i>Gambusia holbrooki</i>	Mosquito Fish	-	-
Amphibia	<i>Crinia signifera</i>	Common Eastern Froglet	P	-
Amphibia	<i>Limnodynastes peronii</i>	Brown-striped Frog	P	-
Amphibia	<i>Litoria fallax</i>	Eastern Dwarf Tree Frog	P	-
Reptilia	<i>Chelodina longicollis</i>	Eastern Snake-necked Turtle	P	-
Reptilia	<i>Intellagama lesueurii</i> Eastern Water Dragon		P	-
Reptilia	<i>Pseudechis porphyriacus</i>	Red-bellied Black Snake	P	-
Aves	<i>Acanthiza pusilla</i>	Brown Thornbill	P	-
Aves	<i>Acridotheres tristis</i>	Common Myna	-	-
Aves	<i>Anthochaera carunculata</i>	Red Wattlebird	P	-
Aves	<i>Anthochaera chrysoptera</i>	Little Wattlebird	P	-
Aves	<i>Bubulcus ibis</i>	Cattle Egret	P	M
Aves	<i>Cacatua galerita</i>	Sulphur-crested Cockatoo	P	-
Aves	<i>Corvus coronoides</i>	Australian Raven	P	-
Aves	<i>Dacelo novaeguineae</i>	Laughing Kookaburra	P	-
Aves	<i>Egretta novaehollandiae</i>	White-faced Heron	P	-
Aves	<i>Malurus cyaneus</i>	Superb Fairy-wren	P	-
Aves	<i>Manorina melanocephala</i>	Noisy Miner	P	-
Aves	<i>Ninox novaeseelandiae</i>	Southern Boobook	P	-
Aves	<i>Psophodes olivaceus</i>	Eastern Whipbird	P	-
Aves	<i>Pycnonotus jocosus</i>	Red-whiskered Bulbul	-	-

Taxa/Fauna group	Scientific Name	Common name	Status	
			BC Act	EPBC Act
Aves	<i>Rhipidura leucophrys</i>	Willie Wagtail	P	-
Aves	<i>Strepera fuliginosa</i>	Black Currawong	P	-
Aves	<i>Trichoglossus haematodus</i>	Rainbow Lorikeet	P	-
Mammalia	<i>Felis catus</i>	Cat	-	-
Mammalia	<i>Macropus giganteus</i>	Eastern Grey Kangaroo	P	-
Mammalia	Microchiroptera suborder	Unidentified Microbat		
Mammalia	<i>Mus musculus</i>	House Mouse	-	-
Mammalia	<i>Petaurus breviceps</i>	Sugar Glider	P	-
Mammalia	<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	P,V	V
Mammalia	<i>Pteropus</i> sp.	Flying Fox	P	-
Mammalia	<i>Rattus rattus</i>	Black Rat	-	-
Mammalia	<i>Trichosurus vulpecula</i>	Common Brushtail		
Mammalian - microbats	<i>Austronomus australis</i>	White-striped freetail bat	P	-
Mammalian - microbats	<i>Chalinolobus gouldii</i>	Gould's wattled bat	P	-
Mammalian - microbats	<i>Chalinolobus morio</i>	Chocolate wattled bat	P	-
Mammalian - microbats	<i>Miniopterus australis</i>	Little bent wing bat	V	-
Mammalian - microbats	<i>Miniopterus orianae oceanensis</i>	Large bent wing bat	V	-
Mammalian - microbats	<i>Myotis macropus</i>	Southern Myotis	E	-
Mammalian - microbats	<i>Nyctophilus</i> species	Long-eared bats	P	-
Mammalian - microbats	<i>Ozimops planiceps</i>	South eastern freetail bat	P	-
Mammalian - microbats	<i>Ozimops ridei</i>	Rides freetail bat	Not listed	-
Mammalian - microbats	<i>Saccolaimus flaviventris</i>	Yellow-bellied sheath tail bay	V	-
Mammalian - microbats	<i>Scoteanax ruepellii</i>	Greater broad nosed bat	V	-
Mammalian - microbats	<i>Vespadelus darlingtoni</i>	Large forest bat	P	-

Taxa/Fauna group	Scientific Name	Common name	Status	
			BC Act	EPBC Act
Mammalian - microbats	Vespadelus vulturnus	Little forest bat	P	-

Annexure C

Hollow-bearing Tree Register

Tree no.	Location	Tree type	Hollow size	Hollow height
1	-33.78799432/ 150.7702809	<i>Eucalyptus Tereiticornis</i>	5-10 cm	15 m
2	-33.79889964/ 150.7683031	<i>Eucalyptus moluccana</i>	5-10 cm	12 m
3	-33.80170355/ 150.7680993	<i>Eucalyptus moluccana</i>	5-10 cm	10 m
4	-33.79967111/ 150.7682817	<i>Eucalyptus moluccana</i>	5-10 cm	15-20 m
5	-33.79356126/ 150.7694258	<i>Eucalyptus moluccana</i>	10-15 cm	10 m
6	-33.79762748/ 150.7679963	Unknown	0-5 cm	5-10 m
7	-33.79763918/ 150.7683732	<i>Eucalyptus spp.</i>	0-5 cm	10 m
8	-33.79253672/ 150.7695621	<i>Eucalyptus eugenioides</i>	15-20 cm	5-15 m
9	-33.7922071/ 150.769607	<i>Eucalyptus moluccana</i>	0-5 cm	20 m
10	-33.81031712/ 150.773994	Unknown	5-10 cm	5-10 m

