Appin Road Safety Improvements from Brian Road to Gilead

Review of Environmental Factors

Roads and Maritime Services | November 2018



BLANK PAGE

Roads and Maritime Services

Appin Road Safety Improvements from Brian Road, Appin to Gilead

Review of environmental factors

November 2018

Prepared by Advisian and Roads and Maritime Services

Copyright: The concepts and information contained in this document are the property of NSW Roads and Maritime Services. Use or copying of this document in whole or in part without the written permission of NSW Roads and Maritime Services constitutes an infringement of copyright.

Document controls

Approval and authorisation

Title

Appin Road Safety Improvements Brian Road, Appin to Gilead - Review of environmental factors

Accepted on behalf of NSW Roads and Maritime Services by

Signed:



Project Development Manager

Dated:

16 November 2018

Richard McHenery

Document status

Document status	Date	Prepared by	Reviewed by
First draft	18 October 2018	AP/GT	GT
Final draft	22 October 2018	GT	GT
Final	16 November 2018	GT	GT

Executive summary

This document is a Review of Environmental Factors (REF) for the 'Appin Road Safety Improvements' (the proposal) required under Division 5.1 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). The purpose of the REF is to describe the proposal, to document the likely impact of the proposal on the environment, and to detail the protective measures (safeguards) that would be implemented when building and operating the proposal.

The proposal

The proposal includes road safety improvements to about a 5.2 kilometre section of Appin Road from the intersection of Appin Road and Brian Road, Appin, and extending north to about 360 metres north of Beulah Reserve, Gilead.

Key features of the proposal include:

- Establishing temporary site compounds and lay down locations required to carry out the proposal
- Providing about two metre wide shoulders along Appin Road about 200 metres north of the intersection of Appin Road and Brian Road, Appin, and extending north to about 360 metres north of Beulah Reserve, Gilead to allow a safer area for vehicles to pull off the road. The shoulders would be widened to about three metres wide at the location of existing driveways
- Building a new northbound overtaking lane at about chainage¹ 2930 to chainage 3600. The overtaking lane would include traffic separation (e.g. safety barrier and/or painted median)
- Installing traffic separation (e.g. safety barrier and/or painted median) for the length of the existing southbound overtaking lane at about chainage 1240 to chainage 1660
- Building a U-turn facility to the north and south of the existing southbound overtaking lane to provide access to and from properties along Appin Road that would be restricted by proposed traffic separation arrangements
- Realigning the existing curve at about chainage 3100 to chainage 3550
- Providing about three metre wide shoulders along Appin Road near and to the north of Beulah Reserve. The offset between the shoulder and the safety barrier on both sides of Appin Road would be to avoid property acquisition at the property directly east of Appin Road which contains an endangered ecological community and at Beulah Reserve which is a biobank site
- Installing new line marking and signposting where required
- Providing fauna fencing in some sections along Appin Road.

Need for the proposal

Appin Road is a key arterial road. Regionally, it connects motorists travelling between South Western Sydney and the Illawarra. It also provides a direct link to the M1 Princes Motorway at Thirroul and the M31 Hume Motorway at Wilton via Wilton Road and at Campbelltown via Narellan Road. Locally the road services the suburbs of Appin, Gilead and Rosemeadow.

Road safety concerns have been identified for Appin Road, due to existing conditions of the road. Roads and Maritime completed a safety review of Appin Road in 2014. Several safety issues were identified in the review such as trees too close to the road's edge, the narrow width of the existing shoulders of the road at a number of locations, and the geometry of the existing curve within the

¹ For all chainage references refer to the strategic design for the proposal (refer to Figure 3-2 to Figure 3-9)

Appin Road Safety Improvements, Brian Rd, Appin to Gilead Review of Environmental Factors proposal location. Safety improvements to Appin Road were recommended to address these safety issues.

Proposal objectives and development criteria

Objectives of the proposal include:

- Improved safety for all road users by reducing the number and severity of road crashes
- Improve travel time reliability and efficiency
- Improved safety for vehicles accessing private properties along Appin Road
- Minimise social and environmental impact both during construction and during operation.

Options considered

The options development process leading to the selection of a preferred option began with Roads and Maritime Services' *The Appin Road - Road Safety Investigation Report* (2014). In 2016, the Federal Government committed funding for work between Appin and Rosemeadow to improve the safety of Appin Road. In 2018, a strategic design was prepared by Roads and Maritime for the proposal.

The strategic road design report for the proposed road safety improvements included key objectives for the proposal. These are to:

- Improve clear zones including installing safety barriers
- Improve overtaking opportunities
- Improve the road alignment about 200 metres north of the intersection of Appin Road and Brian Road, Appin, and extending north to about 360 metres north of Beulah Reserve, Gilead
- Provide a sealed shoulder along Appin Road.

Three options were identified and considered for the proposal. Based on analysis to best address the strategic need and objectives of the proposal, the undertaking of safety improvements to Appin Road generally within the existing road corridor (option 3) was selected as the preferred option.

Statutory and planning framework

The State Environmental Planning Policy (Infrastructure) 2007 (ISEPP) aims to facilitate the effective delivery of infrastructure across NSW. Clause 94 of ISEPP permits development on any land for the purpose of a road or road infrastructure facilities to be carried out by or on behalf of a public authority without consent.

As the current proposal is for a road and is to be carried out on behalf of Roads and Maritime, it can be assessed under Division 5.1 of the EP&A Act. Development consent from council is not required.

This REF fulfils the requirements of Section 5.5 of the EP&A Act and has been prepared in accordance with Clause 228 of the Environmental Planning and Assessment Regulation 2000.

Community and stakeholder consultation

Initial consultation with the local community was carried out in June 2018 with information provided on our plans to complete environmental or technical investigations in the area. Safety improvement work updates were provided on the Roads and Maritime website.

Consultation with other government agencies and stakeholders was also carried out at this time for the proposal. This consultation helped to identify potential environmental and stakeholder issues and opportunities, and to identify potential safeguards and management measures.

Roads and Maritime has reached the next stage of the proposal, which is to display the REF for community and stakeholder feedback. Following the public display period, submissions will be collated and responses will be detailed in a submissions report which will be published online. After considering the submissions, Roads and Maritime will determine whether the proposal should proceed.

Environmental impact

In order to identify the potential environmental impact associated with the proposal including any impact associated with its operation, a number of 'specialist' assessments have been completed. The potential environmental impact during the building of the proposal has been identified which, with the implementation of appropriate safeguards and management measures, is not considered to be significant. The impact and benefits that would likely occur under the proposal are outlined in the sections below.

Biodiversity

The proposal would remove about 4.75 hectares of native vegetation, 3.69 hectares of which comprise two endangered ecological communities, these being Shale Sandstone Transition Forest and Cumberland Plain Woodland.

The native vegetation within the study area is potential habitat for a number of threatened species, including koalas and Cumberland Plain land snail which have been identified as occurring within the study area. A population of koalas is known to exist within the Campbelltown region.

Tests of significance were completed for each threatened species; population and community recorded, or considered to have a moderate-to-high likelihood of occurring locally, which concluded the proposal would not result in any significant impact.

Safeguards are included in the REF to minimise the potential impact on biodiversity. A fauna fencing strategy would be developed to reduce koala road mortality and encourage koalas to move in a north–south direction through and between areas of regional primary habitat. Overall, the proposal has been assessed as not likely to significantly impact threatened species, populations or ecological communities or their habitats, within the meaning of the *Biodiversity Conservation Act 2016* or *Fisheries Management Act 1994*, nor is the proposal likely to significantly impact threatened species, populations, ecological communities or migratory species, within the meaning of the *Environment Protection and Biodiversity Conservation Act 1999*.

Traffic and transport

The proposal would result in a temporary impact on traffic during construction. To minimise the impact to road users, the construction staging has been designed to maintain use of the existing road corridor during construction of the proposal.

However, increased peak period congestion and queuing may potentially occur as a result of the work, leading to minor travel-time delays. Roads and Maritime would work with the contractor to minimise the impact.

Access points along Appin Road and local road access would generally be maintained during the construction period. Temporary disruptions to local access may occur during construction, with further consultation to be carried out with affected landowners prior to these periods to reduce the impact of our works on the surrounding community.

Operation of the proposal would result in improved safety for road users along Appin Road. The proposal is not expected to introduce more traffic onto the road when operational.

Noise and Vibration

During construction, the proposal would result in a temporary noise impact to the surrounding community. These would be most prevalent for surrounding residents, especially if there is any work at night.

There would also be a potential for a vibration impact during construction when vibration causing machinery (e.g. a vibratory roller greater than 18 tonnes) is used within the separation distance of about 25 metres from any building. The vibration impact on heritage items such as the Hume monument is unlikely to exceed the screening level. However, with the implementation of appropriate vibration mitigations as assessed and outlined in the REF, the vibration impact is not expected to be significant.

Safeguards and management measures have been identified to reduce the impact of construction noise and vibration and these are addressed in the REF.

Non-Aboriginal heritage

There are five heritage listed items located within the vicinity of the proposal. These are:

- Beulah (Item I368), listed under Schedule 5 of the Campbelltown LEP. This item is listed on the State Heritage Register (SHR368)
- Brookdale site (Item I54) listed under Schedule 5 of the Campbelltown LEP
- Hume monument (Item I56) listed under Schedule 5 of the Campbelltown LEP
- Humewood Forest (Item I53) listed under Schedule 5 of the Campbelltown LEP. This item is also listed as (original portion 77 of Beulah) on the State Heritage Inventory
- Meadowvale listed under Schedule 4 of the Interim Development Order No.15 City of Campbelltown (IDO15).

Overall, it is considered that on heritage grounds, the proposal would not significantly alter the heritage significance of listed heritage items and/or the associated fabric, character and setting and views to and from each item. The proposal would conserve the heritage value of the area while meeting the specific objectives of improving the safety of the road corridor for users.

Safeguards and management measures have been identified and will be implemented to reduce the potential impact to a heritage item.

Justification and conclusion

Appin Road is a key arterial road connecting motorists between South Western Sydney and the Illawarra. Justification for the proposal was identified through consideration of safety concerns along the road. Following this initial identification for the road safety improvements, Roads and Maritime completed a safety and design review of the road, which identified safety concerns at a number of sections along Appin Road. The review was incorporated into objectives for the proposal, with potential options for the Appin Road safety improvements considered against these objectives. The proposal provides for the best outcomes to meet the objectives.

The proposal is subject to determination under Division 5.1 of the EP&A Act. This REF has examined and considered impacts affecting or likely to affect the environment from building and operating the proposal. The impacts as a result of the proposal would predominately be short-term while the proposal is being built. The impacts will be appropriately mitigated through the implementation of safeguards and management measures identified in this REF, which also included the mitigation of the disruption for road users, residents and other impacted stakeholders.

The proposal would not likely result in any significant long-term impact due to changes to the existing section of the road. Any changes, however, would be offset by the benefits of improved safety for road users. Overall, the proposal is considered justified due to the long-term benefits to the local and regional community and economy and any short term impact can be managed with minimal residual adverse outcomes.

This REF has examined and considered to the fullest extent the impact affecting or likely to affect the environment as a result of the proposal. In conclusion, the proposal's impact are not likely to be significant and therefore preparation of an environmental impact statement under Division 5.2 of the EP&A Act is not required.

Contents

Ex	ecutiv	ve summary	i
Со	ntent	S	vi
1.	Intro	oduction	
	1.1	Proposal identification	
	1.2	Purpose of the report	13
2.	Nee	d and options considered	14
	2.1	Strategic need for the proposal	14
	2.2	Existing infrastructure	
	2.3	Proposal objectives and development criteria	18
	2.4	Alternatives and options considered	19
	2.5	Preferred option	21
3.	Des	cription of the proposal	23
	3.1	The proposal	23
	3.2	Construction activities	
	3.3	Ancillary facilities	42
	3.4	Property acquisition	43
4.	Stat	utory and planning framework	45
	4.1	Environmental Planning and Assessment Act 1979	45
	4.2	Commonwealth legislation	50
	4.3	Confirmation of statutory position	50
5.	Con	sultation	51
	5.1	Consultation strategy	51
	5.2	Community involvement	51
	5.3	Aboriginal community involvement	51
	5.4	ISEPP consultation	
	5.5	Government agency and stakeholder involvement	
	5.6	Ongoing or future consultation	53
6.	Env	ironmental assessment	54
	6.1	Biodiversity	55
	6.2	Soils and geology	68
	6.3	Hydrogeology, hydrology and flooding	73
	6.4	Traffic and transport	
	6.5	Noise and vibration	
	6.6	Aboriginal heritage	
	6.7	Non-Aboriginal heritage	
	6.8	Landscape character and visual impact	
	6.9	Socio-economic and land use	

	6.10	Waste management and resource use	.121
	6.11	Other impact	.124
	6.12	Cumulative impact	128
7.	Envir	onmental management	.134
	7.1	Environmental management plans	.134
	7.2	Summary of safeguards and management measures	.134
	7.3	Licensing and approvals	153
8.	Conc	lusion	154
	8.1	Justification	.154
	8.2	Objects of the EP&A Act	.154
	8.3	The precautionary principle	.155
	8.4	Improved valuation, pricing and incentive mechanisms	.156
	8.5	Conclusion	.157
9.	Certif	fication	158
10.	Refer	rences	.159

Tables

Table 2-1: Existing road network and infrastructure	16
Table 2-2: Existing and proposed cross drainage features	17
Table 3-1: Design criteria	24
Table 3-2: Engineering and development constraints	36
Table 3-3: Likely work activities for the proposal	37
Table 3-4: Indicative plant and equipment required for the proposal	39
Table 3-5: Proposed ancillary facility locations	42
Table 3-6: Proposed property acquisition	43
Table 5-1: Summary of Roads and Maritime Procedure for Aboriginal Cultural Heritage Consultation and	ł
Investigation	51
Table 5-2: Issues raised through ISEPP consultation	52
Table 5-3: Issues raised through stakeholder consultation	52
Table 6-1: Threatened ecological communities in the study area	56
Table 6-2: Threatened faun species recorded with a likelihood to occur	58
Table 6-3: Extent of threatened ecological communities and the amount of loss within the study area	61
Table 6-4: Operation impact	63
Table 6-5: Biodiversity safeguards and management measures	65
Table 6-6: Soils and geology safeguards and management measures	71
Table 6-7: Groundwater bores within one kilometre of the proposal (AECOM 2018)	74
Table 6-8: Hydrogeology, hydrology and flooding safeguards and management measures	77
Table 6-9:Existing traffic distribution along Appin Road (2018)	79
Table 6-10: Traffic and transport safeguards and management measures	81
Table 6-11: Noise catchment areas and monitoring locations	86
Table 6-12: Summary of unattended noise monitoring	86
Table 6-13: Summary of attended noise monitoring	87
Table 6-14: Construction Noise Management Levels for residential receivers	88
Table 6-15: Residential receiver NMLs for building the proposal	90
Table 6-16: Adopted human comfort preferred and maximum does values for intermittent vibration	91
Table 6-17: Adopted structural vibration values – minimal risk of cosmetic damage	92
Table 6-18: Adopted operational road traffic noise criteria for residential receivers	93
Table 6-19: Predicted worst-case noise levels for all work activities and across all NCAs	95
Table 6-20: Predicated operational noise levels	97
Table 6-21: Noise and vibration safeguards and management measures	98
Table 6-22: Survey units	102
Table 6-23: Aboriginal heritage safeguards and management measures	103
Table 6-24: LEP and SHR and LEP items located within the proposal footprint	104
Table 6-25: Non-Aboriginal heritage safeguards and management measures	109
Table 6-26: Landscape character zones	110
Table 6-27: Landscape character and visual impact safeguards and management measures	113

Table 6-28: Socio-economic safeguards and management measures	119
Table 6-29: Waste management safeguards and management measures	123
Table 6-30: Other impact - existing environment and potential impacts	124
Table 6-31 Other impact – safeguards and management measures	126
Table 6-32: Past, present and future projects	130
Table 6-33: Potential cumulative impacts during the building of the proposal	132
Table 6-34: Cumulative impact safeguards and management measures	133
Table 7-1: Summary of safeguards and management measures	135
Table 7-2: Summary of licensing and approvals required	153
Table 8-1: Objects of the EP&A Act	154

Figures

Figure 1-1: Location of the proposal	11
Figure 1-2: The proposal	12
Figure 3-1: Typical cross-section (Appin Road)	27
Figure 3-2: Strategic Design Section A (Appin Road)	28
Figure 3-3: Strategic Design Section B (Appin Road)	29
Figure 3-4: Strategic Design Section C (Appin Road)	30
Figure 3-5: Strategic Design Section D (Appin Road)	31
Figure 3-6: Strategic Design Section E (Appin Road)	32
Figure 3-7: Strategic Design Section F (Appin Road)	33
Figure 3-8: Strategic Design Section G (Appin Road)	34
Figure 3-9: Strategic Design Section H (Appin Road)	35
Figure 4-1: Surface geology	49
Figure 6-1: Location of the proposal, noise catchment areas and monitoring locations	85

Appendices

Appendix A	Consideration of clause 228(2) factors and matters of national environmental significance
Appendix B	Statutory consultation checklist
Appendix C	Biodiversity assessment
Appendix D	Noise and vibration assessment
Appendix E	Aboriginal archaeological survey report
Appendix F	Non-Aboriginal heritage assessment
Appendix G	Landscape and visual impact assessment

1. Introduction

This chapter introduces the proposal and provides the context of the environmental assessment. In introducing the proposal, the objectives and proposal development history are detailed and the purpose of the report provided.

1.1 Proposal identification

Roads and Maritime Services NSW (Roads and Maritime) proposes road safety improvements at Appin Road between Appin and Gilead (the proposal). Roads and Maritime is the proponent for the proposal under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EPA Act).

The proposal includes road safety improvements to about 5.2 kilometre section of Appin Road from the intersection of Appin Road and Brian Road, Appin, and extending north to about 360 metres north of Beulah Reserve, Gilead.