Annexure D

EPBC Protected Matters Search results



EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 04/05/21 16:18:05

[Summary](#)

[Details](#)

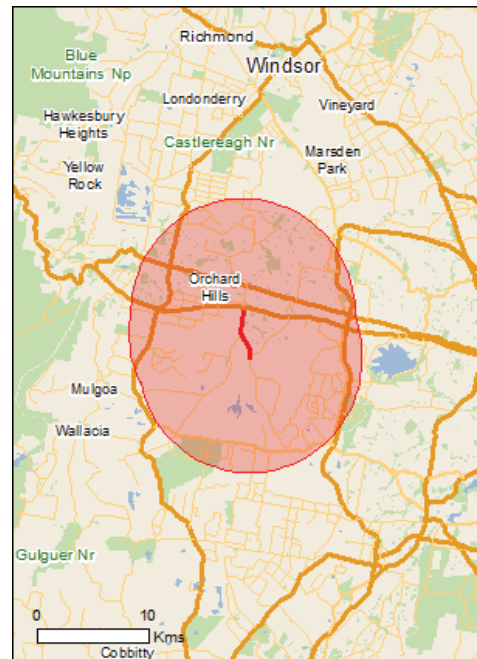
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

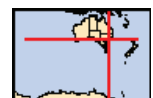
[Acknowledgements](#)



This map may contain data which are
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[Coordinates](#)

Buffer: 10.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	7
Listed Threatened Species:	43
Listed Migratory Species:	15

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	17
Commonwealth Heritage Places:	2
Listed Marine Species:	20
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	3
Regional Forest Agreements:	None
Invasive Species:	50
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities [[Resource Information](#)]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Castlereagh Scribbly Gum and Agnes Banks Woodlands of the Sydney Basin Bioregion	Endangered	Community likely to occur within area
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community	Endangered	Community may occur within area
Cooks River/Castlereagh Ironbark Forest of the Sydney Basin Bioregion	Critically Endangered	Community likely to occur within area
Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest	Critically Endangered	Community likely to occur within area
River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria	Critically Endangered	Community likely to occur within area
Shale Sandstone Transition Forest of the Sydney Basin Bioregion	Critically Endangered	Community may occur within area
Western Sydney Dry Rainforest and Moist Woodland on Shale	Critically Endangered	Community likely to occur within area

Listed Threatened Species [[Resource Information](#)]

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Species or species habitat known to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species

Name	Status	Type of Presence
Rostratula australis Australian Painted Snipe [77037]	Endangered	habitat may occur within area Species or species habitat known to occur within area
Fish		
Macquaria australasica Macquarie Perch [66632]	Endangered	Species or species habitat may occur within area
Prototroctes maraena Australian Grayling [26179]	Vulnerable	Species or species habitat may occur within area
Frogs		
Heleioporus australiacus Giant Burrowing Frog [1973]	Vulnerable	Species or species habitat likely to occur within area
Litoria aurea Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat known to occur within area
Litoria raniformis Growling Grass Frog, Southern Bell Frog, Green and Golden Frog, Warty Swamp Frog, Golden Bell Frog [1828]	Vulnerable	Species or species habitat may occur within area
Mammals		
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat known to occur within area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area
Petauroides volans Greater Glider [254]	Vulnerable	Species or species habitat likely to occur within area
Petrogale penicillata Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat may occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Pseudomys novaehollandiae New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat known to occur within area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Roosting known to occur within area
Plants		
Acacia bynoeana Bynoe's Wattle, Tiny Wattle [8575]	Vulnerable	Species or species habitat known to occur within area
Acacia pubescens Downy Wattle, Hairy Stemmed Wattle [18800]	Vulnerable	Species or species habitat known to occur within area
Allocaeusuarina glareicola [21932]	Endangered	Migration route known to occur within area
Cynanchum elegans White-flowered Wax Plant [12533]	Endangered	Species or species habitat known to occur within area

Name	Status	Type of Presence
Genoplesium baueri Yellow Gnat-orchid, Bauer's Midge Orchid, Brittle Midge Orchid [7528]	Endangered	Species or species habitat may occur within area
Grevillea parviflora subsp. parviflora Small-flower Grevillea [64910]	Vulnerable	Species or species habitat known to occur within area
Haloragis exalata subsp. exalata Wingless Raspwort, Square Raspwort [24636]	Vulnerable	Species or species habitat may occur within area
Melaleuca deanei Deane's Melaleuca [5818]	Vulnerable	Species or species habitat may occur within area
Micromyrtus minutiflora [11485]	Vulnerable	Species or species habitat known to occur within area
Persicaria elatior Knotweed, Tall Knotweed [5831]	Vulnerable	Species or species habitat may occur within area
Persoonia hirsuta Hairy Geebung, Hairy Persoonia [19006]	Endangered	Species or species habitat likely to occur within area
Persoonia nutans Nodding Geebung [18119]	Endangered	Species or species habitat known to occur within area
Pimelea curviflora var. curviflora [4182]	Vulnerable	Species or species habitat may occur within area
Pimelea spicata Spiked Rice-flower [20834]	Endangered	Species or species habitat known to occur within area
Pomaderris brunnea Rufous Pomaderris, Brown Pomaderris [16845]	Vulnerable	Species or species habitat likely to occur within area
Pterostylis gibbosa Illawarra Greenhood, Rufa Greenhood, Pouched Greenhood [4562]	Endangered	Species or species habitat may occur within area
Pterostylis saxicola Sydney Plains Greenhood [64537]	Endangered	Species or species habitat likely to occur within area
Pultenaea parviflora [19380]	Vulnerable	Species or species habitat known to occur within area
Rhizanthella slateri Eastern Underground Orchid [11768]	Endangered	Species or species habitat may occur within area
Rhodamnia rubescens Scrub Turpentine, Brown Malletwood [15763]	Critically Endangered	Species or species habitat may occur within area
Syzygium paniculatum Magenta Lilly Pilly, Magenta Cherry, Daguba, Scrub Cherry, Creek Lilly Pilly, Brush Cherry [20307]	Vulnerable	Species or species habitat may occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Cuculus optatus		
Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat known to occur within area
Hirundapus caudacutus		
White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Monarcha melanopsis		
Black-faced Monarch [609]		Species or species habitat known to occur within area
Motacilla flava		
Yellow Wagtail [644]		Species or species habitat likely to occur within area
Myiagra cyanoleuca		
Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons		
Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
Gallinago hardwickii		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat known to occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus		
Osprey [952]		Species or species habitat known to occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [[Resource Information](#)]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name

Commonwealth Land -
 Commonwealth Land - Airservices Australia
 Commonwealth Land - Australian Postal Commission
 Commonwealth Land - Australian Postal Corporation
 Commonwealth Land - Australian Telecommunications Commission
 Commonwealth Land - Defence Housing Authority
 Commonwealth Land - Defence Service Homes Corporation
 Commonwealth Land - Deputy Director of War Service Homes
 Commonwealth Land - Director of War Service Homes
 Commonwealth Land - Overseas Telecommunications Commission (Australia)
 Commonwealth Land - Telstra Corporation Limited
 Defence - 1CAD ORCHARD HILLS KINGSWOOD
 Defence - AIRTC ST MARYS
 Defence - BRINGELLY RADIO RECEIVING STATION
 Defence - PENRITH DEPOT (Army Stores)
 Defence - RANMME (DEOH)
 Defence - SIGNAL STRS DEPOT-KINGSWOOD

Commonwealth Heritage Places [[Resource Information](#)]

Name	State	Status
Natural		
Orchard Hills Cumberland Plain Woodland	NSW	Listed place
Shale Woodland Llandilo	NSW	Listed place

Listed Marine Species [[Resource Information](#)]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat likely to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat known to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species

Name	Threatened	Type of Presence
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	habitat known to occur within area Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat likely to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Kemps Creek	NSW
Mulgoa	NSW
Wianamatta	NSW

Invasive Species	[Resource Information]
Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resources Audit, 2001.	

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Alauda arvensis Skylark [656]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Carduelis chloris European Greenfinch [404]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Pycnonotus jocosus Red-whiskered Bulbul [631]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat known to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species

Name	Status	Type of Presence
Lepus capensis Brown Hare [127]		habitat likely to occur within area Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Alternanthera philoxeroides Alligator Weed [11620]		Species or species habitat likely to occur within area
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Cytisus scoparius Broom, English Broom, Scotch Broom, Common Broom, Scottish Broom, Spanish Broom [5934]		Species or species habitat likely to occur within area
Dolichandra unguis-cati Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]		Species or species habitat likely to occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom,		Species or species

Name	Status	Type of Presence
Common Broom, French Broom, Soft Broom [20126]		habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Nassella neesiana Chilean Needle grass [67699]		Species or species habitat likely to occur within area
Nassella trichotoma Serrated Tussock, Yass River Tussock, Yass Tussock, Nassella Tussock (NZ) [18884]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area
Ulex europaeus Gorse, Furze [7693]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-33.78641 150.77059,-33.80112 150.76826,-33.81246 150.77564,-33.82041 150.77606

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [-Office of Environment and Heritage, New South Wales](#)
- [-Department of Environment and Primary Industries, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment, Water and Natural Resources, South Australia](#)
- [-Department of Land and Resource Management, Northern Territory](#)
- [-Department of Environmental and Heritage Protection, Queensland](#)
- [-Department of Parks and Wildlife, Western Australia](#)
- [-Environment and Planning Directorate, ACT](#)
- [-Birdlife Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- [-Natural history museums of Australia](#)
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-South Australian Museum](#)
- [-Queensland Museum](#)
- [-Online Zoological Collections of Australian Museums](#)
- [-Queensland Herbarium](#)
- [-National Herbarium of NSW](#)
- [-Royal Botanic Gardens and National Herbarium of Victoria](#)
- [-Tasmanian Herbarium](#)
- [-State Herbarium of South Australia](#)
- [-Northern Territory Herbarium](#)
- [-Western Australian Herbarium](#)
- [-Australian National Herbarium, Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence
Forestry Corporation, NSW](#)
- [-Geoscience Australia](#)
- [-CSIRO](#)
- [-Australian Tropical Herbarium, Cairns](#)
- [-eBird Australia](#)
- [-Australian Government – Australian Antarctic Data Centre](#)
- [-Museum and Art Gallery of the Northern Territory](#)
- [-Australian Government National Environmental Science Program](#)
- [-Australian Institute of Marine Science](#)
- [-Reef Life Survey Australia](#)
- [-American Museum of Natural History](#)
- [-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [-Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- [-Other groups and individuals](#)

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact Us](#) page.