Key features of the proposal include:

- Establishing temporary site compound and lay down locations required to carry out the proposal
- Providing about two metre wide shoulders along Appin Road between about 200 metres north of the intersection of Appin Road and Brian Road, Appin, and extending north to about 360 metres north of Beulah Reserve, Gilead to allow a safer area for vehicles to pull off the road. The shoulders would be widened to about three metres wide at the location of existing driveways
- Building a new northbound overtaking lane at about chainage 2930 to chainage 3600. The overtaking lane would include traffic separation (e.g. safety barrier and/or painted median)
- Installing traffic separation (e.g. safety barrier and/or painted median) for the length of the existing southbound overtaking lane at about chainage 1240 to chainage 1660
- Building a U-turn facility to the north and south of the existing southbound overtaking lane to provide access to and from properties along Appin Road that would be restricted by proposed traffic separation arrangements
- Realigning the existing curve at about chainage 3100 to chainage 3550
- Providing about three metre wide shoulders along Appin Road near and to the north of Beulah Reserve. The offset between the shoulders and the safety barrier on both sides of Appin Road would be to avoid property acquisition at the property directly east of Appin Road which contains an endangered ecological community and at Beulah Reserve which is a biobank site
- Installing new line marking and signposting where required
- Providing fauna fencing in some sections along Appin Road.

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



LEGEND

Work area

Figure 1-1: Location of the proposal





Figure 1-2: The proposal



1.2 Purpose of the report

This review of environmental factors (REF) has been prepared by Advisan on behalf of Roads and Maritime. For the purposes of the work, Roads and Maritime is the proponent and the determining authority under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

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

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

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

• Section 5.5 of the EP&A Act including that Roads and Maritime examine and take into account to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the activity.

The findings of the REF would be considered when assessing:

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

2. Need and options considered

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

2.1 Strategic need for the proposal

Appin Road (MR177) is a key arterial road. Regionally, it connects motorists travelling between South Western Sydney and the Illawarra. It also provides a direct link to the M1 Princes Motorway at Thirroul and the M31 Hume Motorway at Wilton via Wilton Road and at Campbelltown via Narellan Road. Locally the road services the suburbs of Appin, Gilead and Rosemeadow.

Appin Road is currently used by more than 10,000 vehicles per day. Traffic within the proposal is currently predominantly serviced by one traffic lane in each direction with a 450 metre overtaking lane provided for southbound road users. Road user safety has been raised as an issue for Appin Road due to existing road conditions and the relatively high volume of traffic on the road. Roads and Maritime completed a safety review of a section of Appin Road in 2014. The assessment included the proposal location. Safety issues were identified from the audit, including trees located too close to the road edge, the width of the existing lanes and shoulder at a number of locations, and sight lines. Upgrades of Appin Road were recommended to address these safety issues.

In the five year period between 2012 and 2016 there were 27 recorded crashes at Appin Road from Brian Road to Mount Gilead. These included one fatal, 14 injury crashes and 12 non casualty crashes. These were predominantly run-off-road crashes with rear end, striking an animal and head-on also accounting for crashes in the area. Safety improvements to Appin Road was recommended to address these safety issues.

In addition to providing safety, improvements such as the proposed new northbound overtaking lane are also required to cater for predicted additional traffic as a result of planned future land release for urban development within the area.

The proposed upgrade to Appin Road is required to improve the safety of Appin Road and to cater for future land release in the area. The efficient delivery of additional lanes to Appin Road to meet future demand in the area, if required would be subject to further assessment.

2.1.1 NSW Premier's and state priorities

The NSW Government is working to achieve 12 Premier's priorities and 18 state priorities to grow the economy, deliver infrastructure, protect the vulnerable, and improve health, education and public services across NSW.

The proposal specifically addresses or supports the following Premier's priority:

• Key infrastructure projects to be delivered on time and on budget across the state.

The proposal specifically addresses or supports the following state priority:

- Safer communities Reducing road fatalities
- Improving road travel reliability Improving road travel reliability.

2.1.2 A plan for growing Sydney

A Plan for Growing Sydney was released in 2014 and is the strategic plan for the Sydney Metropolitan Area to 2036. It sets out the long-term framework to develop Sydney on the global stage based on integrated 'radical' public transport links and cross-regional transport connections to support economic development. A focussed objective of the Plan is relieving and preventing congestion over the next two decades in the context of the expected growth in Sydney's population. The Plan also focusses on objectives to generate economic benefit including job creation.

The Plan identifies the Campbelltown-Macarthur area as a Sydney strategic centre supporting surrounding communities. The proposal would support key actions of the plan by providing safer access to the Campbelltown-Macarthur area as well as enhancing regional connections between Campbelltown-Macarthur and Wollongong.

2.1.3 Western city district plan

The Western City District Plan (Greater Sydney Commission 2018) is one of five draft District Plans developed by the Greater Sydney Commission for each of Sydney's Districts. The plan provides a 20-year strategic vision for the growth of the Western District of Greater Sydney.

The Western City District Plan identifies Greater Macarthur and Wilton as growth areas, which aims to coordinate planning for:

- Planning priority W1 Planning for a city supported by infrastructure
- Planning priority W5 Providing housing supply, choice and affordability, with access to jobs, services and public transport.

The Greater Macarthur area is targeted as providing additional capacity for housing supply including Gilead and Appin. Additional infrastructure is required to service the new housing, and the draft Western City District Plan identifies Appin Road under the *Western Sydney Growth Roads Program* as an important road upgrade to meet traffic demand from surrounding centres.

2.1.4 National road safety action plan 2018-2020

This Plan sets priority actions to be achieved between 2018 and 2020 which focuses on reducing crashes and serious injuries on regional roads and encouraging shared responsibility for road safety outcomes.

The proposal would support:

• Priority action 2 - Target infrastructure funding towards safety-focused initiatives to reduce trauma on regional roads.

The proposal would create 'safer roads' through safety improvements including widening and sealing the road shoulder, removing roadside hazards, realigning the road from chainage 3099 to chainage 3541 and installing safety barriers.

2.1.5 Campbelltown local planning strategy

A key objective of this strategy is to ensure land use planning decisions are consistent with the Metropolitan Plan 2036 (superseded by A Plan for Growing Sydney).

The proposal would improve access through Appin Road to the Greater Macarthur Priority Growth Area, which is a key strategy in A Plan for Growing Sydney.

2.1.6 Wollondilly local planning strategy

In 2011 Wollondilly Shire Council adopted a Growth Management Strategy in recognition of the need to have a plan for future growth, as well as plan for future service and infrastructure provision.

The proposal is consistent with the strategy by supporting "hard" infrastructure improvement by providing safety improvements along Appin Road.

2.2 Existing infrastructure

This section describes the existing roads and infrastructure in the area, which has helped define the options developed for the proposal.

2.2.1 Existing road infrastructure

Table 2-1 describes the existing road network and infrastructure that forms and intersects with the proposal footprint.

Table 2-1: Existing road network and infrastructure

Road description

Appin Road (MR177) (Arterial)

- Running north to south connecting the suburbs of Campbelltown and Appin
- Two-lane undivided road through the proposal footprint
- Includes a 450 metre southbound overtaking lane at chainage 1240 to chainage 1660, southbound right turn bay and northbound left turn slip lane at the intersection of Appin Road and Brain Road
- Other key features:
 - Lane width of about 3.5 metres
 - · Posted speed limit of 80 kilometres per hour at the proposal location
 - The road generally follows the natural topography with a compound curve from chainage 3099 to chainage 3541.

Brian Road (Nearest local collector road)

- Running east to west at Appin
- Two-way undivided road

- About 800 metres long in about a eight metre wide road corridor
- Other key features: intersection with Appin Road

2.2.2 Civil infrastructure

Drainage

Road side drainage within the proposal footprint consists of table drains that are shallow in nature and an existing 640 metre and a 112 metre length type SO gutter along the western side of Appin Road at chainage 995 to chainage 1850. Road side drainage along the remainder of the footprint drains directly into property that is located directly next Appin Road.

Cross drainage features (exiting and proposed) are shown in Table 2-2.

Table 2-2: Existing and proposed cross drainage features

Crossing name	Location (chainage on MC00)	Description of existing crossing structure	Description of proposed crossing structure
XD01	8	2 x 375 mm diameter reinforced concrete pipe	Retain existing
XD02	1725	2 x 375 mm diameter reinforced concrete pipe	Remove and replace
XD03	1978	375 mm diameter reinforced concrete pipe	To be extended
XD04	2030	None	New pipe
XD05	2435	375 mm diameter reinforced concrete pipe	Remove and replace
XD06	2588	375 mm diameter reinforced concrete pipe	Remove and replace
XD07	3085	375 mm diameter reinforced concrete pipe	To be extended
XD08	3328	300 mm diameter reinforced concrete pipe	Remove and replace
XD09	3988	450 mm diameter reinforced concrete pipe	To be extended
XD10	4030	450 mm diameter reinforced concrete pipe	Retain existing
XD11	4362	375 mm diameter reinforced concrete pipe	To be extended
XD12	4583	450 mm diameter reinforced concrete pipe	Retain existing

Utilities and services

There are a number of utilities within the proposal footprint. The main utilities in the area are:

- Sydney Water
- Endeavour Energy (Electricity)
- Jemena (Gas)
- Telstra.

2.3 Proposal objectives and development criteria

2.3.1 Proposal objectives

Objectives of the proposal include:

- Improved safety for all road users by reducing the number and severity of road crashes
- Improve travel time reliability and efficiency
- Improved safety for vehicles accessing private property along Appin Road
- Minimise social and environmental impact.

2.3.2 Development criteria

The development criteria for the proposal include:

- Designing the proposal in a manner that is informed by environmental investigations to minimise any adverse impact while maximising environmental benefits
- Satisfying the technical and procedural requirements of Roads and Maritime and other stakeholders with respect to the design of the proposal
- Optimising the design to ensure that the proposal can be practically and efficiently constructed and maintained while meeting all other proposal objectives
- Applying appropriate urban design, landscape and visual principles in the concept design of the proposal elements
- Designing all connections, modifications and improvements necessary to link the proposed work to the existing road system
- Planning temporary arrangements that minimise disruption to local and through traffic and that maintain access to adjacent properties during construction
- Developing, implementing and maintaining effective management systems for quality, work health and safety, environmental, proposal reporting, risk management, value management and value engineering, constructability assessment, safety audits and community participation.

2.3.3 Urban design objectives

Urban design objectives for the proposal include:

- Maximise tree retention where possible, including throughout the road corridor to minimise the impact to areas of the proposal which contain endangered ecological communities. These areas also contain vegetation communities which are a preferred Koala habitat. Beulah Reserve is also a biobanking site
- Provide high quality urban outcomes for stretches of the road that are primarily rural landscape
- Retain and protect existing heritage sites for their visual and place making contribution to the road
- Contribute to the overall quality of the public domain for the community, including transport users.

The proposal's landscape objectives are to:

- Provide an attractive rural landscape road with scattered tree canopy highlights
- Protect sensitive environments directly next to the road corridor including Beulah Reserve and endangered ecological communities located within the corridor Appin Road, heritage items and local residences as far as practical.

2.4 Alternatives and options considered

A number of alternatives and options were identified and considered in developing the proposal and selecting the preferred option. They are summarised in this section.

2.4.1 Methodology for selection of preferred option

The options development process leading to the selection of a preferred option began with the Roads and Maritime *The Appin Road - Road Safety Investigation Report* (Roads and Maritime Services 2014). In 2016 the Federal Government committed \$50 million to target work between Appin and Rosemeadow to improve safety along Appin Road. In 2016 BG&E prepared a strategic design for road safety improvements for a 5.9 kilometre length of Appin Road. The strategic design was taken forward and refined by Roads and Maritime in 2017.

The strategic road design report for the proposed road safety improvements along Appin Road included an assessment of existing traffic conditions along Appin Road including five year crash history from 2012 to 2016. As part of the report a number of objectives for the proposal were identified. These included the following key objectives:

- Improve clear zones including installing safety barrier
- Improve overtaking opportunities
- Improve the road alignment at about 200 metres north of the intersection of Appin Road and Brian Road, Appin, and extending north to about 360 metres north of Beulah Reserve, Gilead
- Provide sealed shoulder along Appin Road.

Consideration of concept design options were considered and a preferred option was selected taking into consideration the proposal objectives (refer to section 2.3.1).

2.4.2 Identified options

Option 1 - Do nothing: adopt the current alignment and safety arrangement of Appin Road

The 'do nothing' option would result in no change to Appin Road. Appin Road would remain a two-lane single carriageway road between the intersection of Appin Road and Brian Road and extending north to about 360 metres north of Beulah Reserve. Road safety hazards would not be corrected as a result of this option.

Option 2 - Undertake safety improvement to Appin Road including road widening at the northern end of Appin Road near Beulah reserve

Option 2 provides safety improvements within the proposal footprint including sealed shoulder, removal of roadside hazards, U-turn facilities and safety barrier, curve realignment of the high-risk curve at about chainage 3100 to chainage 3550, and a new northbound overtaking lane. There would be minor land acquisition along Appin Road as part of the safety improvements including land at Beulah Reserve which is a biobank site.

Option 3 - Undertake safety improvement to Appin Road generally within the existing road corridor

Option 3 predominantly follows the existing alignment of Appin Road and offers safety improvements within the proposal footprint including sealed shoulder, removal of roadside hazards, safety barrier, curve realignment of the high-risk curve at about chainage 3100 to chainage 3550 and a new northbound overtaking lane. There would be minor land acquisition along Appin Road as part of the safety improvements.

This option would not require widening of Appin Road to the western side near Beulah Reserve and therefore no need to acquire land at Beulah Reserve.

2.4.3 Analysis of options

Option 1 - Do Nothing

This option would not meet the proposal objectives or address the strategic need of the proposal. The 'do nothing' option would maintain the road in its current configuration of generally two undivided lanes and offer no improvement to road safety.

Option 1 would have the least environmental impact of all the options as road work would be avoided. The social impact would also be avoided because there would be no impact traffic during construction.

Option 2 - Undertake safety improvement to Appin Road including road widening at the northern end of Appin Road near Beulah reserve

This option would meet the proposal objectives and address the strategic need of the proposal. Option two would improve the general safety of the road including removing the high-risk curve within the proposal footprint.

Option 2 would have the most environmental impact of all the options as there would be land acquisition and land clearing at Beulah reserve as a result of widening of Appin Road to the western side near the reserve. This option would also see minor disruptions due to increased traffic impact during construction.

Option 3 - Undertake safety improvement to Appin Road generally within the existing road corridor

Option 3 would best meet the proposal objectives and address the strategic need of the proposal. Option 3 would improve the general safety of the road including removing the high-risk curve within the proposal footprint.

Option 2 would have some environmental impact as there would be the need for some land acquisition and land clearing as a result of the safety improvement work. This option does avoid the need for land acquisition and addition clearing at Beulah Reserve as improvements would be generally be contained within the existing road reserve. This option would see minor disruptions to traffic during construction.

2.5 Preferred option

Based on the analysis of options detailed in section 2.4, Option 3 was selected as the preferred and comprises:

- Shoulder widening where required within the proposal footprint to provide a two metre sealed shoulder along Appin Road. The sealed shoulder would be widened to about three metres at the location of driveways along Appin Road to allow vehicles to pull off the road when turning left into driveways and allow vehicles to safely pass vehicles waiting to turn right.
- Providing a new 670 metre northbound overtaking lane from about chainage 2930 to chainage 3600. The overtaking lane would include traffic separation using safety barrier and/or painted centre median
- Installing about a 1.5 metre wide median with traffic separation (e.g. safety barrier and/or painted centre median) for the length of the existing 450 metre long southbound overtaking lane about chainage 1240 to chainage 1660
- Providing U-turn facilities with right turn bay access north and south of the existing southbound overtaking lane to provide right turn access to and from properties along Appin Road
- Realigning the existing curve from about chainage 3100 to chainage 3550
- Shoulder widening on both sides of Appin Road near Beulah Reserve and to the north of Beulah Reserve. The offset between the shoulder and safety barrier on both sides of Appin Road would be reduced to about 2.5 metre to avoid property acquisition from the property directly to the east which contains an endangered ecological community and from Beulah Reserve which also is a biobank site
- New line marking and signposting where required
- Provision of fauna fencing in some locations along Appin Road.

The preferred option is based on the following analysis outcomes:

- The preferred road design provides the best technical design to deliver road safety improvements in general accordance with the proposal objectives
- Road safety improvements would be improved while maintaining traffic flows. In particular, by allowing for the curve realignment and the addition of a northbound overtaking lane, it would improve in safety performance along Appin Road
- The environmental and social impact of the proposal would predominately be generated during the building of the proposal; however, the impact would be minimised as far as practical through the implementation of best practice management and mitigation measures.

The principles of ESD were also considered, with the preferred option:

- Adopting a simple cost-effective design that makes use of an existing road
- Being easy to build, which would reduce the construction program and footprint and therefore minimise the social impact on the people that live in the area.

3. Description of the proposal

This chapter describes the proposal, the design parameters including major design features, the construction method and associated infrastructure and activities.

3.1 The proposal

The proposal includes road safety improvements to about 5.2 kilometre section of Appin Road from the intersection of Appin Road and Brian Road, Appin, and extending to about 360 metres north of Beulah Reserve, Gilead (Lot 23 DP1132437) in the north.

The proposal is shown in Figure 1-2.

Key features of the proposal include:

- Establishing temporary site compound and lay down locations required to carry out the proposal
- Providing about two metre wide shoulders along Appin Road between about 200 metres north of the
 intersection of Appin Road and Brian Road, Appin, and extending north to about 360 metres north of
 Beulah Reserve, Gilead to allow a safer area for vehicles to pull off the road. The shoulders would be
 widened to about three metres wide at the location of existing driveways
- Building a new northbound overtaking lane at about chainage 2930 to chainage 3600. The overtaking lane would include traffic separation (e.g. safety barrier and/or painted median)
- Installing traffic separation (e.g. safety barrier and/or painted median) for the length of the existing southbound overtaking lane at about chainage 1240 to chainage 1660
- Building a U-turn facility to the north and south of the existing southbound overtaking lane to provide access to and from properties along Appin Road that would be restricted by proposed traffic separation arrangements
- Realigning the existing curve at about chainage 3100 to chainage 3550
- Providing about three metre wide shoulders along Appin Road near and to the north of Beulah Reserve. The offset between the shoulder and the safety barrier on both sides of Appin Road would be to avoid property acquisition at the property directly east of Appin Road which contains endangered ecological communities and at Beulah Reserve which is a biobank site
- Installing new line marking and signposting where required
- Providing fauna fencing in some locations along Appin Road.

3.2 Design

3.1.1 Design standards

The following guidelines and standards have been used to inform and develop the concept design:

 Austroads Guide to Road Design (Austroads 2009) (in conjunction with RTA Austroads Guide Supplements)

- Guide to Asset Management
- Guide to Pavement Technology
- Guide to Project Delivery
- Guide to Project Evaluation
- Guide to Road Design
- Guide to Road Safety
- Guide to Transport Planning
- Guide to Traffic Management
- Beyond the Pavement Urban Design Policy Procedures and Design Principles (Roads and Maritime, 2014).

3.1.2 Design criteria

The above standards describe the criteria that should be adopted for specific road types (i.e. rural roads, sub-arterials, arterial etc.) and conditions (i.e. rural, semi-urban). The criteria have been developed to ensure all roads are designed to be safe, effective, well-planned and easily maintained. The adoption of the criteria is often referred to as being 'consistent with design standards'. Where different criteria have been adopted this is referred to as a 'departure from standards'. Any departures from the standards need justifying to ensure they still provide a safe outcome. A typical cross-section is shown in Figure 3-1 below.

Table 3-1 shows design criteria that have been adopted for the proposal.

Aspect	Design criteria	
Cross-section and lane widths		
Cross-section	About 11 metres wide	
Lane width	Traffic lanes: • Northbound - 3.5 metres • Southbound - 3.5 metres Turning lanes: • Right turn lanes - 3.3 metres	
Medians	About a 1.6 metre wide median with safety barrier has been adopted next to the proposed northbound overtaking lane to prevent right turns from the overtaking lane into private properties and thus prevent the potential for rear end crashes. About a 1.6 metre wide painted median is the minimum width for a safety barrier such as wire rope and recognises that with 1.7 metre deflection at 100 kilometres per hour would result in the wire rope encroaching about 0.9 metres into the opposing lane. A 1.5 metre wide painted median with a safety barrier has been adopted next to the existing southbound overtaking lane. This is slightly less than the minimum width but would avoid any widening of the existing pavement formation to reduce costs. There are wire rope	

Table 3-1: Design criteria

Appin Road Safety Improvements, Brian Rd, Appin to Gilead Review of Environmental Factors

Aspect	Design criteria	
	safety barrier products that only have a maximum 1.4 metre deflection. The maximum encroachment into the opposing lane would therefore be 0.7 metre.	
Shoulders	Sealed shoulder width are to be between about two and three metres wide. The sealed shoulders would provide a recovery area and help to reduce run off road crashes. Austroads indicates that safety does not improve significantly for shoulder widths over 1.5 metres. The sealed shoulder is to be widened to about three metres where there are driveways to allow vehicles to pull off the road safely when entering driveways. The sealed shoulder would be widened to about three metres where there are driveways on the right hand side to allow through vehicles to pass around a vehicle waiting to turn right into a property similar to a basic right turn treatment.	
Footpaths/ verges	There are no footways. A one metre wide verge has been adopted outside the edge of shoulders. If a safety barrier is required, it would be placed outside the verge and provide about a three metre offset from the painted edge line.	
Cross fall	As this proposal mainly involves safety improvement work, the existing road cross fall and superelevation have generally been adopted for the proposal.	
Pavement type	Pavement investigations and design has not been carried out for the proposal. A pavement type consisting of a 700 millimetre deep pavement consisting of 300 millimetre select material, 200 millimetre heavy bound material and 200 millimetre asphalt has been assumed for strategic quantity purposes.	
Barrier type	Safety barrier (e.g. wire rope)	
Design specification		
Speed	 Design speed: Northbound: 90 kilometres per hour (Design speed) Southbound: 90 kilometres per hour (Design speed). Posted speed: Northbound: 80 kilometres per hour (Posted speed) Southbound: 80 kilometres per hour (Posted speed). 	
Design Vehicle - Turning movement	 Through lanes: 26-metre long B-double. Turning path (for U-turn facilities): Semi-trailer. 	
Stopping sight distance	 Northbound (900 metre radius curve; chainage 1075 to chainage 1205: Stopping sight distance would be achieved for the posted speed of 80 kilometres per hour. Southbound (700 metre radius curve chainage 1760 to chainage 1805) for vehicles entering the overtaking lane: Stopping sight distance would be achieved for the posted speed of 80 kilometres per hour. 	

Aspect	Design criteria	
Engineering specification	on	
Lane width	Through lanes: • 3.5 metre. Right turn lane: • 3.3 metre.	
Medians	1.5 to 1.6 metre median	
Design specification		
Speed	80 kilometres per hour	
Stopping distance	Car	



Figure 3-1: Typical cross-section (Appin Road)



Figure 3-2: Strategic Design Section A (Appin Road)



Figure 3-3: Strategic Design Section B (Appin Road)



Figure 3-4: Strategic Design Section C (Appin Road)



Figure 3-5: Strategic Design Section D (Appin Road)



Figure 3-6: Strategic Design Section E (Appin Road)


Figure 3-7: Strategic Design Section F (Appin Road)



Figure 3-8: Strategic Design Section G (Appin Road)



Figure 3-9: Strategic Design Section H (Appin Road)

3.1.3 Engineering constraints

Several engineering issues and constraints for the design and construction of the proposal have been identified. Table 3-2 identifies the main issues and constraints for the proposal. These issues and constraints have informed the development of the design for the proposal. Further discussion of these issues and constraints are provided in chapter 6 where there is an expected environmental impact to the study area as a result of the proposal.

Constraint	Comment
Utilities in the area	• Utilities affected by the road widening would need to be relocated next to the proposal boundary due to space constraints.
Properties	• Existing property boundaries in the north have provided a constraint to avoid impact to property.
Existing pavement levels	• The design would maintain the existing pavement levels on the current carriageway.
Drainage	• Runoff from major storms flow along the western side of Appin Road at chainage 995 to chainage 1850. Road side drainage along the remainder of the footprint drains directly into property that is located directly next Appin Road.

Table 3-2: Engineering and development constraints

3.2 Construction activities

The likely method, staging, work hours, plant and equipment requirements needed to build the proposal are described in this section. An indicative work plan and method are also provided.

At this stage, Roads and Maritime needs to finalise the detailed design for the proposal. Roads and Maritime would then appoint a contractor to build the proposal.

The contractor appointed to build the proposal would prepare a detailed construction plan and method once the proposal's design is finalised. The work plan and method may allow for several activities to be undertaken at the same time. It would also account for the need to minimise the traffic impact on the major roads in the area, particularly during peak periods. The actual work method may vary from the description provided in this section due to the identification of additional constraints before work starts, ongoing detailed design refinements, feedback from community and stakeholder consultation, and contractor requirements/limitations.

3.2.1 Work methodology, construction hours and duration

The proposal is anticipated to be built over a two-year period starting in financial year 2019/20.

The proposal would be built under Roads and Maritime construction specifications under a construction environmental management plan (CEMP). These specifications cover environmental performance and management including vegetation removal, stockpile management, and erosion and sediment control.

The proposal has been designed to allow Appin Road to remain operational during work actives to carry out the proposal. Consideration of worker safety during construction would be considered prior to the commencement of work such as the use of safety barriers.

The proposal would generally involve a sequence of work activities as follows:

- Site establishment and environmental protection
- Utility adjustment/installation, earthwork and drainage work
- Road removal, building and/or repair of the road and installing new road infrastructure
- Amenity, landscaping and urban design work
- Finalisation work
- Site demobilisation.

Table 3-3 describes the likely work activities that would be undertaken to build the proposal. It is likely that the following activities would take place across all work stages in all sections of the proposal footprint.

Table 3-3: Likely work activities for the proposal

Activity	Description		
Site establishment and environmental protection	• Setup environmental, safety and traffic management controls (refer to Chapter 7)		
	Pre-clearance surveys and obtaining any permits or licences		
	 Establish site compounds (refer to section 3.5), designated storage areas, stockpile areas and stabilised access to work zones across the proposal footprint 		
	• Site demarcation, exclusion fencing and barrier establishment, identification and protection of sensitive areas (i.e. habitat zones, trees)		
	 Land clearance (vegetation removal, clearing and grubbing) and any property adjustments 		
	Install temporary site drainage controls (as required).		
Utilities, earthwork and drainage	 Install temporary site drainage controls (as required). Utilities: Protect existing utilities Adjust and relocate: existing utilities Install and test: new utilities General utility work would vary depending on whether the utility was being protected, adjusted or installed, and would include a combination of: Trench and/or under-boring excavation Bedding material installation Pipeline and conduit installation Cable pulling to install new power and communications cables Pit and cutover excavation Valve, switch and other infrastructure installation to allow the transfer of utilities to the new alignment Service testing and commissioning Backfill and compaction 		

Activity	Description		
	 Ground surface restoration. Earthwork: Sequentially strip and excavate top soil and sub soil Grade and compact areas (where required). Drainage lines and general drainage work. Drainage work would vary depending on whether the drainage was being relocated, removed or installed. Typically it may involve: Temporary diversions and erosion and sediment control measures Excavating overburden on existing structures and protect, cap, seal and remove any existing infrastructure Trench excavation for the new structures and inclusion of measures to protect any retained drainage structures Installing foundation and bedding material Installing and connect infrastructure Backfill and compaction with excavated materials or import new clean fill Ground surface restoration work. 		
Road removal, building and/or repair, installing new road infrastructure	 Implement diversions and traffic management controls (as needed) Remove materials to support the new work and depth (referred to as boxing out) Milling the road surface Prepare and level the subgrade Lay and compact new road surface layers Install new road infrastructure. 		
Amenity, landscaping and urban design work	Carry out final grading, levelling and compactionLandscape and final treatments and finishes.		
Finalisation work	Paint permanent line markings etc.		
Demobilisation	 Demobilise the site compounds Remove temporary traffic management controls Remove environmental, safety and traffic controls (refer to Chapter 7). 		

3.2.2 Construction hours and duration

Roads and Maritime plans to carry out the proposal over a period of about 12-18 months (weather permitting). As discussed above construction is scheduled to commence in FY2019/20.

Construction would normally be limited to between the following standard work times:

- 7am to 6pm Monday to Friday
- 8am to 1pm Saturday.

Work outside of standard hours would be required throughout the proposal in order to minimise the traffic impact in the area, particularly during peak periods.

Appropriate impact investigation prior to implementation, mitigation measures and community consultation would be carried out for work proposed outside of the standard working hours. All required approvals including Road Occupancy Licence (ROL) from the Transport Management Centre would be obtained prior to the work being carried out.

3.2.3 Plant and equipment

An indicative list of plant and equipment that would typically be required is provided in Table 3-4. Additional equipment would be likely used and would be identified during detailed design by the construction contractor.

Table 3-4: Indicative plant and equipment required for the proposal

Activity	Indicative plant and equipment
Site establishment and environmental protection work	 Site office, site shed and amenities Light and heavy vehicles Generator Hand held tools
Utilities, earthwork and drainage work	 Light and heavy vehicles Excavator Concrete truck Generator Hand held tools
Road removal, building and/or repair, installing new road infrastructure	 Light and heavy vehicles Asphalt profiling machine Asphalt paver Vibratory roller Generator
Amenity, landscaping and urban design work	 Light and heavy vehicles Generator Hand tools
Finalisation work	 Line marking truck Hand tools Light vehicles

Activity	Indicative plant and equipment	
Demobilisation	 Light and heavy vehicles Hand tools Generator 	

3.2.4 Earthwork

Materials would be sourced from local areas where practicable. This section also describes how surplus material and water use would be managed.

Excavations would be required to carry out the safety improvements. The ability to reuse the material would depend on its physical and chemical properties. Material unsuitable for construction use would need to be transported offsite by a licensed contractor for disposal at a licensed waste management facility following testing and classification (refer to section 6.10). In summary, it is estimated that to build the proposal about:

- 316 square metres of existing road pavement would be removed
- 27,500 square metres of earthwork would be carried out to build the proposal
- 26,500 square metres of new pavement would be needed to build the proposal
- 4,350 metres of safety barrier would be needed to be built the proposal.

Earthwork materials and estimated quantities would be further refined prior to the start of construction. Any unsuitable or surplus material would be managed in accordance with resource management hierarchy principles. This includes, in order of preference:

- Reuse as engineered fill onsite
- Transfer:
 - · To another Roads and Maritime project for use as engineering fill
 - · For storage at a Roads and Maritime stockpile site to allow for its future reuse
 - · To another construction site for use as engineering fill
 - To a licenced waste recovery site
 - For disposal at a licenced facility.

3.2.5 Materials

Natural resources would include aggregate and sand for use in concrete. Asphalt would be required for the proposal. Manufactured items, including steel, pre cast components would also be required.

Materials would be sourced from appropriately licensed facilities. Wherever possible, materials would be sourced from commercial suppliers in nearby areas or other viable sources such as other nearby infrastructure planning proposals. No materials currently proposed to be used for the proposal are considered to be in short supply.

If additional fill material is required, that cannot be sourced from within the proposal footprint, it would be imported from a suitably licensed nearby quarry. Surplus material that cannot be used within the proposal footprint would be reused on other projects or disposed of in the following order of priority:

- Transferred to other Roads and Maritime projects sites for reuse in accordance with the NSW EPA Excavated Public Road Material resource recovery exemption
- Transferred to an approved Roads and Maritime stockpile site for future re-use, only if a specific project
 has been identified before stockpiling and Protection of the *Environment Operations Act 1997* (POEO
 Act) waste regulatory requirements have been met. If a project cannot be identified the material would
 not be stockpiled within the proposal
- Transported off site for reuse by a third party in accordance with a relevant EPA resource recovery exemption or planning approval
- Disposed of at an approved materials recycling or waste disposal facility
- As otherwise provided for by the relevant waste legislation.

Water use

Water would be required for activities such as the compaction of earthwork and pavement layers and dust suppression. The amount of water that would be required during construction is unknown at this stage. The amount would depend on material sources and methodologies applied by the contractor. Water would be sourced from the Sydney Water's water supply network.

3.2.6 Traffic management and access

Vehicle movements

Road traffic would be impacted throughout the construction period. The majority of construction activities would generally be carried out during day time in order to minimise disruption to nearby sensitive receptors. However, there would be the need for some night work to minimise the impact to traffic. Lane closures and detours would be detailed in the Traffic Management Plan (TMP) for the proposal.

Construction traffic movements would occur on the surrounding road network with around 50 heavy vehicle and 50 light vehicle movements per day during peak construction times. Access to the site would be restricted to left-in-left-out only where practical and feasible to do so.

Heavy vehicles would be used to deliver construction material to the proposal footprint and transfer construction materials to nominated stockpile sites. These would be managed in accordance with the management measures outlined in the TMP for the proposal.

Traffic management, control and signage

Where possible, construction would be programmed to minimise the impact on traffic using the local and regional road network.

Standard traffic management measures would be used to minimise the traffic impact expected during construction. These measures would be identified in a TMP for the proposal and would be developed in accordance with the Roads and Maritime's *Traffic Control at Work Sites Manual* (Roads and Maritime 2018) and Roads and Maritime *Specification G10 - Traffic Management* Roads and Maritime, 2015d.

The TMP would provide details of traffic management to be implemented during construction. Impact to the public (including traffic and cyclists) during construction would be managed through the TMP and detailed traffic control plans. During all stages of construction, access to businesses and to work areas would be maintained.

Road and lane closures

Traffic delays may occur as a result of the proposal being built would be managed through the provisions of a TMP. Traffic management would be designed to ensure the flow of traffic throughout the periods of lane closures while the proposal being built.

The impact of construction worker vehicle parking would be managed through measures identified in the TMP. Further details on the potential traffic impact as a result of the proposal are provided in section 6.4.

3.3 Ancillary facilities

Compound sites close to the proposal footprint would be required to store equipment, machinery and vehicles to build the proposal. The specific requirements for each site would depend on the construction staging. Provisionally, there are three locations that would be used as site compounds during construction.

The location of all ancillary facilities has been selected to meet the following criteria:

- Away from areas of ecological and heritage conservation value
- Outside of flood prone land
- At least 50 metres from a watercourse
- On previously disturbed areas that do not require the clearing of native vegetation
- More than 100 metres from residential properties
- Outside the drip line of trees and on relatively level ground.

Table 3-5 describes the proposed ancillary facilities and Figure 1-2 shows the location of the facilities.

Table 3-5: Proposed ancillary facility locations

Facility	Likely role, use and associated work activities		
Site compound - 275 Appin Road, Appin	Proposed as the site compound for the work and used to support building the whole proposal.		
	Main uses:		
	Material storage and laydown		
	Temporary waste storage		
	Stockpiling		
	Refuelling		
	Construction equipment, plant and vehicle storage		
	Vehicle wash down (if required)		
	Inspections, maintenance and repairs		

Facility	Likely role, use and associated work activities		
	Staff parking, site offices and amenities.		
Site compound - Sydney Water site	 Proposed as a satellite compound used to support building the whole proposal and the main site compound at Brian Road. This would be used for: Material storage and laydown Stockpiling Construction equipment, plant and vehicle storage. 		
Site compound/laydown area – from about chainage 3100 to chainage 3550	 Proposed as a satellite compound used to support building the whole proposal and the main site compound at Brian Road. This would be used for: Material storage and laydown Stockpiling Construction equipment, plant and vehicle storage. 		