Annexure E

MNES Assessments of Significance

Significant Impact assessment for vulnerable species - Grey-headed Flying-fox

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

Criteria	Response
A) Lead to a long-term decrease in the size of an important population of a species	No impacts on breeding or roosting habitat for the Grey-headed Flying-fox are expected to result from the proposal as breeding/roosting camps do not occur in the proposal area and therefore would not be impacted.
B) Reduce the area of occupancy of an important population	About 9.30 hectares of potential foraging habitat would be cleared and therefore impacted by the proposal. The foraging habitat present is considered to be of low quality and consists of narrow areas of roadside remnant and regenerating woodland. Multiple flowering Eucalyptus species are present within proposed impact areas, some of which may contribute to winter and spring food resources. The significance of this contribution is not expected to be high as similar foraging habitat of higher quality occurs within the locality and the Grey-headed Flying Fox is a highly mobile species. Additionally, the proposal would not result in a significant reduction in the availability of potential foraging habitat within the locality, and the currently proposed removal of foraging habitat is not expected to cause a long-term decrease in the size of any population of the species.
C) Fragment an existing important population into two or more populations	The proposal is unlikely to increase fragmentation for any population of the species, as the Grey-headed Flying Fox is a highly mobile species and the proposal will not present as a barrier to movement of Grey-headed Flying Fox within the region. The proposal would not impact on areas where the species is known to breed and roost.

Criteria	Response
<p>D) Adversely affect habitat critical to the survival of a species</p>	<p>Habitat critical to the survival of the species has been loosely nominated within DECCW (2009) Draft National Recovery Plan for the Grey-headed Flying-fox. The Draft plan contains a definition for critical foraging habitat, and critical roosting habitat which have been addressed below:</p> <p>Critical Roosting Habitat</p> <p>DECCW (2009) states that habitat that meets at least one of the following criteria can be explicitly identified as habitat critical to survival, or essential habitat, for Grey-headed Flying-foxes. Roosting habitat that:</p> <ol style="list-style-type: none"> 1. Is used as a camp either continuously or seasonally in > 50% of years <p>The proposal area and immediate surrounds are not presently or historically used as a camp site.</p> <ol style="list-style-type: none"> 2. Has been used as a camp at least once in 10 years (beginning in 1995) and is known to have contained > 10 000 individuals, unless such habitat has been used only as a temporary refuge, and the use has been of limited duration (i.e. in the order of days rather than weeks or months) <p>As above.</p> <ol style="list-style-type: none"> 3. Has been used as a camp at least once in 10 years (beginning in 1995) and is known to have contained > 2 500 individuals, including reproductive females during the final stages of pregnancy, during lactation, or during the period of conception (i.e. September to May). <p>As above.</p> <p>Critical Foraging Habitat</p> <p>DECCW (2009) states that foraging habitat that meets at least one of the following criteria can be explicitly identified as habitat critical to survival, or essential habitat, for Grey-headed Flying Foxes. Natural foraging habitat that is:</p> <ol style="list-style-type: none"> 1. Productive during winter and spring, when food bottlenecks have been identified (ParryJones and Augee 1991, Eby et al. 1999): <p>Eucalyptus species within the proposal area have been recorded flowering in the winter months, however this is unlikely to be a reliable occurrence such that it constitutes a productive food source during food bottlenecks. The proposal area may be used on occasion for foraging given the species feeds on a variety of eucalypts. 9.38 ha of potential foraging habitat occurs within the proposal area however, higher quality potential foraging habitat is available in the locality which would not be impacted by the proposal. Given that the potential foraging habitat within the proposal area constitutes such a small area of low quality roadside vegetation, is unlikely to be significantly productive during both winter and spring to an extent that it is critical foraging habitat for the species.</p> <ol style="list-style-type: none"> 2. Known to support populations of > 30 000 individuals within an area of 50 km radius (the maximum foraging distance of an adult) <p>The proposal area does not support a population of >30,000 individuals.</p> <ol style="list-style-type: none"> 3. Productive during the final weeks of gestation, and during the weeks of birth, lactation and conception (September to May) <p>The proposal area is highly unlikely to be productive for the species given absence of roost sites, and the presence of higher quality foraging habitat elsewhere in the locality that will not be impacted by the proposal.</p> <ol style="list-style-type: none"> 4. Productive during the final stages of fruit development and ripening in commercial crops affected by Grey-headed Flying-foxes (months vary between regions) <p>The proposal area is highly unlikely to be productive for the species given absence of roost sites, and the presence of higher quality foraging habitat elsewhere in the locality that will not be impacted by the proposal. No commercial crops or important commercial fruit trees would be impacted by the proposal.</p> <ol style="list-style-type: none"> 5. Known to support a continuously occupied camp <p>No camp sites occur within the proposal area.</p>
<p>D) Disrupt the breeding cycle of an important population</p>	<p>The proposal is unlikely to disrupt the breeding cycle of the species as breeding events for this species primarily take place within camps, none of which would be adversely impacted by the proposal.</p>