3.3.1 Public utility adjustment

The proposal would require certain underground utilities and services to be adjusted, relocated or installed along the alignment. The location and presence of utilities that would be potentially impacted include:

- Telstra ducts at chainage 850 to 890, chainage 1630 to 1730, chainage 1660, chainage 1840 to 1880, chainage 1990 to 2030, chainage 2250, chainage 2850 to chainage 3770
- Telstra optical fibre cable (Melbourne Sydney high integrity data) at chainage 1990 to chainage 2030, chainage 3770 to chainage 3880, chainage 4090 to chainage 5200
- Telstra optical fibre cable and power pole at chainage 2405
- Underground electricity at chainage 930
- Rising sewer main at chainage 860 to chainage 880

Additional surveys would be carried out prior to the start of work to determine any additional utility impact. Consultation with public utility providers for the proposal is ongoing, as detailed in section 5.5.

3.4 Property acquisition

About 20,618 square-metres (about 2.1 hectares) of land would need to be acquired from private land owners to build the proposal. Roads and Maritime would also need to temporarily lease or negotiate access for additional land during construction. While the final land purchase requirements would be confirmed during the detailed design, all land acquisition would be carried out in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991* and it's supporting policy along with the Roads and Maritime *Land Acquisition Guide* (Roads and Maritime 2012).

Table 3-6 describes the proposed acquisition of land required for the proposal.

Table 3-6: Proposed property acquisition

Area ID	Description	Approximate total area (m ²)	Acquisition type	Current owner	Lot and DP	Land use zone (LEP)
1	345 Appin Road	1,378	Partial Acquisition Required	Private Property	105/ 1188670	RU2 - Rural landscape
2	345 Appin Road	348	Partial Acquisition Required	Crown Land	104/ 1188670	RU2 - Rural landscape
3	369-467 Appin Road	325	Partial Acquisition Required	Private Property	2/ 1113072	RU2 - Rural landscape
4	487 Appin Road	1,734	Partial Acquisition Required	Private Property	1/ 744101	RE1 - Public recreation RU2 - Rural landscape SP2 - Infrastructure
5	515 Appin Road	1,769	Partial Acquisition Required	Private Property	1/ 70208	RU2 - Rural landscape SP2 - Infrastructure
6	563 Appin Road	11,061	Partial Acquisition Required	Private Property	1/ 772025	RU2 - Rural landscape SP2 - Infrastructure
7	490 Appin Road	803	Partial Acquisition Required	Private Property	1/ 629717	RU2 - Rural landscape
8	588 Appin Road	3,200	Partial Acquisition Required	Private Property	101/ 842937	RU2 - Rural landscape SP2 - Infrastructure

4. Statutory and planning framework

4.1 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) establishes the statutory framework for planning and environmental assessment in NSW. Implementation of the EP&A Act is the responsibility of the Minister for Planning, statutory authorities and local councils.

Key additions to the objects of the EP&A Act taking effect 1 March 2018 include:

- Good design and amenity of the built environment
- The sustainable management of built and cultural heritage (including Aboriginal cultural heritage)
- The proper construction and maintenance of buildings, including the protection of the health and safety of their occupants.

Others changes including community participation plans and local strategic planning statements which will take effect progressively over the next several years.

The EP&A Act contains two main parts which impose requirements for planning approval:

- Part 4 provides for development assessment and consent. It includes provisions relating to development requiring consent, complying development, concept development applications, Crown development, State significant development and integrated development
- Part 5 provides for infrastructure and environmental assessment and includes the following divisions:
 - Division 5.1 Environmental impact assessment (except for State significant infrastructure)
 - Division 5.2 State significant infrastructure
 - Division 5.3 Infrastructure corridors. This division was introduced with recent amendments to the EP&A Act and is intended to ensure proposed activities will not affect future plans for an infrastructure corridor.

The applicable approval process is generally determined by reference to the relevant environmental planning instruments and other controls. These include local environmental plans (LEPs) and State Environmental Planning Policies (SEPPs). Pursuant to Division 3.2, Section 3.28 of the EP&A Act there is a general presumption that a State environmental planning policy prevails over a local environmental plan in the event of an inconsistency.

4.1.1 State Environmental Planning Policies

State Environmental Planning Policy (Infrastructure) 2007

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

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

As the proposal is for a road or road infrastructure facilities and is to be carried out by Roads and Maritime, it can be assessed under Division 5.1 of the EP&A Act. Development consent from Campbelltown Council and Wollondilly Council is not required.

The proposal is not located on land reserved under the National Parks and Wildlife Act 1974 (NPW Act) and does not affect land or development regulated by State Environmental Planning Policy (Costal Management) 2018, State Environmental Planning Policy (State and Regional Development) 2011, State Environmental Planning Policy (Major Development) 2005 or State Environmental Planning Policy (State Significant Precincts) 2005.

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

State Environmental Planning Policy No.44 - Koala Habitat Protection

State Environmental Planning Policy No.44 (SEPP 44) aims to encourage the conservation and management of areas of natural vegetation that provide habitat for Koala's to ensure a permanent freeliving population over their present range and reverse the current trend of Koala population decline. SEPP 44 applies to a range of local government areas including Campbelltown and Wollondilly.

Part 2 of SEPP 44 regulates impact on Koala habitats. While it strictly only applies to proposals being assessed under Part 4 of the EP&A Act, as a matter of practice Roads and Maritime considers SEPP 44 as part of the Division 5.1 assessment process.

The potential impact on Koala habitat and habitat connectivity is an important issue for the proposal and is discussed in section 6.1.

Sydney Regional Environmental Plan No. 20 - Hawkesbury-Nepean River (deemed a SEPP)

The proposal is located within land to which the *Sydney Regional Environmental Plan No. 20 -Hawkesbury-Nepean River* (SREP 20) applies. SREP 20 aims to protect the environment of the Hawkesbury-Nepean River system by ensuring that the impact of future land uses are considered in a regional context. To achieve this aim SREP 20 details general planning considerations, specific planning policies and recommended strategies of their application.

Clauses 5 and 6 of SREP 20 set out general planning considerations and specific planning policies and recommended strategies respectively. Clause 4 requires that those considerations, policies and recommended strategies be taken into consideration by consent authorities and by public authorities proposing to undertake development that does not require consent. The proposal has been considered in the context of the SREP 20 planning matters.

4.1.2 Local Environmental Plans

The proposal is located within two local government areas of Campbelltown and Wollondilly.

Campbelltown Local Environmental Plan 2015

The northern part of the proposal is located within the Campbelltown local government area (LGA). Land use and development is primarily the subject of Campbelltown LEP.

Zoning maps for the Campbelltown LGA identify the proposal footprint, as being located in areas zoned SP2 - Infrastructure and RU2 - Rural Landscape.

A section of the proposal is located directly next to land identified as 'Deferred Matter' under the LEP. This land is the subject of the Campbelltown (Urban Area) LEP 2002 and Interim Development Order No 15.

Wollondilly Local Environmental Plan 2011

Proposed safety improvement work located in the southern section of the study area are located within the Wollondilly local government area. Land use and development in this section is primarily the subject of the Wollondilly LEP.

Zoning maps under the Wollondilly LEP identify the proposal footprint, as being located in areas zoned SP2 - Infrastructure and RU2 - Rural Landscape.

Clause 2.3(c) of the Wollondilly LEP allows the consent authority to grant consent to road development. The temporary compound is associated with the proposed road improvements which is also permissible with consent.

As discussed in section 4.1.1 above, ISEPP permits the proposed activity without development consent despite the LEP requirement. Accordingly, assessment under Division 5.1 of the EP&A Act is appropriate.

4.1.3 Other relevant NSW legislation

Protection of the Environment Operations Act 1997

Part 5.3 of the *Protection of the Environment Operations Act 1997* (POEO Act) prohibits the pollution of waters. As part of the proposal development process, consideration would need to be given to measures to prevent pollution.

Air and noise related pollution is outlined in Part 5.4 and Part 5.5 respectively and requires activities to be carried out in a proper and efficient manner. Section 128 also details the prescribing of standards of air related emissions not to be exceeded as a result of the activity.

Pollution of land and waste is covered by Part 5.6 of the POEO Act. The Act defines 'waste' for regulatory purposes and establishes management and licensing requirements for waste. It defines offences relating to waste and sets penalties. The POEO Act also establishes the ability to set various waste management requirements via the Protection of the Environment Operations (Waste) Regulation 2014.

Part 3.2 of the POEO Act requires an environmental protection licence for scheduled development work and the carrying out of scheduled activities (as set out in Schedule 1 of the POEO Act). Item 35 of Schedule 1 of the POEO Act applies to road construction, meaning the construction, widening or rerouting of roads.

For the purposes of Item 35(2) of Schedule 1 of the POEP Act, consideration would need to be given to whether construction of the proposal within the proposal footprint is likely to trigger the requirement for an environmental protection license.

Item 19 of Schedule 1 applies to land-based extractive activates and defines them as follows:

...the extraction, processing or storage of extractive materials, either for sale or re-use, by means of excavation, blasting, tunnelling, quarrying or other such land-based methods.

Under Item 19(3) the requirement for a licence is triggered where the land-based extractive activity involves the extraction, processing or storage of more than 30,000 tonnes per year of extractive materials. The need for an environmental protection licence for the proposal would be considered prior to construction.

Heritage Act 1977

Natural, cultural and built heritage is protected in NSW under the *Heritage Act 1977*. The Act is administered by the Heritage Branch (formerly the Heritage Office) within the Office of Environment and Heritage.

The Act provides permanent protection for a heritage item or place. Items of State or local (Section 4A(1) of the Act) heritage significance are defined as

... a place, building, work, relic, moveable object or precinct, means significance to the State in relation to the historical, scientific, cultural, social, archaeological, architectural, natural or aesthetic value of the item.

Section 170 of the *Heritage Act 1977* also requires State Government Agencies to keep records of heritage items owned or operated by it.

Where a known heritage item or unexpected heritage find requires disturbance or excavation, a permit under Section 139 is required in certain circumstances.

An assessment of the potential impact of the proposal on heritage items and places occurring within the proposal footprint is provided in section 6.7 of this REF.

National Parks and Wildlife Act 1979

The *National Parks and Wildlife Act 1974* (NPW Act) is administered by the Office of Environment and Heritage (OEH). It provides legislative protection for Aboriginal heritage NSW. Part 6 of the Act refers to Aboriginal objects and places and prevents persons from impacting on an Aboriginal place or relic, without consent or a permit.

Roads and Maritime manages their business, legislative and social responsibilities via the *Procedure for Aboriginal Cultural Heritage Consultation and Investigation* (PACHCI). This procedure was followed for the proposal.

The impact on Aboriginal heritage values is assessed in section 0 of this REF.

Coal Mine Subsidence Compensation Act 2017

Under Section 21 of the *Coal Mine Subsidence Compensation Act 2017*, a person must not carry out work, or cause work to be done, in connection with the erection or alteration of an improvement within a mine subsidence district, except in accordance with the approval Subsidence Advisory NSW. For the purposes of the Act 'improvement' includes infrastructure, whether above or below the surface of the land.

The investigation area traverses the South Campbelltown Mine Subsidence District (refer to Figure 4-1) and the proposal would therefore require approval under the *Coal Mine Subsidence Compensation Act 2017*.

Consultation with Subsidence Advisory NSW is provided in chapter 5 of this REF.



While early care is blar to enum the sourcey of his day, Vorley Asians make to expendences or variantee above, which is complement or variable for any particular purpose and declame all reported by and all lables (including variable increases lables) in registrice) for all expense, base, durages (including induces or warman above its day and the set of the day base and define a set of the day base and declame all reported by and all lables (including variable increases all day of the day. Vorley Asians makes to expense all days and the set of the day base and declame all reported by and the set of variables in the set of the day. Note: Asian and the set of the day and the set of the day base and the day and the set of the day and the day and the set of the day and the

Figure 4-1: Surface geology

4.2 Commonwealth legislation

4.2.1 Environment Protection and Biodiversity Conservation Act 1999

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

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

The potential impact to biodiversity matters is considered within section 6.1 of the REF and Appendix C.

Matters of national environmental significance

Assessments of impact significance were conducted for all threatened fauna species and ecological communities considered likely to be affected by the proposal. Through these assessments and in consideration of proposed mitigation measures, it was concluded that the proposal is unlikely to have a significant impact on any threatened species, population or ecological community except for the Koala.

Assessment of the proposal against the EPBC Act Referral Guidelines for Koala was undertaken. It found that there is loss of 'habitat critical to the survival of the Koala', and as no mitigation in the form of a Koala land bridge, underpass or vegetation retention is proposed, there is a residual impact to the Koala which is likely to require referral under the EPBC Act. Advice should be therefore be sought from the Commonwealth Department for the Environment to clarify the requirement for referral under the EPBC Act for the Koala.

4.3 Confirmation of statutory position

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

Roads and Maritime is the determining authority for the proposal. This REF fulfils Roads and Maritimes obligation under section 5.5 of the EP&A Act including to examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the activity.

5. Consultation

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

5.1 Consultation strategy

A Community and Stakeholder Engagement Plan has been prepared by Roads and Maritime to guide communications and consultation activities during the preparation and public display of the REF. The Plan would be updated following the REF display period.

5.2 Community involvement

Initial communication and consultation activities have been focused on informing landowners about environmental or technical investigations that needed to occur near their properties.

The next stage of the proposal is to display the REF for community and stakeholder feedback. Following the public display period, submissions will be collated and responses to them will be detailed in a submissions report. After considering submissions, Roads and Maritime will determine whether the proposal should proceed. Details of ongoing and future consultation is provided at section 5.6.

5.3 Aboriginal community involvement

Consultation with the Aboriginal community occurred following the Roads and Maritime Procedure for Aboriginal Cultural Heritage and Consultation Investigation (PACHCI) guidelines. The proposal is located within the Campbelltown and Wollondilly LGA, the Parish of Menangle and Appin, and the County of Cumberland. It is contained within the boundaries of the Tharawal Local Aboriginal Land Council (LALC).

Section 0 details the Aboriginal cultural heritage assessments following the Roads and Maritime procedures for Aboriginal and Cultural Heritage consultation and investigation. Table 5-1 provides a summary of the stages of this procedure.

Stage	Description
Stage 1	Initial Roads and Maritime assessment
Stage 2	Site survey and further assessment
Stage 3	Formal survey and further assessment
Stage 4	Implement environmental impact assessment recommendations

Table 5-1: Summary of Roads and Maritime Procedure for Aboriginal Cultural Heritage Consultation and Investigation

Tharawal LALC participated in a survey of the study area as part of the Stage 2 PACHCI survey for this proposal. No issues were raised were raised during the survey, and Tharawal LALC did not identify any areas of cultural significance were present in the areas surveyed (refer to section 0).

5.4 ISEPP consultation

Campbelltown City Council, Wollondilly Shire Council and Sydney Water have been consulted about the proposal as per the requirements of Clause 14 and Clause 15 of the ISEPP. Appendix B contains an ISEPP consultation checklist that documents how ISEPP consultation requirements have been considered.

As part of these requirements, a formal consultation letter was sent to Campbelltown Council, Wollondilly Council and Sydney Water notifying them of the proposal in accordance with the ISEPP. Matters raised as a result of this consultation to date are outlined below in Table 5-2.

Issue	Detail	Response / where addressed in REF	
Campbelltown City Council			
Site work	No concerns raised during the ISEPP consultation period	Noted. Ongoing and future consultation with council will be carried out for the proposal	
Wollondilly Shire Council			
Site work	No concerns raised during the ISEPP consultation period	Noted. Ongoing and future consultation with council will be carried out for the proposal	

Table 5-2: Issues raised through ISEPP consultation

5.5 Government agency and stakeholder involvement

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

- Department of Planning and Environment
- Campbelltown City Council
- Office of Environment and Heritage
- Other service providers
- Subsidence Advisory NSW
- Sydney Water
- Wollondilly Council.

Table 5-3: Issues raised through stakeholder consultation

Agency	Issue raised	Response / where addressed in REF
Sydney Water	Site work and Sydney Water	Suitable arrangements should be made and agreed upon for the use of Sydney Water land to host a

Appin Road Safety Improvements, Brian Rd, Appin to Gilead Review of Environmental Factors

Agency	Issue raised	Response / where addressed in REF
	infrastructure	construction work compound prior to the commencement of the proposal. Ongoing and future consultation with Sydney Water will be carried out for the proposal. Refer to section 7.3
Subsidence Advisory NSW	Site work	Subsidence Advisory NSW raised no concerns to the proposal being carried out

Roads and Maritime have worked with these agencies through the preparation of this REF.

5.6 Ongoing or future consultation

The REF will be placed on public exhibition to assist and inform the community and stakeholder groups about the proposal and encourage participation and feedback during the display period. Roads and Maritime shall keep the community and interested stakeholder groups informed, listen to and acknowledge their views, and provide feedback on how their input will be considered when finalising the proposal.

Communication and consultation activities planned to coincide with the public display of the REF include:

- A community update that includes an outline of the proposal, the main findings of the REF and details on where people can find out more information and provide feedback. The update will advertise the community information sessions
- Copies of the REF will be made available for viewing at:
 - Campbelltown Civic Centre, Queen Street, Campbelltown
 - Narellan Library Corner Queen and Elyard Street, Narellan
 - Wollondilly Shire Council, Menangle Street, Picton
 - Camden Library, John Street, Camden.
- Information on how to provide feedback and details on the community information sessions will appear on the Roads and Maritime website
- A series of community information sessions will be held near the proposal so people can view the REF, learn more about the proposal, speak to the project team and submit feedback on the proposal.

People who make submissions on the proposal will receive an acknowledgement email or letter. A community update and revised website information will be used to let the community know the outcome of the planning process (including a copy of the Submissions Report). Information on how community input influenced the decision will be included in the update.