Criteria	Response
E) Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The extent of foraging habitat to be removed is not considered sufficient to result in the decline of the species given the occurrence of large areas of higher quality foraging habitat within the locality. The proposal would not isolate areas of foraging habitat.
F) Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;	<p>The proposal is unlikely to increase the likelihood of weeds being established in areas adjacent to impact areas that constitute potential foraging habitat for the species. The disturbance area is an existing road, which is in itself a mechanism for the introduction and spread of weeds in the proposal area. Widening of this road is unlikely to significantly increase weed spread. The proposal will include measures to control weeds becoming established in such areas through the implementation of a Landscape and Rehabilitation Plan.</p> <p>Potential invasive predators such as the fox are likely to be already present within the proposal area and the proposal is not expected to increase the level of predation threat for the Grey-headed Flying-fox.</p>
G) Introduce disease that may cause the species to decline, or	There are no known documented diseases that are currently contributing to the decline of the species. The proposal is not expected to cause an increase in risk of any bat diseases.
H) Interfere substantially with the recovery of the species.	The proposal does not directly or substantially interfere with any of the specific recovery objectives under the draft National Recovery Plan (Commonwealth of Australia 2017). A general objective is to lessen the currently operating threats to the species which includes the removal of foraging habitat. The proposal is therefore not consistent with this general objective. However, the amount and type of foraging habitat removal is not considered to constitute substantial interference with the recovery of the species.
<p>Conclusion: Based on the assessment completed, we concluded that the proposal is unlikely to result in a significant impact due to the following:</p> <ul style="list-style-type: none"> • No Grey-headed Flying Fox camp sites occur within the proposal area or immediate surrounds • The habitat to be removed is not considered to be particularly important foraging habitat in terms of its constitution or size, and • Higher quality foraging habitat occurs elsewhere in the locality, including within protected areas. 	

Significant Impact assessment for listed migratory species - Yellow Wagtail

An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

Criteria	Response
A) Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species, or	No important habitat for any of the potentially occurring migratory species is considered likely to occur within the proposal area, as such, no important areas of habitat will be substantially modified, destroyed or isolated.
B) Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or	No important habitat for any of the potentially occurring migratory species is considered likely to occur within the proposal area, and no invasive species of particular significance to the identified migratory species are expected to become established as a result of the proposal. The proposal area is already affected by invasive plants including some high threat weeds and introduced fauna such as the Cat which have potential to adversely impact most fauna occurring within the proposal area and surrounds. New invasive species are unlikely to become established due to the proposal if mitigation measures are adhered to, including pest and weed management.
C) Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	None of the potentially occurring migratory species would have a significant proportion of their population occurring within the proposal area or utilise the site for a significant proportion of breeding, feeding, migration or resting activity. The Yellow Wagtail does not breed in Australia. Cattle Egrets may breed in wetlands adjacent to the proposal area however, it is unlikely this habitat would be utilised for breeding due to the proximity to the road, high level of noise and light pollution, and the abundance of higher quality wetland habitat present in other parts of the Penrith LGA.
<p>Conclusion: The Proposal would remove 9.30 hectares of native vegetation, which predominantly consists of small areas of remnant and regenerating roadside woodland, drainage lines, and farm dam adjacent areas. None of the above species occur in significant numbers within the proposal area and the proposal area does not support significant breeding habitat such that it may be used by a significant number of individuals to conduct any aspect of their lifecycle including foraging, breeding, overwintering or sheltering. The proposal is not likely to result in a significant impact on the Yellow Wagtail.</p>	

Significance Assessment for Cumberland Plain Woodland

Criteria	Response
<p>A. Reduce the extent of an ecological community</p>	<p>Based on validated vegetation mapping, about 3.68 hectares of Cumberland Plain Woodland that meets the Commonwealth definition of the ecological community will be impacted by the proposal.</p> <p>The validated Cumberland Plain Woodland in the construction footprint occurs as fragmented patches adjacent to Mamre Road or within paddocks. It presents as small, modified patches of woodland and/or scattered clumps of trees.</p> <p>The TEC in the construction footprint is characterised by a canopy of <i>Eucalyptus moluccana</i> (Grey Box) and <i>Eucalyptus tereticornis</i> (Forest Red Gum). The understorey has been highly modified by a history of edge effects and disturbance from land clearing, agricultural activities and weed invasion. Similar condition patches of Cumberland Plain Woodland occur adjacent to the construction footprint (within the BioBank site), and in the Locality as shown in Figure 11.</p> <p>The proposal may result in indirect impacts, such as causing further changes to local hydrological processes, increasing weed invasion and other edge effects in surrounding remnants of Cumberland Plain Woodland. However, any indirect impacts will be managed by the implementation of mitigation measures, which, when implemented, should ameliorate indirect impacts and minimise impacts to Cumberland Plain Woodland within the locality.</p> <p>The local occurrence of Cumberland Plain Woodland mapped by NPWS (2013) totals about 20 hectares, and occurs in varied conditions. Most of which is considered likely to align to the Commonwealth CEEC listing (excludes local occurrences of low condition or derived native grassland, which do not meet the commonwealth definition of the TEC).</p> <p>Cumberland Plain Woodland is preserved to the west of the proposal area within the Orchard Hills Defence Establishment Biodiversity Offset Delivery Plan.</p> <p>It is estimated that the proposal would result in a 12 per cent reduction to the current local occurrence of Cumberland Plain Woodland.</p>
<p>B. Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines</p>	<p>The vegetation within the construction footprint has been fragmented by existing road infrastructure, past land-clearing and agricultural activities. The proposal will marginally increase fragmentation by widening Mamre Road within the existing road reserve.</p> <p>Due to the fragmentation, the construction footprint is connected to Cumberland Plain Woodland in the locality via scattered remnants to the west, which predominantly occurs in paddocks.</p> <p>Whilst the proposal will further reduce the eastern edge of the locality where Cumberland Plain Woodland occurs in a moderate condition, the proposed works will not result in further isolation of a patch of Cumberland Plain Woodland.</p>
<p>C. Adversely affect habitat critical to the survival of an ecological community</p>	<p>The proposal occurs within a highly degraded and fragmented landscape, attributed to road infrastructure, residential development and agricultural practices. For most of the site (excluding the BioBank) the intensity and duration of disturbance to the Cumberland Plain Woodland habitat in the construction footprint is considered to be sufficient to have permanently altered the composition of remaining Cumberland Plain Woodland and significantly impaired the re-establishment of Cumberland Plain Woodland. This is evident in the relatively low native species diversity and high abundance of exotic species recorded in the plot and transect data collected by Aurecon (2020) and Niche. The Cumberland Plain Woodland within the proposal area lacks resilience such that if it were left without any active restoration and management, it is considered likely that the condition of the vegetation in construction footprint would continue to decline.</p> <p>A total of about 3.68 hectares of vegetation of varied conditions (Figure 6) occurs within the locality, of which most is considered likely to align to the Commonwealth CEEC listing. The proposal would result in a 12 per cent reduction to the current local occurrence of Cumberland Plain Woodland.</p>

Criteria	Response
<p>D. Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns</p>	<p>A total of 3.68 hectares of Cumberland Plain Woodland within the construction footprint would be cleared.</p> <p>Based on our understanding of the proposal, we anticipate that all indirect impacts associated with hydrology or erosion would be managed in the design, operation and construction, to ensure minimal impacts to surrounding vegetation.</p>
<p>E. Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting</p>	<p>The Cumberland Plain Woodland within the construction footprint is already in a moderate condition.</p> <p>In relation to indirect impacts to Cumberland Plain Woodland within the locality that may occur as a result of the proposal, the proposal area occurs within a highly degraded and fragmented landscape. For most of the site (excluding the BioBank) the intensity and duration of disturbance on the Cumberland Plain Woodland habitat in the construction footprint is considered to be sufficient to have permanently altered the composition of remaining Cumberland Plain Woodland and significantly impaired the re-establishment of Cumberland Plain Woodland. The exchange of genetic material and available seed bank from within the construction footprint is likely to be quite low, and therefore is not of great importance to the persistence of Cumberland Plain Woodland within the locality. Therefore, it is unlikely that the proposed works will substantially impact upon species composition and viability within the locality.</p>
<p>F. Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to: assisting invasive species, that are harmful to the listed ecological community, to become established, or causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or</p>	<p>The Cumberland Plain Woodland within the construction footprint is already in a low to moderate condition state, as is evident in the relatively low native species diversity and high abundance of exotic species recorded in the plot and transect data collected by Aurecon (2020) and Niche.</p> <p>The Cumberland Plain Woodland within the proposal area lacks resilience such that if it were left without any active restoration and management, it is considered likely that the condition of the vegetation in construction footprint would continue to decline. The exchange of genetic material and available seed bank from within the construction footprint is likely to be quite low, and therefore is not of great importance to the persistence of Cumberland Plain Woodland within the locality.</p> <p>Furthermore, good condition patches of Cumberland Plain Woodland within protected areas in the locality provide genetic material and a viable seed source, and would not be impacted by the proposal.</p> <p>A range of mitigation measures would be implemented to minimise indirect impacts associated with the proposal. This would reduce the likelihood of invasive species from becoming established adjacent to the construction footprint.</p> <p>As such, it is considered that the proposal is unlikely to cause a substantial reduction the quality or integrity of the CEEC within the locality.</p>
<p>G. Interfere with the recovery of an ecological community</p>	<p>The proposal would interfere with the recovery of the community as it would result in the removal of Cumberland Plain Woodland. However, the viability of the CEEC to be cleared is low given the extensive history of disturbance and permanently altered composition that resulted. Further, the condition is considered likely decline overtime without active management. As such the proposal would not impact on any areas of Cumberland Plain Woodland that are important to the recovery of the ecological community.</p>
<p>Conclusion: Based on the assessment completed, we concluded that the proposal is may result in a significant impact due to the following:</p> <ul style="list-style-type: none"> • About 3.68 ha of the CEEC would be directly impacted by the proposal <p>The Cumberland Plain Woodland to be impacted is already fragmented and is in a degraded condition state</p> <ul style="list-style-type: none"> • The Cumberland Plain Woodland to be removed will not adversely affect habitat critical to the survival of an ecological community, and • The Cumberland Plain Woodland to be removed is unlikely to be an important source of genetic diversity or viable seed for the persistence of the ecological community within the locality. 	