6. Environmental assessment

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

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

The environmental factors assessed within this section include:

- Biodiversity
- Soils and geology
- Hydrology and flooding
- Traffic and transport
- Noise and vibration
- Aboriginal heritage
- Non-Aboriginal heritage
- Landscape character and visual impact
- Socio-economic
- Waste management and resource use
- Other impacts (including hazards and risk, air quality and greenhouse gas emissions)
- Cumulative impact.

Technical study reports for some of these environmental factors are appended to this REF and can be referred to for detailed information. This includes:

- Biodiversity Appendix C
- Noise and vibration Appendix D
- Aboriginal heritage Appendix E
- Non-Aboriginal heritage Appendix F
- Landscape Character and visual impact Appendix G.

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

6.1 Biodiversity

This section summarises the assessed impact on biodiversity values that are likely to occur when building and operating the proposal. A biodiversity assessment was undertaken by Eco Logical Australia to support the REF, and is included as Appendix C.

6.1.1 Methodology

Desktop assessment

A desktop assessment was completed to identify threatened flora and fauna species, populations and ecological communities, Commonwealth listed Migratory species or critical habitat which have been recorded previously or are predicted to occur in the locality. The results informed the identification of appropriate field surveys. Database searches were undertaken as part of the biodiversity assessment, and generally included a search area comprising a five kilometre radius of the study area. Results from the following databases were obtained:

- NSW BioNet, Atlas of NSW Wildlife database search (5 km radius)
- EPBC Act Protected Matters Search tool (PMST) (5 km radius)
- The Native Vegetation of the Sydney Metropolitan Area OEH (2018).

A review of relavant reports, included:

- Appin Road Upgrade REF (WSP 2018)
- Biocertification Assessment MDP lands 2015-2018
- Greater Macarthur Investigation Area Biodiversity Assessment (ELA 2015)
- Ecological assessment Mt Gilead Balance Lands 2015-2017
- Preliminary Environmental Investigation (Niche 2018)
- Rezoning Flora and Fauna Assessment (ELA 2015).

Field survey

Field surveys included terrestrial flora and fauna surveys. They were completed in July 2018. As the proposal does not cross any major watercourse and no aquatic habitat was identified during the site visit, as such no aquatic surveys were not carried out for the proposal.

Flora

Vegetation surveys carried for the proposal equated to about 55-person hours in total, exceeding the requirement listed in *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC 2004). Flora surveys involved traversing the study area to identify the presence and extent of any native vegetation communities within the study area following the desktop assessment. The condition of the vegetation was also determined for identified native vegetation communities. Vegetation communities. Vegetation condition types were categorised into low, medium and high condition. Further detail on vegetation condition types is included in Appendix C.

Fauna

Opportunistic sightings of fauna were undertaken throughout the survey period, including evidence of animal activity, such as scats, diggings, scratch marks, nests/dreys, burrows etc. Fauna surveys were also carried out targeting activity periods within the study area. Fauna surveys such as a dawn bird survey.

The fauna habitat assessments were carried out to assess the likelihood of threatened species of animals identified during the desktop assessment occurring within the study area.

Assessing ecological significance

The significance of impact was assessed in accordance with the following guidelines:

- Threatened Species Assessment Guidelines: The Assessment of Significance (DECCW 2007)
- Significant Impact Guidelines 1.1: Matters of National Environmental Significance (Commonwealth Department of the Environment 2013).

The above guidelines outline the processes to determine if an impact as a result of a proposal by defining if it is predicted to have a significant impact, which would trigger additional legal and statutory requirements and provisions.

6.1.2 Existing environment

Much of the existing environment within the study area has been previously cleared for the earlier development of Appin Road. The environment surrounding the existing road transitions through areas of remnant bushland, agricultural grazing land, and some residential development in the south of the study area.

Vegetation communities

Vegetation within the study area has been mapped by the NSW National Parks and Wildlife Service (Office of Environment and Heritage 2013). Table 6-1lists the characteristics of each vegetation community identified within the study area. Detailed information is provided in Appendix C.

Vegetation community	Description
Shale Sandstone Transitional Forest	Vegetation in the northern portion of the study area conforms to the characteristic assemblage of the Shale Sandstone Transitional Forest. These species included <i>Angophora floribunda</i> (Rough-barked Apple), <i>Corymbia maculata</i> (Spotted Gum), <i>Eucalyptus crebra</i> (Narrow-leaved ironbark), <i>E. eugenioides</i> (Thin-leaved stringybark), <i>E. fibrosa</i> (Red Ironbark), <i>E. moluccana</i> (Grey Box), <i>E. punctata</i> (Grey Gum) and <i>E. tereticornis</i> (Forest Red Gum). The vegetation in the subject site identified as being of moderate and moderate/good condition.
Cumberland Plain Woodland	Vegetation observed in the southern portion of the study area corresponds with the characteristic assemblage species of the Cumberland Plain Woodland community. These species included <i>E. crebra</i> , <i>E. eugenioides</i> and <i>E. moluccana</i> . Patches of Cumberland Plain Derived Native Shrub (DNS), Cumberland Plain Derived

Table 6-1: Threatened ecological communities in the study area

Vegetation community	Description
	Native Grassland (DNG).
	The vegetation in the subject site is identified as being of low and moderate condition.
Exotic pasture	Exotic pastures were recorded in multiple locations throughout the subject site such as near agricultural land in the southern portion of the study area and near the roadside.
	Ground cover was dominated <i>Cenchrus clandestinus</i> (Kikuyu) and <i>Paspalum dilatatum</i> (Paspalum). Other exotic species included <i>Plantago lanceolata</i> (Lambs tongue), <i>Brassica fruticulosa</i> (Twiggy Turnip), <i>Chloris gayana</i> (Rhodes Grass) and <i>Setaria sp.</i>
	Minimal native species were identified within this stratum, these included <i>Rytidosperma sp., Goodenia hederacea</i> (Ivy Goodenia), <i>Lomandra multiflora</i> (Many-flowered Mat-rush) and <i>Hardenbergia violacea</i> (False Sarsaparilla).

Groundwater dependent ecosystems

No groundwater dependent ecosystems were identified from the desktop studies and field surveys to be within the study area.

Threatened flora

Desktop reviews identified 14 threatened flora species as being within five kilometres of the study area. No threatened flora were recorded within the study area.

Weeds

A total of seven priority weeds (listed under the Biosecurity Act) were identified within study area, and five weeds of national significance. Table 2 of Appendix C provides more details on these species.

Fauna

Desktop reviews identified 50 threatened fauna species recorded within five kilometres of the study area. Of the recorded species, four threatened fauna species were recorded in or directly next to the study area. This includes the Koala (30 records), Cumberland Plain Land Snail (three records), Squaretailed Kite (one record) and Cattle Egret (two records).

Survey of the study area recorded 25 species within the study area (refer to Appendix C), including two threatened fauna species:

- Koala (Phascolarctos cinereus), listed as vulnerable under the BC Act and the EPBC Act
- Little Lorikeet (Glossopsitta pusilla), listed as vulnerable under the BC Act.

Furthermore, the study area is considered to provide potential habitat for an additional 31 threatened fauna species listed under the BC Act, five of which are also listed under the EPBC Act as indicated in Table 6-2

Table 6-2: Threatened faun species recorded with a likelihood to occur

Scientific name	Common name	BC Act status	EPBC Act status	Potential occurrence			
Woodland Birds							
Petroica phoenicea	Flame Robin	-	-	Suitable habitat present			
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V	-	Recorded within the study area			
Daphoenositta chrysoptera	Varied Sittella	V	-	Potential to occur			
Petroica boodang	Scarlet Robin	V	-	Suitable habitat present			
Melanodryas cucullata cucullata	Hooded Robin	V	-	Suitable habitat present			
Chthonicola sagittata	Speckled Warbler	V	-	Potential to occur			
Stagonopleura guttata	Diamond Firetail	V	-	Suitable habitat present			
Callocephalon fimbriatum	Gang-Gang Cockatoo	V	-	Potential to occur			
Calyptorhynchus lathami	Glossy Black-cockatoo	V	-	Potential to occur			
Blossom Dependent Species							
Anthochaera phrygia (syn. Xanthomyza phrygia)	Regent Honeyeater	E	E & M	Test of significance carried out (refer to appendix C)			
Melithreptus gularis gularis	Black-chinned Honeyeater	V	-	Suitable habitat present			
Pteropus poliocephalus	Grey-headed Flying-fox	V	-	Suitable habitat present			
Lathamus discolor	Swift Parrot	Е	Е	Suitable habitat present			
Ninox strenua	Powerful Owl	V	-	Suitable habitat present			
Tyto novaehollandiae	Masked Owl	V	-	No suitable habitat present			
Ninox connivens	Barking Owl	V	-	Suitable habitat present			
Raptor							

Scientific name	Common name	BC Act status	EPBC Act status	Potential occurrence
Hieraaetus morphnoides	Little Eagle	V	-	Suitable habitat present
Lophoictinia isura	Square-tailed Kite	V	-	Suitable habitat present
Microchiropteran Bats				
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	Recorded within the study area
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	Recorded within the study area
Miniopterus australis	Little Bent-wing Bat			
Miniopterus schreibersii oceanensis	Eastern Bent-wing Bat	V	-	Recorded within the study area
Mormopterus (Micronomus) norfolkensis	Eastern Freetail Bat	V	-	Recorded within the study area
Myotis macropus	Southern Myotis	V	-	Recorded within the study area
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	Recorded within the study area
Chalinolobus dwyeri	Large-eared Pied Bat	-	V	Recorded within the study area
Gliders				
Petaurus norfolcensis	Squirrel Glider	V	-	Potential. Recorded less than 1 km to the study area
Petaurus australis	Yellow-bellied Glider	V	-	Recorded within the study area
Other species				
Meridolum corneovirens	Cumberland Plain Land Snail	E	-	Potential. Known records along Appin Road and within the study area
Dasyurus maculatus maculatus	Spotted-tailed Quoll	V	-	Suitable habitat present

Scientific name	Common name	BC Act status	EPBC Act status	Potential occurrence
Varanus rosenbergi	Rosenberg's Goanna	V	-	Potential to occur

Migratory species

The study area contains potential habitat for five migratory species listed under the EPBC Act. The proposal is unlikely to result in an additional impact to migratory species as a result of the proposal.

Fauna habitat

As discussed above, Appin Road is a major arterial road connecting South Western Sydney to the Illawarra. Within the study area the existing environment surrounding Appin Road transitions through areas of remnant bushland, agricultural grazing land, and some residential development.

During the site visit 23 trees were identified to contain habitat features, including 25 hollows and four nests (refer to Appendix C Figures 8 to 21). The list of habitat trees is included in Appendix C. The study site also contained a sparse layer of leaf litter and woody debris.

Foraging and roosting habitat for a number of known and potentially occurring threatened species occurred within the study area, including the Little Lorikeet which utilises tree hollows.

Koala habitat

Koala habitat, including *Eucalyptus punctata, Eucalyptus tereticornis* and *Eucalyptus microcorys* which are known Koala feed trees are located within the study area. Evidence of Koala within the study area have been observed within the last two years.

Wildlife corridors consist of native vegetation that join two or more areas of similar habitat and are critical for sustaining ecological processes, such as provision for animal movement and the maintenance of viable populations (Department of Environment 2016). Koalas are known to travel through this region. The primary Koala corridor is located along the eastern side of Appin Road and links to the secondary Koala corridors on the western side of Appin Road.

Records indicate that Koalas have been struck and killed by vehicles on this section of Appin Road multiple times in recent years.

Cumberland Plain Land Snail habitat

The Cumberland Plain Land Snail is associated with open eucalypt forests, particularly Cumberland Plain Woodland. They are typically found under fallen logs, debris and in bark and leaf litter around the trunk of gum trees, or burrowing in loose soil around clumps of grass.

Urban waste may also form suitable habitat (OEH 2015).

6.1.3 Potential impact

The proposal has the potential to have a direct and indirect impact on local biodiversity values during building and operation of the proposal:

The direct impact may include:

- Removal of native vegetation and threatened fauna habitat
- Removal of threatened flora
- Fragmentation of habitat corridors
- Injury and mortality of fauna.

The indirect impact may include:

- Changes to hydrology
- Edge effects of nearby native vegetation and habitat
- Invasion and spread of pests
- Invasion and spread of weeds, pathogens and disease
- Noise, light and vibration.

Construction

Native vegetation removal

The proposal is expected to require the removal of about 4.75 ha of vegetation in total. Table 6-3 summarises the extent of vegetation identified within the study area that is predicted to be cleared.

Table 6-3: Extent of threatened ecological communities and the amount of loss within the study area

Native vegetation community	BC/EPBC Act listed	Amount of predicted habitat loss (ha)
Cumberland Plain Woodland (Derived Native Grassland)	No	0.34
Cumberland Plain Woodland (Derived Native Shrub)	No	0.04
Cumberland Plain Woodland (Low Condition)	Yes	0.97
Cumberland Plain Woodland (Moderate Condition)	Yes	0.53
Shale Sandstone Transition Forest (Moderate)	Yes	0.78
Shale Sandstone Transition Forest (Moderate/Good)	Yes	1.03
Exotic pasture	No	1.06
Total		4.75

Threatened flora loss

As discussed in section 6.1.2 above, there were no threatened flora species identified within the study area. The proposal is unlikely to result in the loss of any threatened flora.

Threatened fauna loss and habitat removal

The development is expected to result in the removal of about 4.75 ha of vegetation in total. This includes about 3.69 hectares of woodland that supports flowering tree species such as Eucalypts, about 0.04 hectare of vegetation supporting shrubland and about 0.3 hectare of grassland.

The development is not expected to result in the removal of a significant amount of coarse woody debris.

The proposal would also result in the removal of about 19 hollow-bearing trees that support hollowdependant species such as the Little Lorikeet. Hollows to be removed range in size from about three centimetres to 80 centimetres.

Koala habitat

Koalas feed almost exclusively on Eucalypt species. As discussed above, the proposal would remove about 3.69 hectares of habitat that support Eucalypt species. The management of Koala habitat and connectivity in the region is guided through State Environmental Planning Policy No 44 - Koala Habitat Protection (SEPP 44).

In accordance with ISEPP, the proposal is permissible without consent and can be assessed under Division 5.1 of the EP&A Act. Subsequently SEPP 44 is not applicable to the proposal. However, parts of the proposal footprint meet the definition of both potential and core Koala habitat under the ISEPP and consideration of potential Koala habitat has been considered as part of the proposal.

Migratory species

The study area contains potential habitat for five migratory species listed under the EPBC Act. The proposal has the potential to affect these migratory species as a result of the proposed clearing of vegetation detailed in Table 6-3.

Injury and mortality

Injury and mortality may occur:

- During work activities when vegetation and habitat is being cleared
- When mobile machinery and plant are moved to, from, and on site
- During public use of the road through the operational phase of the proposal.

Mortality of native fauna due to vehicle strike is predominately due to the close proximity of suitable fauna habitat along sections of Appin Road within the study area. Other factors such as low visibility, and the high speed limit may also contribute to the issue.

The proposal would improve visibility due to the increased road corridor width. The proposal also includes the installation of fauna fencing along sections of Appin Road that are known fauna corridors. As a result, there is the potential for a significant reduction in fauna injury and mortality during the operation phase of the proposal.

Hydrology changes

The existing road surface and design, and the cleared or slashed vegetation along the road edge currently influences the volume and way in which surface water drains within the study area. The proposal would increase the extent of impervious ground surface within the subject site and therefore increase the volume of runoff from the road into the adjacent study area. However, these changes would be relatively minor.

Wildlife habitat fragmentation and loss of connectivity

The proposal would include the widening of Appin Road in some areas such as the proposed U-turn bays. The proposal includes the installation of fauna fencing along Appin Road at areas of potential or known fauna habitat. This would potentially:

- Reduce the likelihood of vehicle strikes at these locations, which means fewer fauna injured or killed by vehicle strikes
- Reduce the ability of fauna such as Koala's to utilise areas along both sides of Appin Road for foraging and breeding.

Edge effects, including weed invasion noise, light and vibration (indirect)

Edge effects would primarily impact disturbed vegetation present along both sides of Appin Road. The proposed loss of vegetation within the study area may result in an increase in edge effects to existing vegetation located directly next to the proposal. The Impact may include higher light and heat exposure to ground surfaces, leading to an increased impact such soils changes, invasion of weeds, and increased water pollution.

Due to the small width of roadside vegetation proposed for removal, the activity is not expected to significantly increase the impact of edge effects on any vegetation within the study area, including corridors or active or proposed biobank sites.

Pests, pathogens and diseases

Pests and pathogens typically spread via the same methods as weeds. Exotic pests present or likely to occur within the proposal include the European Red Fox, Rabbit, Cat, Common Myna and Common Starling.

The proposal is unlikely to result in any additional impact from existing species within the study area given the nature of the proposal and the already disturbed nature of the study area.

Operation

Once operational, the proposal would be managed in accordance with Roads and Maritime specifications. There would be some aspects that would continue to have a permanent impact on the ecological values of the area as described above. In addition, the following impact would only potentially occur once the proposal was operational. The potential impact as a result of operation of the proposal is summarised in Table 6-4.

Table 6-4: Operation impact

Potential impact	Description
Aquatic: minor increased volumes of surface water and stormwater entering local drainage points as a result of additional hard stand, which may affect the flow and drainage pattern to nearby drainage lines and creeks including aquatic habitat	Areas of hardstand within the study area would increase as a result of the proposal, the impact to aquatic habitat surrounding the area is considered to be negligible.