Significance Assessment for River-flat Eucalypt Forest

Criteria	Response
<p>A. Reduce the extent of an ecological community</p>	<p>Based on validated vegetation mapping, about 2.97 hectares of River-flat Eucalypt Forest that meets the Commonwealth definition of the ecological community will be removed for the proposal.</p> <p>The validated River-flat Eucalypt Forest in the construction footprint occurs as fragmented patches adjacent to Mamre Road or within paddocks. It presents as small, modified patches of forest. River-flat Eucalypt Forest in the construction footprint (within the BioBank) is connected via a riparian corridor to intact vegetation found in the Defence Establishment in Orchard Hills.</p> <p>The TEC in the construction footprint is characterised by a canopy of <i>Eucalyptus tereticornis</i> (Forest Red Gum) and <i>Angophora floribunda</i> (Rough-barked Apple). The understorey has been highly modified by a history of edge effects and disturbance from land clearing, agricultural activities and weed invasion. Similar condition patches of River-flat Eucalypt Forest occur adjacent to the construction footprint.</p> <p>The proposal may result in indirect impacts, such as causing further changes to local hydrological processes, increasing weed invasion and other edge effects in surrounding remnants of River-flat Eucalypt Forest. However, any indirect impacts will be managed by the implementation of mitigation measures, which, when implemented, should ameliorate indirect impacts and minimise impacts to River-flat Eucalypt Forest within the locality.</p> <p>The local occurrence of River-flat Eucalypt Forest mapped by DPIE is about 70 ha. Most of which is considered likely to align to the Commonwealth EEC listing (excludes local occurrences of low condition or derived native grassland, which do not meet the commonwealth definition of the TEC). River-flat Eucalypt Forest is preserved to the west of the proposal area within the Orchard Hills Defence Establishment Biodiversity Offset Delivery Plan. Additionally, intact River-flat Eucalypt Forest occurs in the western Sydney Parklands to the east of the proposal area which zoned as E2 – Environmental Conservation under the State Environmental Planning Policy (Sydney Region Growth Centres) 2006 (SEPP, SRGC).</p> <p>It is estimated that the proposal would result in a 2 % percent reduction to the current local occurrence of River-flat Eucalypt Forest.</p> <p>Therefore, whilst the removal of River-flat Eucalypt Forest associated with the Proposal would result in a small reduction of the local occurrence, the TEC will continue to exist within the locality. Thus, the reduction in extent is unlikely to be a significant impact such that it threatens the long-term persistence of River-flat Eucalypt Forest in the locality.</p>
<p>B. Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines</p>	<p>The vegetation associated with the proposal has been fragmented by existing road infrastructure, past land-clearing and agricultural activities. The proposal would marginally increase fragmentation by widening Mamre Road within the existing road reserve. River-flat Eucalypt Forest in the construction footprint is connected to larger patches of vegetation via riparian corridors.</p> <p>Whilst the proposal will further reduce the eastern edge of the locality where River-flat Eucalypt Forest occurs in a moderate condition, the proposed works would not result in further isolation of any patches of River-flat Eucalypt Forest.</p> <p>Given the current condition of the vegetation in the construction footprint, and its location adjacent to Mamre Road and paddock vegetation, it's considered that the marginal increase in fragmentation associated with the proposal would not significantly impact the EEC in the locality.</p>

Criteria	Response
<p>C. Adversely affect habitat critical to the survival of an ecological community</p>	<p>The proposal occurs within a highly degraded landscape, attributed to road infrastructure, residential development and agricultural practices. For most of the site (excluding the BioBank) the intensity and duration of disturbance to the River-flat Eucalypt Forest habitat in the construction footprint is considered to be sufficient to have permanently altered the composition of remaining River-flat Eucalypt Forest and significantly impaired the re-establishment of River-flat Eucalypt Forest. This is evident in the relatively low native species diversity and high abundance of exotic species recorded in the plot and transect data collected by Aurecon (2020) and Niche. The River-flat Eucalypt Forest within the proposal area lacks resilience such that if it were left without any active restoration and management, it is considered likely that the condition of the vegetation in construction footprint would continue to decline.</p> <p>A total of about 70 hectares of similar TEC occurs within the locality, of which most is considered likely to align to the Commonwealth EEC listing. The proposal would result in a 2% reduction to the current local occurrence of River-flat Eucalypt Forest.</p>
<p>D. Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns</p>	<p>A total of 2.97 hectares of River-flat Eucalypt Forest within the construction footprint would be cleared.</p> <p>Based on our understanding of the proposal, we anticipate that all indirect impacts associated with hydrology or erosion would be managed in the design, operation and construction, to ensure minimal impacts to surrounding vegetation.</p>
<p>E. Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting</p>	<p>The River-flat Eucalypt Forest within the construction footprint is already in a moderate condition.</p> <p>In relation to indirect impacts to River-flat Eucalypt Forest within the locality that may occur as a result of the proposal, the subject area occurs within a highly degraded landscape. For most of the site (excluding the BioBank) the intensity and duration of disturbance on the River-flat Eucalypt Forest habitat in the construction footprint is considered to be sufficient to have permanently altered the composition of remaining River-flat Eucalypt Forest and significantly impaired the re-establishment of River-flat Eucalypt Forest. The exchange of genetic material and available seed bank from within the construction footprint is likely to be quite low, and therefore is not of great importance to the persistence of River-flat Eucalypt Forest within the locality.</p> <p>Therefore, it is unlikely that the proposed works will substantially impact upon species composition of River-flat Eucalypt Forest within the locality.</p>
<p>F. Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to: assisting invasive species, that are harmful to the listed ecological community, to become established, or causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or</p>	<p>The River-flat Eucalypt Forest within the construction footprint is already in a low to moderate condition, as is evident in the relatively low native species diversity and high abundance of exotic species recorded in the plot and transect data collected by Aurecon (2020) and Niche. The River-flat Eucalypt Forest within the proposal area lacks resilience such that if it were left without any active restoration and management, it is considered likely that the condition of the vegetation in construction footprint would continue to decline.</p> <p>A range of mitigation measures would be implemented to minimise indirect impacts associated with the proposal. This would reduce the likelihood of invasive species from becoming established adjacent to the construction footprint and minimise potential for the mobilisation of any chemical pollutants into the EEC as a result of the proposal.</p> <p>As such, it is considered that the proposal is therefore unlikely to cause a substantial reduction the quality or integrity of the EEC within the locality.</p>