Appin Road Safety Improvements, Brian Rd, Appin to Gilead Review of Environmental Factors

Potential impact	Description
Injury and mortality impact: vehicle strikes from wildlife crossing the operational road	The study area is identified as a Koala corridor and is used by other wildlife. The implementation of fauna fencing along Appin Road at areas of potential or known fauna habitat would potentially improve the current road mortality within the study area. The proposal is unlikely to result in an increase in vehicle strikes and injury and/or mortality of threatened species, but instead improve the current situation along Appin Road.
Noise impact: the operational movement of traffic and its effects on wildlife.	The operational phase of the proposal is not likely to result in a significant increase in noise levels within the study area. Noise levels are unlikely to result in any changes in behavioural response or effect fauna species within the area, therefore the impact is considered to be negligible.
Shading and light impact: the introduction of additional road infrastructure such as safety barriers and lightening (e,g, within the proposed U-turn bays) in the area	Changes in shading and lightening within the study areas is considered to be minor in nature and as a result of the proposal the impact is considered to be negligible.
Weed invasion	There would be the potential for invasive weed species to (re) establish over time. Providing this is managed in accordance with the <i>NSW Noxious Weed (Weed Control) Order 2014</i> , the impact would be negligible.

Conclusion on significance of impact

Assessments of impact significance were conducted for all threatened fauna species and ecological communities considered likely to be affected by the proposal. Through these assessments and in consideration of proposed mitigation measures, it was concluded that the proposal is unlikely to have a significant impact on any threatened species, population or ecological community except for the Koala.

Assessment against the EPBC Act Referral Guidelines for Koala was carried out for the proposal. It found that while there would be a minor loss of habitat critical to the survival of the Koala as a result of the proposal, the proposed fauna fencing in some areas along Appin Road would potentially reduce Kola injury and mortality due to vehicle strikes within the study area.

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

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

6.1.4 Safeguards and management measures

Table 6-5 lists the biodiversity safeguards and management measures that would be implemented to account for the impact identified in section 6.1.3.

Impact	Environmental safeguards	Responsibility	Timing	Reference
Biodiversity	 A Flora and Fauna Management Plan will be prepared in accordance with Roads and Maritime's <i>Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects</i> (RTA 2011b) and implemented as part of the CEMP. It will include, but not be limited to: 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 Guideline</i> (RTA, 2008) Pre-clearing survey requirements Procedures for unexpected threatened species finds and fauna handling Protocols to manage weeds and pathogens. 	Contractor	Detailed design / Pre- construction	Standard safeguard B1 Section 4.8 of QA G36 Environment Protection
Biodiversity	Measures to further avoid and minimise the construction footprint and native vegetation or habitat removal will be investigated during detailed design and implemented where practicable and feasible.	Contractor	Detailed design / Pre- construction	Standard safeguard B2
General biodiversity mitigation	Ensure any fauna encountered onsite would be managed in accordance with <i>Biodiversity</i> <i>Guidelines, Guide 9</i> (fauna handling) (Roads and Maritime, 2016)	Contractor	Pre- construction	Standard safeguard B3
General biodiversity mitigation	 The pre-clearing survey as part of the Flora and Fauna Management Plan shall: Confirm clearing boundaries, exclusion zones, protected habitat features and revegetation areas prior to starting work Identify, in toolbox talks, where biodiversity controls are located on the site. 	Contractor	Pre- construction	Standard safeguard B4
Invasive and noxious weed management	 A Weed Management Plan will be prepared in accordance with <i>Biodiversity Guidelines, Guide 6</i> (Roads and Maritime, 2016) and include: The Identification of weeds on site (confirmed during pre-clearing survey) 	Contractor	Pre- construction	Standard safeguard B5

Impact	Environmental safeguards	Responsibility	Timing	Reference
	Weed management priorities and objectives			
	• Exclusion zones, protected habitat features and revegetation areas prior to starting work within or directly next to the site			
	• The location of weed infested areas			
	Weed control methods			
	 Measures to prevent the spread of weeds, including machinery hygiene procedures and disposal requirements 			
	A monitoring program to measure the success of weed management			
	Communication with local Council noxious weed representative.			
Pathogen management	Ensure the Flora and Fauna Management Plan includes management measures to control and/or prevent the introduction and/or spread of disease causing agents such as bacteria and fungi in accordance with the <i>Biodiversity Guidelines, Guide</i> 7 (Roads and Maritime, 2016).	Contractor	Pre- construction	Standard safeguard B6
Unexpected find	If unexpected flora or fauna are discovered on site stop work immediately and implement the Roads and Maritime Unexpected Threatened Species Find Procedure in the Biodiversity Guidelines, Guide 1 (Roads and Maritime, 2016b).	Contractor	Construction	Standard safeguard B7
Fauna Injury and mortality management	 In the invent of a fauna injury or mortality during building the proposal, implement the following controls: Manage fauna in accordance with Biodiversity Guidelines, Guide 9 (Roads and Maritime, 2016b) Remove any habitat in accordance with Biodiversity Guidelines, Guide 4 (Roads and Maritime, 2016b). 	Contractor	Construction	Standard safeguard B8
Native vegetation removal Threatened species habitat and habitat features	 Native vegetation removal will be minimised through detailed design Implement the following controls under the Flora and Fauna Management Plan: Pre-clearing survey requirements in accordance with <i>Biodiversity Guidelines, Guide 1</i> (Roads) 	Roads and Maritime Services; Contractor	Detailed design / Pre- construction / Post construction	Standard safeguard B9

Impact	Environmental safeguards	Responsibility	Timing	Reference
	 and Maritime, 2016b) Confirm clearing boundaries, exclusion zones, in accordance with <i>Biodiversity Guidelines, Guide 2</i> (Roads and Maritime, 2016b) Vegetation removal would be carried out in accordance with <i>Biodiviersity Guidelines, Guide 4</i>: Clearing of vegetation and removal of bushrock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011b) Reinstate native vegetation in accordance with <i>Biodiversity Guidelines, Guide 3</i> (Roads and Maritime, 2016b) Reinstate habitat in accordance with <i>Biodiversity Guidelines, Guide 5 and Guide 8</i> (Roads and Maritime, 2016b). 			
Koala habitat management	A fauna fencing strategy will be implemented along Appin Road in accordance with detailed design and construction drawings. A detailed fauna fencing will be prepared and included in the CEMP for the work.	Roads and Maritime Services; Contractor	Detailed design / Pre- construction	Standard safeguard B10
Groundwater dependent ecosystems	Interruptions to water flows associated with groundwater dependent ecosystems would be minimised through detailed design.	Roads and Maritime Services; Contractor	Detailed design / Pre- construction	Standard safeguard B11

6.1.5 Biodiversity offsets

The proposal would require the removal of approximately 4.75 hectares, of which 3.69 hectares is native vegetation that also constitutes habitat for threatened species. All native vegetation to be cleared is consistent with two threatened ecological communities.

The potential need for biodiversity offsets is founded in the theory of 'avoid, minimise and mitigate' the impact of the proposal. The accepted approach to environmental assessment requires that, in the first instance, any environmental impact is avoided or minimised as far as possible and subsequently reduced to acceptable levels through appropriate safeguards and management measures. Where measures to avoid and mitigate an impact are not feasible or cost effective, then offset strategies can be used to compensate the residual impact of the proposal on biodiversity.

The proposal would result in the clearing of threatened ecological communities, including:

- 1.81 ha of Shale Sandstone Transition Forest, in moderate to high condition
- 1.88 ha of Cumberland Plain Woodland, in moderate to high condition.

Given the proposal would result in the clearing of 3.69 hectares of threatened ecological communities, it may be necessary to procure biodiversity offsets. In accordance with the Framework for Biodiversity Assessment, offsets in the order of about 35 to 40 credits per hectare (147.6 in total) would be required to offset the proposed impact on Shale Sandstone Transition Forest and Cumberland Plain Woodland, noting that these endangered ecological communities also provide habitat for the koala.

The above estimate of credits would be further refined and a Biodiversity Offset Strategy would be prepared during the detailed design phase of the proposal.

The strategy would be developed in accordance with the *Guideline for Biodiversity Offsets* (Roads and Maritime, 2011h) and the *NSW BioBanking Assessment Methodology 2014*. In determining the area, the location and type of biodiversity offset would depend on factors such as:

- Vegetation types and species that are impacted
- Regional and catchment landscapes (e.g. fragmentation and fauna movement corridors)
- Mitigation measures employed
- Availability of offsetsLag time between causing an impact and achieving an offset.

6.2 Soils and geology

This section summarises the assessed impact on soils and geology likely to occur when building and operating the proposal.

6.2.1 Methodology

The assessment of soils and geology was completed in general accordance with relevant policy and guidelines, including:

- Acid Sulfate Soils Assessment Guidelines. (Acid Sulfate Soil Management Advisory Committee 1998)
- Guidelines for Consultants Reporting on Contaminated Sites (Office of Environment and Heritage 2011)
- Guidelines for Construction Water Quality Monitoring (Roads and Traffic Authority; undated)
- Guidelines for the Management of Contamination (Roads and Maritime Services 2013)
- Managing Urban Stormwater: Soils and Construction (Blue Book), Volume 1, 4th Edition (Landcom, 2004)
- National Environment Protection (Assessment of Site Contamination) Measure (National Environment Protection Council 2013)
- Code of Practice for Water Management Road Development Management (Roads and Traffic Authority 1999)
- Stockpile Management Protocol (Roads and Maritime Services 2014)
- Technical Guideline Temporary stormwater drainage for road construction (Roads and Maritime Services 2011)
- Water Policy (Roads and Traffic Authority; undated).
Soils and geology

A desktop assessment has been carried as part of the REF. The purpose of this was to describe the regional and local soils and geology. This information was then used to consider the impact to the underlying soil and geology during construction potentially impacting on surface and ground waters.

Acid sulfate soils

Acid sulfate soils (ASS) are soils that contain iron sulfides which when exposed to air, generate sulphuric acid that can cause an environmental and human health impact. They typically occur in low lying coastal areas such as coastal floodplains, rivers and creeks. The probability of encountering any acid sulphate soils within the study area was confirmed through a review of published ASS Risk Mapping and the NSW Natural Resource Atlas.

Contaminated land

A desktop search has been carried out as part of the REF to assess the potential for any known contaminated sites within the study area in order to identify the need for further investigation.

Desktop searches carried out during September 2018 included a search and review of the:

- NSW Environmental Protection Authority (EPA) Contaminated land record of notices
- NSW EPA List of NSW contaminated sites notified to EPA
- Protection of the Environment Operations Act, 1997 (POEO Act) public register search for licences and notices
- Department of Defence Defence Environmental Remediation Program New South Wales.

Study area

The study area comprised the proposal footprint, and the underlying soil and geology. Regional characteristics provided additional context to the site.

6.2.2 Existing environment

Soils and geology

The 1:100,000 Soil Landscapes of Wollongong-Port Hacking Sheet (9029-9129) indicates soils within the study area are Blacktown residual soil landscape and Kurosols (AECOM 2018). Characteristics of Kurosols soils include hard acidic red soils with hard neutral and acidic yellow mottled soils.

The geology of the study area is mainly comprised of Ashfield Shale of the Wianamatta Group, consisting of laminate and dark grey siltstone. There are smaller areas of Hawkesbury Sandstone, consisting of medium to coarse grained quartz sandstone, very minor shale and laminate lenses. The Hawkesbury Sandstone generally underlies the Ashfield Shale geology (AECOM 2018).

The proposal is located within the South Campbelltown mining subsidence district with a fault transecting the northern end of the proposal in a northeast-southwest direction.

Acid sulphate soils

Acid sulphate soils are typically found on coastal lowlands, with elevations below five metres. There is no known occurrence of acid sulphate soil with the study area as identified by acid sulphate soil risk mapping.

The majority of the proposal footprint has been mapped as having a moderate salinity potential, with a small section being identified as having a very low salinity potential (Department of Infrastructure, Planning and Natural Resources 2003).

Contaminated land

A search of the NSW Environment Protection Authority contaminated land records for the Campbelltown LGA and Wollondilly LGA was carried out on 6 September 2018. There were no site notices placed on land within one kilometre of the proposal. A search of the NSW EPA contaminated sites list (as at 6 September 2018) also returned no records.

Surface waste was observed during a site visit such as construction and domestic waste and general litter. No observed material showed evidence of being asbestos containing material (ACM).

6.2.3 Potential impact

Construction

Soils

The potential work activity impact would be primarily associated with soil loss from erosion of exposed soils and stockpiles, and potential sedimentation of surrounding land and waterways, including Georges River and Woodhouse Creek. Work activities with the potential to expose soils include:

- Vehicle movements
- Stockpiling
- Excavation
- Importation of fill material (as required)
- Vegetation removal.

These activities would potentially cause:

- Erosion and sedimentation of exposed soils
- Erosion, leaching and dust generation from stockpiled materials
- Loss of soil quality and condition from material stockpiling
- Associated soil quality impact as a result of accidental spills and leaks caused by:
 - Use of fuels and oils outside of bunded and/or contained areas
 - Leaks from poorly maintained vehicles, machinery and equipment
 - Temporary storage and management of spoil and waste.

The defining trait and unconsolidated nature of excavated material from cleared sections of land potentially make the above impact more likely, and consistent with the *Erosion and Sedimentation Risk Assessment*

Procedure (Roads and Maritime 2004). A secondary water quality impact may also occur through spills and leaks and/or sediment discharge, discussed further in section 6.3.

Contaminated land

Based on existing environmental conditions, risk to human and environmental health as a result of contamination is considered low. Measures to reduce surface waste would be carried out pre-construction. Potential contaminated excavated soils would be managed to minimise health hazards and prevent the spread of contaminants.

Fuels, oils and other hazardous materials are to be stored in small amounts at secure locations, therefore limiting the potential environmental impact due to accidental spills and leaks. As such, there would be no change with regard to the risk for erosion and scour at the stormwater discharge points or potential for sediment discharge and pollution.

Operation

Operation of the proposal would be consistent with the existing use of Appin Road. The operation and ongoing maintenance of the road would be managed through similar practices that are currently carried out along the road. There is expected to be no net change or impact from maintaining the road.

The proposal would result in some additional hardstand areas (e.g. proposed U-turn facilities). The increase in hardstand areas may result in the increase of surface water run-off and the risk of soil erosion along Appin Road. Given the nature of the work, there would be no change with regard to the risk for erosion and scour at stormwater discharge points or potential for sediment discharge and pollution.

6.2.4 Safeguards and management measures

Table 6-6 lists the soils and geology safeguards and management measures that would be implemented to account for the impact identified in section 6.2.3.

Impact	Environmental safeguards	Responsibility	Timing	Reference
Soils	A Soil and Water Management Plan (SWMP) will be prepared and implemented as part of the CEMP. The SWMP will identify all reasonably foreseeable risks relating to soil erosion and water pollution and describe how these risks will be addressed during construction.	Contractor	Detailed design / Pre- construction	Standard safeguard C1
Soils	A site specific Erosion and Sediment Control Plan/s will be prepared and implemented as part of the Soil and Water Management Plan. The Plan will include arrangements for managing wet weather events, including monitoring of potential high risk events (such as storms) and specific controls and	Contractor	Detailed design / Pre- construction	Standard safeguard C2

Table 6-6: Soils and geology safeguards and management measures

Appin Road Safety Improvements, Brian Rd, Appin to Gilead Review of Environmental Factors

Impact	Environmental safeguards	Responsibility	Timing	Reference
	follow-up measures to be applied in the event of wet weather.			
Contaminated land	 A Contaminated Land Management Plan will be prepared in accordance with the <i>Guideline for the Management of</i> <i>Contamination</i> (Roads and Maritime 2013) and implemented as part of the CEMP. The plan will include, but not be limited to: Capture and management of any surface runoff contaminated by exposure to the contaminated land Measures to ensure the safety of site personnel and local communities during construction 	Contractor	Detailed design / Pre- construction	Standard safeguard C3 Section 4.2 of QA G36 Environment Protection
Contaminated land	If contaminated areas are encountered during construction, appropriate control measures will be implemented to manage the immediate risks of contamination. All other work that may impact on the contaminated area will cease until the nature and extent of the contamination has been confirmed and any necessary site- specific controls or further actions identified in consultation with the Roads and Maritime Environment Manager and/or EPA are carried out	Contractor	Detailed design / Pre- construction	Standard safeguard C4 Section 4.2 of QA G36 Environment Protection
Contaminated land	Areas identified as containing surface lying waste will be remediated prior to construction. All waste are to be disposed of to a suitably licenced landfill facility.	Contractor	Pre- construction	Standard safeguard C5 Section 4.2 of QA G36 Environment Protection
Accidental spills and leaks	A site-specific emergency spill plan will be developed, and include spill management measures in accordance with the <i>Roads</i> <i>and Maritime Code of Practice for Water</i> <i>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, and notification of emergency services and relevant authorities (including Roads and Maritime and EPA officers).	Contractor	Pre- construction	Standard safeguard C6

6.3 Hydrogeology, hydrology and flooding

This section details the potential impact on hydrogeology, hydrology and flooding likely to occur or associated with construction and operation of the proposal.

6.3.1 Methodology

The assessment of surface water and flooding was completed in general accordance with relevant policy and guidelines detailed in section 6.1.5. The assessment included a review of publicly available information to determine:

- Surface water characteristics of the proposal footprint
- The current drainage arrangements and discharge pathways across the study area, focusing on the proposal
- Confirmed any potential flood risk potential across the proposal footprint
- Key activities that could potentially impact surface water and need safeguarding or managing under the proposal.

The likelihood for the proposal to impact on the local surface waters and the wider catchment and therefore impact on the value of these resources, and to what extent these values would be likely affected by the proposal, has be considered as part of this assessment.

Exposure, contamination, migration, flood risk and change in quality were also considered in undertaking the assessment.

Study area

The study area considered the impact across the proposal footprint, within the local surface water catchment of the Georges River. Regional characteristics were used to provide a wider context and reference, as described in section 6.3.2.

6.3.2 Existing environment

Regional hydrogeology

Regional groundwater within the study area along Appin Road generally follows a ridgeline with the land to the east generally sloping and draining to the east towards the Georges River. Land to the west generally slopes to the west and drains to the west and northwest into Woodhouse Creek, Nepean Creek, Mallaty Creek and Lily Ponds Gully (AECOM 2018).

As discussed in section 6.2.2 above, geology of the study area is mainly comprised of Ashfield Shale of the Wianamatta Group, consisting of laminate and dark grey siltstone. There are smaller areas of Hawkesbury Sandstone, consisting of medium to coarse grained quartz sandstone, very minor shale and laminate lenses. The Hawkesbury Sandstone generally underlies the Ashfield Shale geology (AECOM 2018).

There are six registered groundwater bores identified within one kilometre of the proposal (refer to Table 6-7. Groundwater is likely fresh and at depths greater than 30 metres below ground surface in the

Hawkesbury sandstone aquifer. Shallow perched groundwater at the clay/bedrock interface may also be present.

Groundwater bore ID	Туре	Depth (m)	Standing water level	Geology
GW005316	General Use	36.5	-	0.00 m-0.60 m Topsoil Black 0.60 m-1.52 m Clay 1.52 m-36.57 m Shale
GW106449	Domestic, Stock	207	-	0.00 m-0.50 m Topsoil 0.50 m-1.00 m Yellow Clay 1.00 m-2.00 m Weathered Shale 2.00 m-4.00 m Brown Shale 4.00 m-10.50 m Yellow Sandstone 10.50 m-178.00 m White Sandstone, Shale Bands 178.00 m-204.00 m Black Shale 204.00 m-207.00 m Red Shale
GW113154	Mines Monitoring	23	-	-
GW113153	Mines Monitoring	29	-	-
GW113152	Mines Monitoring	36	-	-
GW104633	Domestic	141.3	38	0.00 m-0.40 m Topsoil 0.40 m-5.50 m Weathered Shale 5.50 m-8.10 m Sandstone 8.10 m-42.50 m Sandstone / Shale 42.50 m-141.30 m Sandstone

Table 6-7: Groundwater bores within one kilometre of the proposal (AECOM 2018)

Regional hydrology

The study area is located between the catchments for the Georges River and Nepean River. The Georges River catchment is mostly an urbanised catchment covering an area of about 960 square kilometres. The catchment has a population of about one million people.

The Georges River is located about 530 metres east from the study area.

The Hawkesbury-Nepean catchment covers a distance of about 470 kilometres (from south of Goulburn near Lake Bathurst to Broken Bay) and includes an area of about 21,400 square kilometres. This area includes the catchments for Warragamba, the Upper Nepean and the Mangrove Creek dams, which form the main water supply reservoirs for the Sydney metropolitan area.

The Nepean River is located over three kilometres west from the study area.

There are several minor tributaries which collect drainage from Appin Road that ultimately drain into the Georges River and/or Nepean River. Flows from these minor tributaries occur intermittently during periods of high rainfall.

Local hydrology

Local hydrology within the proposal area is defined by the existing topography of Appin Road. Surface water drains off Appin Road into the existing network along the western side of Appin Road at about

chainage 995 to chainage 1850. Road side drainage along the remainder of the study area drains directly into property located directly next to Appin Road.

Water quality

The study area is located predominately within the Georges River catchment. Given the separation of Appin Road to the Nepean River an assessment of the existing water quality was not considered necessary for the Nepean River.

Campbelltown City Council undertakes routine water quality testing at a number of sites within the Georges River Catchment as part of its compliance with the relevant national and state water quality monitoring and management guidelines. The current Water Quality Monitoring Program includes the sampling and monitoring of 13 sites within the Georges River and the Nepean River catchments. The nearest monitoring location within proximity to the study area is Wedderburn Gorge, Georges River.

Monitoring results at Wedderburn Gorge for 2012/2013 were ranged from very poor to good. These ratings indicate a range of less than 25 to greater than 75 per cent compliance with relevant water quality guidelines (Campbelltown City Council 2013). More recent monitoring results were not publicly available at the time of this REF.

Flood risk

Campbelltown City Council LEP defines flood planning level as land at or below the level of a 1:100-year average recurrence interval flood event plus 0.5 metre freeboard.

Wollondilly LGA has a number of areas that are subject to flooding. The Floodplain Development Manual (Office of Environment and Heritage 2005) sets out the management of flood risk in the Wollondilly.

The proposal is not known to flood or be prone to water logging.

6.3.3 Potential impact

Construction

Groundwater

Excavation work required to build the proposal would be relatively shallow in depth, and not likely to intersect regional groundwater. As such, no impact to groundwater quality or groundwater resources is anticipated as a result of the proposal.

Water quality

The potential impact to water quality could arise if activities are not appropriately managed. Surface water impact from construction activities is typically directly related to the exposure of underlying soil, potentially leading to erosion and downstream sedimentation. Activities during the building of the proposal that have the potential to contribute to water quality within the study area include:

- General earthwork (e.g. stripping of topsoil, excavation work or placement of fill)
- Stockpiling of material
- Leaks or spills from chemicals or fuels used during the building of the proposal.

There are no major surface waters that intersect the proposal. Surface water discharge from drainage lines to nearby surface waters would present a risk of impact to surface water during construction. Drainage discharge from the proposal footprint is however intermittent and any potential risk would likely be limited to prolonged and heavy periods of rainfall.

Construction activities with the potential to impact water quality include:

- Sedimentation resulting from activities on site such as earthwork and back-filling of drainage work, resulting in reduced capacity and flow
- Risk of spills of fuels and chemicals from machinery and plant on site. The majority of fuels and chemicals would be stored at the compound site (refer to section 3.3). On site use of chemicals and fuel would be managed with appropriate safeguards for the proposal.

Material being excavated and backfilled has the potential to result in an impact to surface water quality, through erosion or movement of these materials. No temporary basins would be required given the nature of the work during building the proposal. Local erosion and sediment control measures would be implemented. Safeguards and management measures are detailed in section 6.3.4, with the residual potential impact of the proposal not likely to be significant.

Flooding

The proposal is not located within flood liable land, as discussed in section 6.3.2 above. Potential localised flood risks would be considered prior to and during construction.

The potential for an on-site impact as a result of a flood incident is considered to be negligible. Appropriate mitigation measures as described in section 6.3.4 would be implemented during construction.

Operation

Groundwater

Once operational, the proposal would have no net change in the impact the road has on groundwater levels, flows, recharge, quality or other values. The operational groundwater impact is considered to be negligible.

Water quality

Rain events typically flush road surface contaminants into stormwater infrastructure, which is then discharged to the local environment. These pollutants include:

- Suspended sediments from impervious surfaces
- Oils, greases, heavy metals and hydrocarbons
- Litter from the road corridor
- Nutrients from biological matter.

Any additional pollutant or sediment impact is considered unlikely during operation.

The proposal would involve the creation of additional hardstand areas as a result of the proposed U-turn bays and shoulder work along Appin Road. The proposal may result in some additional stormwater and surface water drainage flows from Appin Road. Impact from the road on the local water quality is existing, therefore additional impact to water quality is not expected to increase as a result of the proposal.

Flooding

The area is not prone to flooding and there are no major drainage lines identified within the vicinity of the study area. Existing impacts and are not expected to increase in frequency or magnitude as a result of the proposal.

6.3.4 Safeguards and management measures

Table 6-8 lists the hydrogeology, hydrology and flooding safeguards and management measures that would be implemented to account for the impact identified in section 6.3.3.

Table 6-8: Hydrogeology, hydrology and flooding safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Hydrology and flooding	The layout and detail of the drainage system including water quality treatments, discharge points, swale design and scour protection will be refined during detailed design in consultation with the Roads and Maritime Environment Branch.	Roads and Maritime	Detail design	Standard safeguard H1
Hydrology and flooding	Drainage line crossing points will be designed in accordance with Guidelines for Controlled Activities: Watercourse Crossings (NSW DEC, 2008).	Roads and Maritime	Details design	Standard safeguard H2
Incident Reporting	In case of an incident, the Environmental Incident Classification and Reporting Procedure (Roads and Maritime Services 2016) will be followed. The RMS Contract Manager and Environment Manager will be contacted immediately.	Contractor	Construction	Standard safeguard H4
Accidental spill	An emergency spill kit will be available on-site. All personnel will be trained in its use and aware of its location.	Contractor	Pre- construction	Standard safeguard H5
Stormwater Discharge	Dirty water will not be released into drainage infrastructure and/or waterways.	Construction	Stormwater Discharge	Standard safeguard H6
Stormwater Discharge and Pollutant Loads	Water quality controls will be implemented to prevent materials, including concrete and sediment, to enter drainage infrastructure or waterways.	Contractor	Detailed design / pre- construction	Standard safeguard H7

6.4 Traffic and transport

6.4.1 Existing environment

Road conditions

Appin Road is a classified State Road (gazetted road number 177) which travels in a north-south direction linking the townships of Campbelltown and Appin. The road has a posted speed limit of 70 kilometres per hour and 80 kilometres per hour. There are no intersections along the proposal footprint. The nearest intersection to the proposal footprint is Appin Road and Brian Road.

Appin Road

Appin Road at the proposal is generally a two lane road with a southbound overtaking lane about 1.5 kilometre north Brian Road, Appin. The road is about 14 metres wide with the northbound carriageway consisting of about a 2.5 metre shoulder and a 3.5 metre lane. The southbound carriageway consists of about a 1.5 metre shoulder and a 3.5 metre lane. The southbound overtaking lane is about 3.5 metres wide and about 700 metres in distance.

Appin Road provides access to properties directly next to the road. North of Brian Road there are about 14 driveway accesses on the western side and about 30 driveway accesses on the eastern side. The following driveways provide access to commercial properties or multiple property owners and therefore would generate more turning movements on and off Appin Road than for individual privately owned properties:

- Entrance to Inghams Chicken Farm (No. 345 Appin Road) at chainage 530 on the western side
- Entrance to Sydney Water high pressure sewer main station at chainage 955 on the western side
- Entrance to 497 Appin Road at chainage 2020 on the western side
- Entrance to Belltrees Kennels (514 Appin Road) at chainage 2290 on the eastern side
- Entrance to 515 Appin Road at chainage 2305 on the western side
- Entrance to 563 Appin Road at chainage 2695 on the western side.

Existing traffic volumes

Traffic counts to the north and south of the proposal area provided an indication of the existing traffic distribution along the road within and near the proposal. These are shown in Table 6-9. It is estimated that heavy vehicles comprise about 13 per cent of total traffic (Austraffic 2018).

Table 6-9: Existing traffic distribution along Appin Road (2018)

Location	Average weekly volumes				
	Northbound	Southbound	Total		
Appin Road, north of Gilead ¹	5,843	5,847	11,690		
Appin Road, south of Gilead ¹	5,832	5,822	11,654		

¹ Located to the north and south of the proposal area. These values are automatic tube counts carried out in March 2013

Road network performance

Level of service (LoS) is a qualitative measure used to describe the potential for delay during traffic operation, usually in peak demand situations. LoS ranges from best performance (LoS A) to poorest performance (LoS F). A performance of D or better is considered acceptable. Volume-capacity (v-c) ratios on a stretch of road provide an indication of whether it is carrying its vehicular capacity.

The network performance along Appin Road in the vicinity of the proposal generally operates at a LoS A.

Forecasted traffic flows

The proposal is not expected to result in additional traffic in the area given the nature of the proposal.

Public transport

The 887 bus operated by Sydney Buses passes through the proposal area daily, travelling between Campbelltown and Wollongong. There are no bus stops within the proposal.

Parking

There are no defined parking areas on Appin Road along the proposal. Informal parking along Appin Road is not prohibited and therefore can occur, except within proximity to intersections. However, most properties directly next to the road are predominately rural properties so informal street parking is minimal.

Pedestrians and cyclists

Appin Road currently has limited pedestrian and cycling facilities within the proposal footprint. There is no pedestrian footpath or shoulder on Appin Road, with any pedestrians utilising the road verge and cyclists utilising trafficable lanes. The speed of traffic along Appin Road and the rural nature of the proposal footprint results in minimal pedestrian and cycle activity.

Road safety

The existing Appin Road within the study area has a number of safety deficiencies such as trees within the clear zone and narrow shoulders. These deficiencies have contributed to traffic accidents in the area.

6.4.2 Potential impact

Construction

During construction, the potential impact would be generally associated with an increase in construction traffic volumes as well as a change in the general type of traffic using the road. This is discussed in further detail below.

The potential impact from construction traffic would include:

- Traffic delays due to increased construction vehicle and machinery movements, and reduced speed limits in the proposal footprint
- Increased traffic congestion associated with increases in traffic when manual traffic control would be in operation
- Safety risks associated with construction vehicle and machinery movements
- Altered property access during construction.

Two-way traffic would be maintained along Appin Road during construction. Access to compound sites would be via existing driveways to minimise the impact of the proposal to land located directly next to Appin Road.

Vehicle movements and traffic delays

The estimates of the light and heavy vehicle movements are based on the type of activities and type and volume of material required for each work of activity. Peak construction activities are expected to include about 50 light vehicles and 50 heavy vehicle movements. The majority of construction trips to the site are generated during earthwork and paving activities.

Minor traffic delays along Appin Road would be expected during the construction phase due to the increase in vehicle movements, speed limit reductions and traffic control.

Access and parking

Access points along Appin Road and local roads adjacent to the proposal would generally be maintained during the construction period. Temporary disruptions to local access may occur during construction. Prior to any unavoidable disruption to access, consultation would be undertaken with the affected property and/or business owners. Informal parking along the western side of Appin Road would not be available during construction. However, there would be the need for staff parking during construction. No worker parking would be permitted within the Appin Road corridor. Only plant and vehicles required to undertake construction activities would be permitted to park behind the safety barriers.

Active transport

Pedestrians travelling through the construction areas would be guided to cross the road at designated locations. This may cause minor detours for pedestrians but given the very low pedestrian volumes using Appin Road, the level of impact would be expected to be minor and could be managed adequately. Similarly, the narrowing of the road shoulder width may impact cyclists using Appin Road. Cyclists would need to move into the traffic lane to pass through the road work. Provision of a roadwork speed limit and roadwork signage would assist cyclists moving through construction areas.

Public transport

There may be delays to the bus services using Appin Road as a result of construction activities. The bus stops located on Appin Road may need to temporarily be relocated during construction before being reinstated to the current location. The location of the temporary bus stops during construction would be determined during detailed design.

Safety

The slowing down, entering and turning movements of work vehicles during construction may potentially impact the safety of other road users. In addition, there may be safety risks associated with workers

working near the existing road. An approved traffic safety barrier may be provided to separate the construction staff from vehicles travelling along Appin Road. Traffic management during construction would be in accordance with the *Roads and Maritime Traffic Control at Worksites Manual 2018*.

Operation

Road performance and safety benefits

The proposal would improve safety and road network performance. Key traffic and safety features of the proposal include:

- Consistent widened shoulders for provide a recovery area and help to reduce run off road crashes
- · Improved sealed shoulder at driveways to allow vehicles to pull off the road
- Improved verge outside the edge of shoulders for on-road cyclists and pedestrians.

Access

Direct access would be preserved and/or improved under the proposal, with no significant impact anticipated.

Public transport

There would be no change to existing bus routes along Appin Road as a result of the proposal.

Road safety

The proposal is anticipated to improve road safety through the sealing of the existing shoulder of Appin Road, providing safety barriers and fauna fencing (where required) along Appin Road, building a new northbound overtaking lane and providing improved traffic separation.

6.4.3 Safeguards and management measures

Table 6-10 lists the traffic and transport safeguards and management measures that would be implemented to account for the impact identified in section 6.4.2.

Table 6-10: Traffic and transport safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Traffic and transport	A Traffic Management Plan (TMP) will be prepared and implemented as part of the CEMP. The TMP will be prepared in accordance with the Roads and Maritime Traffic Control at Work Sites Manual (Roads and Maritime 2018) and QA Specification G10 Control of Traffic (Roads and Maritime, 2015d). The TMP will include:	Contractor	Detailed design / Pre- construction	Standard safeguard TT1 Section 4.8 of QA G36 Environment Protection

Impact	Environmental safeguards	Responsibility	Timing	Reference
	Confirmation of haulage routes			
	 Measures to maintain access to local roads and properties 			
	• Site specific traffic control measures (including signage) to manage and regulate traffic movement			
	 Measures to maintain pedestrian and cyclist access 			
	• Requirements and methods to consult and inform the local community of impacts on the local road network			
	• 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.			
Property access	Property access will be maintained where feasible and reasonable and property owners will be consulted before starting any work that may temporarily restrict or control access. (Side) road and lane closures will be minimised where feasible and reasonable.	Contractor	Construction	Standard safeguard TT2
Management at	The following traffic	Contractor	Construction	Standard

Impact	Environmental safeguards	Responsibility	Timing	Reference
ancillary sites	 management provisions will be provided at each ancillary facility: Appropriate 'sight distances' to allow traffic to safely enter and exit Temporary painted road lines to provide delineation Suitable intersection arrangements where required Other controls to separate, slow down, or temporarily stop traffic to allow for safe entry and exit 			safeguard TT3

6.5 Noise and vibration

This section summarises the noise and vibration impact that is likely to occur when building and operating the proposal. This was informed by a specialist noise and vibration assessment and is included as an appendix (Appendix F).

6.5.1 Methodology

Construction noise has been assessed in accordance with the *Interim Construction Noise Guideline* (ICNG) (DECC 2009), and with reference to the *Construction Noise and Vibration Guideline* (CNVG), (Roads and Maritime 2016). Construction road traffic noise has been assessed in accordance with the NSW Road Noise Policy (RNP) (NSW EPA, 2011).

The operational road traffic noise impact as a result of the proposal has been assessed in accordance with guidance provided in the *NSW Road Noise Policy* (RNP) (NSW EPA 2011) and with reference to the *Noise Mitigation Guideline* (Roads and Maritime 2015b).

Vibration from operation and construction has been assessed in accordance with Assessing Vibration: A Technical Guideline, DEC, 2006 and DIN 4150:Part 3-1999 Structural vibration - Effects of vibration on structures (Deutsches Institute fur Normung 1999).