Criteria	Response
G. Interfere with the recovery of an ecological community	The proposal would interfere with the recovery of the community as it will result in the removal of River-flat Eucalypt Forest. However, the viability of the EEC to be cleared is moderate and, given the extent of fragmentation and ongoing disturbances and edge effects, the condition of the EEC would likely decline overtime without active management. As such the proposal would not impact on good condition patches of River-flat Eucalypt Forest in the locality that are important to the recovery of the ecological community.
<p>Conclusion: Based on the assessment completed, we concluded that the proposal is unlikely to result in a significant impact due to the following:</p> <ul style="list-style-type: none"> • The River-flat Eucalypt Forest to be impacted is already fragmented and is in a degraded condition state • The River-flat Eucalypt Forest to be removed will not result adversely affect habitat critical to the survival of an ecological community, and • The River-flat Eucalypt Forest to be removed is unlikely to be important to support genetic diversity and a seed source for the locality. 	

Annexure F

BAM-C Credit Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00025463/BAAS20002/21/00025464	6634 Mamre rd upgrade	24/11/2021
Assessor Name	Report Created	BAM Data version *
Luke Baker	25/05/2022	50
Assessor Number	BAM Case Status	Date Finalised
BAAS17033	Open	To be finalised
Assessment Revision	Assessment Type	
1	Part 5 Activities	

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	TEC name	Current Vegetation integrity score	Change in Vegetation integrity (loss / gain)	Area (ha)	Sensitivity to loss (Justification)	Species sensitivity to gain class	BC Act Listing status	EPBC Act listing status	Biodiversity risk weighting	Potential SAI	Ecosystem credits
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Cumberland riverflat forest												
3	835_Mode rate	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	72.4	72.4	3	PCT Cleared - 93%	High Sensitivity to Potential Gain	Endangered Ecological Community	Not Listed	2.00		108
4	835_Low	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	27.6	27.6	1.2	PCT Cleared - 93%	High Sensitivity to Potential Gain	Endangered Ecological Community	Not Listed	2.00		17
										Subtotal	125	
Cumberland shale plains woodland												
1	849_Mode rate	Cumberland Plain Woodland in the Sydney Basin Bioregion	48.6	48.6	3.7	PCT Cleared - 93%	High Sensitivity to Potential Gain	Critically Endangered Ecological Community	Critically Endangered	2.50	TRUE	112

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2	849_Low	Cumberland Plain Woodland in the Sydney Basin Bioregion	7.6	7.6	0.93	PCT Cleared - 93%	High Sensitivity to Potential Gain	Critically Endangered Ecological Community	Critically Endangered	2.50	TRUE	0
										Subtotal	112	
Cumberland Swamp Oak riparian forest												
5	1800_Moderate	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	36.1	36.1	0.47	PCT Cleared - 60%	High Sensitivity to Potential Gain	Endangered Ecological Community	Endangered	2.00		8
										Subtotal	8	
										Total	245	

Species credits for threatened species

Vegetation zone name	Habitat condition (Vegetation Integrity)	Change in habitat condition	Area (ha)/Count (no. individuals)	Sensitivity to loss (Justification)	Sensitivity to gain (Justification)	BC Act Listing status	EPBC Act listing status	Potential SAIL	Species credits
<i>Meridolum corneovirens / Cumberland Plain Land Snail (Fauna)</i>									
849_Moderate	48.6	48.6	1.6			Endangered	Not Listed	False	39
849_Low	7.6	7.6	0.41			Endangered	Not Listed	False	2

BAM Credit Summary Report

835_Moderate	72.4	72.4	1.1		Endangered	Not Listed	False	41
835_Low	27.6	27.6	0.19		Endangered	Not Listed	False	3
1800_Moderate	36.1	36.1	0.13		Endangered	Not Listed	False	2
							Subtotal	87
<i>Myotis macropus / Southern Myotis (Fauna)</i>								
849_Moderate	48.6	48.6	1.5		Vulnerable	Not Listed	False	37
849_Low	7.6	7.6	0.07		Vulnerable	Not Listed	False	1
835_Moderate	72.4	72.4	2.6		Vulnerable	Not Listed	False	94
835_Low	27.6	27.6	1.2		Vulnerable	Not Listed	False	17
1800_Moderate	36.1	36.1	0.47		Vulnerable	Not Listed	False	8
							Subtotal	157