The specialist noise and vibration assessment carried out to assess the impact of the proposal comprised:

- · Identifying noise and vibration sensitive receivers within the study area
- · Determining the background noise levels within the study area
- Predicting how building and operating the proposal would impact on noise and vibration-sensitive receivers

• Identifying the adverse impact that would need safeguarding or management measures under the proposal.

To quantify and characterise the existing ambient noise survey across the study area, a baseline noise monitoring survey was undertaken in June and July 2018. The measured noise levels have been used to establish existing noise levels as a basis for assessing the potential noise impact of the proposal.

6.5.2 Existing environment

The proposal is located along Appin Road between Appin and Gilead. The area surrounding the proposal is generally rural with a residential development located to the south.

The existing ambient noise environment surrounding the route is typically dominated by road traffic noise from Appin Road particularly during the morning peak and afternoon peak traffic periods. During the evening and night-time periods, the ambient noise level decreases due to infrequent traffic movements along Appin Road.

The proposal area has been split into a number of Noise Catchment Area's (NCAs) which represent the various receiver areas and changing land use surrounding the proposal. The location of the NCAs are indicated in Figure 6-1



Figure 6-1: Location of the proposal, noise catchment areas and monitoring locations

Noise sensitive receivers

Sensitive receivers were selected to be representative of receivers and communities (also referred to as Noise Catchment Areas (NCA)) potentially affected by the building and operation of the proposal as summarised in Table 6-11. Also, shown in the table are the specific locations within the study area of monitoring locations at nearby sensitive receiver locations.

Table 6-11: Noise catchment areas a	and monitoring locations
-------------------------------------	--------------------------

Noise monitoring location ID	NCA	Location
NM1	NCA06	239 Appin Road, Appin
NM2	NCA05	310 Appin Road, Appin
NM3	NCA04	345 Appin Road, Appin
NM4	NCA05	400 Appin Road, Appin
NM5	NCA02	369-467 Appin Road, Gilead
NM6	NCA01	612 Appin Road, Gilead
NM7	NCA01	675 Appin Road, Gilead

Background noise monitoring

Unattended noise monitoring

The results of the unattended ambient noise surveys are summarised in Table 6-12 as the Rating Background Level (RBL) and LAeq noise levels for the ICNG daytime, evening and night-time periods.

Noise monitoring location ID	Measured Noise Level (dBA)1					
	RBL		LAeq			
	Daytime	Evening	Night-time	Daytime	Evening	Night-time
NM1	44	39	30 ²	58	56	55
NM2	41	39	30	57	57	56
NM3	41	39	30 ²	50	48	47
NM4	42	39	31	64	62	60

Table 6-12: Summary of unattended noise monitoring

Noise monitoring location ID	Measured Noise Level (dBA)1						
	RBL			LAeq			
	Daytime	Evening	Night-time	Daytime	Evening	Night-time	
NM5	39	38	32	53	51	50	
NM6	43	39	32	59	58	57	
NM7	34	34	30	49	42	40	

Note 1: ICNG Governing Periods – Day: 7.00 am to 6.00 pm Monday to Saturday, 8.00 am to 6.00 pm Sunday; Evening: 6.00 pm to 10.00 pm; Night: 10.00 pm to 7.00 am Monday to Saturday, 10.00 pm to 8.00 am Sunday.

Note 2: In accordance with the Noise Policy for Industry (NPfI), the minimum night-time background noise level of 30dBA has been adopted.

Attended noise monitoring

Attended measurements (refer to Table 6-13) of ambient noise were recorded during the noise logging survey to determine the various noise sources that influence the existing noise environment. During each measurement the observer noted the various noise sources and the contributing noise level.

At each location the attended measurements were performed for 15 minutes using a calibrated Brüel and Kjær 2260 Precision Sound Level Meter (S/N:2414604 and S/N:2487418). Wind speeds were less than five metres per second at all times, and all measurements were performed at a height of about 1.5 metres above ground level.

Table 6-13: Summary of attended noise monitoring

Noise monitoring	Ме	asured Noise	Levels	Description of Ambient Noise Source -		
location ID	LA90	LAeq	LAmax	I ypical LAmax Levels		
NM1	55	59	73	Light Vehicles – 57 to 60 dBA Heavy Vehicles – 68 to 73 dBA Motorcycle – 68 to 72 dBA Dog – 66 dBA Wind noise – 65 dBA		
NM2	53	62	78	Light Vehicles – 58 to 68 dBA Heavy Vehicles – 63 to 68 dBA Wind – 55 to 67 dBA		
NM3	44	50	62	Constant Traffic – 52 to 54 dBA Heavy Vehicles – 54 to 55 dBA Local Road – 61 to 62dBA		
NM4	53	64	80	Light Vehicles – 63 to 74 dBA Heavy Vehicles – 69 to 77 dBA Motorcycle – 75 to 80 dBA		
NM5	48	53	71	Light Vehicles – 52 to 57 dBA Heavy Vehicles – 56 to 57 dBA		

Noise monitoring location ID	Measured Noise Levels			Description of Ambient Noise Source -	
	LA90	LAeq	LAmax	i ypicai LAmax Leveis	
				Motorcycle – 59 dBA wind – 48 to 61 dBA Operator – 71 dBA	
NM6	49	57	75	Constant Traffic – 58 dBA Light Vehicle – 53 dBA Car horn – 75 dBA Heavy Vehicle – 65 to 69 dBA	
NM7	39	44	61	Aircraft – 48 to 61 dBA Birds – 42 to 55 dBA Traffic – 47 to 51 dBA	

6.5.3 Criteria

Assessment criteria

Residential receivers

The ICNG details the approach for determining LAeq(15minute) noise management levels (NMLs) at residential receivers located directly next to the road based on the measured LA90(15minute) Rating Background Level (RBL), and is described in Table 6-14.

Table 6-14: Construction Noise Management Levels for residential receivers

Time of day	NML LAeq(15 minute	How to apply
Standard hours: Monday to Friday 7:00 am to 6:00 pm Saturday 8:00 am to 1:00 pm No work on Sundays or public holidays	RBL + 10 dBA Highly Noise Affected 75 dBA	 The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured LAeq(15minute) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practises to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of work to be carried out, the expected noise levels and duration, as well as contact details. The Highly Noise Affected (HNA) level represents the point above which there
		may be strong community reaction to

Time of day	NML LAeq(15 minute	Ηο	w to apply
		•	noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restructuring the hours that the very noisy activities can occur, taking into account:
		•	Times identified by the community when they are less sensitive to noise (such as before and after school for work near schools or mid-morning or mid-afternoon for work near residences). If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	RBL + 5 dBA	•	A strong justification would typically be required for work outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practises have been applied and noise is more than 5 dBA above the noise affected level, the proponent should negotiate with the community.

Note 1 The RBL is the overall single-figure background noise level measured in each relevant assessment period (during or outside the recommended standard hours). The term RBL is described in detail in the NSW Noise Policy for Industry.

Non-residential receivers

The ICNG notes that due to the broad range of sensitivities that commercial or industrial land can have to noise from construction, the process of defining management levels is separated into three categories:

- Industrial premises: external LAeq(15minute) 75 dBA
- Offices, retail outlets: external LAeq(15minute) 70 dBA
- Other businesses that may be very sensitive to noise, where the noise level is specific to the proposal as discussed below.

The external noise levels should be assessed at the most-affected occupied point of the premises. No other sensitive receiver types have been identified in the study area.

Residential NML Summary

Using the background noise levels in Table 6-13 above, the residential NMLs derived for the proposal are detailed in Table 6-15.

The noise monitoring locations used are considered to be the likely most affected residential locations surrounding the proposal.

Background noise levels may reduce for receivers that are located back from the work (and nearby roads), the construction noise predictions are likely to drop off at a quicker rate meaning the level of impact would be lower than the most affected 'front row' receivers.

NCA	Noise monitoring location ID	Standard construction (RBL+10dB)	Out of hours	Sleep disturbance screening (RBL+15dB)		
		Daytime	Daytime	Evening	Night-time	
NCA01	NM7	44	39	39	35	45
NCA02	NM5	49	44	43	37	47
NCA03	NM5	49	44	43	37	47
NCA04	NM3	51	46	44	35	45
NCA05	NM2	51	46	44	35	45
NCA06	NM1	54	49	44	35	45
NCA07	NM1	54	49	44	35	45

Table 6-15: Residential receiver NMLs for building the proposal

Construction noise assessment criteria

As stated in the RNP application notes, the consideration of mitigation would only be required where additional traffic on existing roads creates an increase of more than 2 dBA at existing sensitive receivers. This corresponds to a traffic volume increase of minimum 60 percent, provided the mix of light and heavy vehicle traffic is generally similar.

Construction vibration assessment criteria

Vibration from building the proposal may have a potential impact, for which limits have been set, including:

- Those in which the occupants or users of the building are inconvenienced or possibly disturbed ('tactile vibration')
- Those where a building's contents may be affected (for example, the operation of vibration sensitive equipment such as microscopes in hospitals)
- Vibration affecting the buildings and structures in terms of their susceptibility to damage ('structural damage').

Human comfort vibration

The Department of Environment and Conservation's (DEC) Assessing Vibration: a technical guideline (2006) provides guideline values for continuous, transient and intermittent events that are based on a Vibration Dose Value (VDV) rather than a continuous vibration level. The VDV is dependent upon the level and duration of the vibration event, as well as the number of events occurring during the daytime or night-time period.

The VDVs recommended in the guideline for vibration that is intermittent nature are presented in Table 6-16.

Table 6-16: Adopted human comfort preferred and maximum does values for intermittent vibration

Building type	Vibration does vale (m/s ^{1.75})					
	Preferred	Maximum				
Critical Working Areas (e.g. hospital operating theatres, precision laboratories)	0.10	0.20				
Residential Daytime	0.20	0.40				
Residential Night-time	0.13	0.26				
Offices, schools, educational institutions and places of worship	0.40	0.80				
Workshops	0.80	1.60				

Note 1: Daytime is 7:00 am to 10:00 pm and night-time is 10:00 pm to 7:00 am

Effects on building contents

People can perceive floor vibration at levels well below those likely to cause damage to building contents or affect the operation of typical equipment found in most buildings that is not particularly vibration sensitive. For most receivers, the controlling vibration criterion is the human comfort criterion, and it is therefore not normally required to set separate criteria in relation to the effect of construction vibration on typical building contents.

Where appropriate, objectives for the satisfactory operation of vibration sensitive critical instruments or manufacturing processes should be sourced from manufacturer's data and/or other published objectives.

Structural damage vibration

Structural damage vibration limits are based on Australian Standard AS 2187: *Part 2-2006 Explosives - Storage and Use - Part 2: Use of Explosives and British Standard BS 7385 Part 2-1993 Evaluation and measurement for vibration in buildings Part 2.* These standards provide frequency-dependent vibration limits related to cosmetic damage, noting that cosmetic damage is very minor in nature, is readily repairable and does not affect the structural integrity of the building.

The recommended vibration limits from BS 7385 for transient vibration for minimal risk of cosmetic damage to residential and industrial buildings are shown in

Table 6-17. The vibration guide values are at the base of the building.

Table 6-17: Adopted structural vibration values - minimal risk of cosmetic damage

Line	Type of building	Peak Component Particle Velocity in Frequency Range of Predominant Pulse				
		4 Hz to 15 Hz	15 Hz and above			
1	Reinforced or framed structures. Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above				
2	Unreinforced or light framed structures. Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above			

Note 1: m/s^{1.75} represents the standard time period recognised in the assessment criteria. Critical areas include locations such as hospital operating theatres, precision laboratories)

General vibration screening criterion

The guide values in

Table 6-17 above relate predominantly to transient vibration which does not give rise to resonant responses in structures and low-rise buildings. Dynamic loading caused by continuous vibration may give rise to dynamic magnification due to resonance, especially at low frequencies where lower guide values may need to be reduced by up to 50 percent.

For activities involving intermittent vibration sources such as rockbreaker, piling rigs, vibratory rollers and excavators, the predominant vibration energy occurs at frequencies greater than 4 Hz (and usually in the 10 Hz to 100 Hz range). On this basis, a conservative vibration damage screening level per receiver type is given below:

- Reinforced or framed structures: 25.0 mm/s
- Unreinforced or light framed structures: 7.5 mm/s.

At locations where either the predicted and/or measured vibration levels are greater than shown above (peak component particle velocity) monitoring should be performed during work activities. At these locations a more detailed analysis of the building structure, vibration source, dominant frequencies and dynamic characteristics of the structure would need to be carried out prior to the start of any vibration generating activity to determine the applicable safe vibration level.

Utilities and other vibration sensitive structures

Where structures and utilities are encountered which may be considered to be particularly sensitive to vibration, a vibration goal which is more stringent than the structural damage goal may need to be adopted for the proposal. Examples of such structures and utilities may include the gas pipeline, fibre optic cable, and heritage items as detailed in section 3.3.1.

Specific vibration goals should be determined on a case-by-case requirement during preparation of the Construction Noise and Vibration Management Plan. It is anticipated that an acoustic consultant would be engaged by the construction contractor and would liaise with the structure or utility's owner in order to determine acceptable vibration levels.

Operational road traffic noise

Residential receivers

The proposal includes the safety improvements at Appin Road. Where an existing road is redeveloped and it changes functional class, it is considered a new road according to the *Noise Mitigation Guideline* (Roads and Maritime 2015a). The work carried out within the study area would not result in a change in the functional class of the road, therefore all roads are assessed against the redeveloped and minor work criteria.

Table 6-18: Adopted operational road traffic noise criteria for residential receivers

Road category	Type of proposal/land use	Assessment of criteria	ı dBA
		Day (7am-10pm)	Night (10pm-7am)
Existing roads	Minor work	Existing noise +2 dB: equivalent to about per cent increase in traffic ¹	

Note 1: Where the noise levels increase by more than 2 dB during the build scenario, the existing road criteria (daytime 60 dBA and night-time 55 dBA) is applied

The Noise Mitigation Guideline (Roads and Maritime 2015a) states that for existing roads that are affected by more than a 2 dB increase due to the changes introduced under the proposal, feasible and reasonable safeguards and management measures should be investigated for affected sensitive receivers. This criterion apples to the existing roads in the proposal footprint and extends to cover adjacent roads outside of the proposal footprint.

Sleep disturbance

The guidance within the RNP indicates that internal noise levels of 50-55 dBA are unlikely to cause sleep awakenings. Therefore, at levels above 55 dBA, sleep disturbance would be considered likely. Receivers may have windows partially open for ventilation, a 10 dB outside to inside correction has been adopted as indicted in the ICNG guideline.

A sleep disturbance screening criterion of 45 dBA has been adopted for the proposal.

6.5.4 Potential impact

Construction

Construction noise assessment

While construction staging would be further refined prior to the commencement of work on site, each of the main work activities of the proposal would likely involve the use of varying equipment along different sections of the road at various times of the day. This understanding of the work has been used to define the combined noise output (i.e. sound power levels for equipment) provided in Appendix F and generated in a work activity scenario for the proposal. Separate results are provided for residential, commercial and other sensitive receiver types.

Noise levels are representative of the worst-case impact, for a given receiver type and are intended to give an overview of the likely noise levels from work carried out at their closest. A summary of the predicted noise levels (without additional mitigation) in each of the NCAs for the various work activities is presented in Table 6-19

Table 6-19: Predicted worst-case noise levels for all work activities and across all NCAs

NCA	Noise level	e mana	nagement Predicted LAeq(15 minute) noise level (dBA) ¹											
	1L standard daytime	1L daytime out of hours	1L evening	1L night-time	W.0001 - compound establishment	W.0002 - Appin Road/Brian Road compound (office etc.)	W.0003 - laydown (northern compound)	W.0004 - stockpiling (Sydney Water site)	W.0005 – general earthwork	W.0006 - Concrete Saw (if required)	W.0007 - drainage work	W.0008 - mill and re- sheet existing road	W.0009 - line marking	W.0010 - installation of new sign posts
	Z	Z	Z	Z					Operatin	g Perioc				
Residential					D	D/N	D/N	D/N	D/N	D/N	D/N	D/N	D/N	D/N
NCA01	44	39	39	35	<30	<30	33	<30	56	55	53	59	46	51
NCA02	49	44	43	37	<30	<30	38	32	70	69	67	73	60	65
NCA03	49	44	43	37	37	30	42	40	71	70	68	74	61	66
NCA04	51	46	44	35	46	39	<30	49	51	50	48	54	41	46
NCA05	51	46	44	35	49	51	<30	48	73	72	70	76	63	68
NCA06	54	49	44	35	47	49	<30	37	57	56	54	60	47	52
NCA07	54	49	44	35	52	54	<30	34	70	69	67	73	60	65
Commercia	al													
NCA01	70	70	70	70	-	-	-	-	-	-	-	-	-	-
NCA02	70	70	70	70	-	-	-	-	-	-	-	-	-	-
NCA03	70	70	70	70	-	-	-	-	-	-	-	-	-	-
NCA04	70	70	70	70	39	39	25	42	46	45	43	49	36	41
NCA05	70	70	70	70	-	-	-	-	-	-	-	-	-	-
NCA06	70	70	70	70	-	-	-	-	-	-	-	-	-	-
NCA07	70	70	70	70	-	-	-	-	-	-	-	-	-	-

Note 1: Cell shown in red indicates highest predicted exceedance of NML for worst-case proposed operating period greater than 20dB

Predicted noise levels provided in

Table 6-19 are based on the exceedance of the NML during that period and for that receiver type. A qualitative description of the NML exceedance bands are provided as follows.

- Noise levels 1 to 10 dB above NML the impact would typically be marginal to minor
- Noise levels 11 dB to 20 dB above NML the impact would typically be moderate
- Noise levels >20 dB above NML the impact would typically be high.

Predicted noise levels and the number of exceedances presented indicate that a relatively high noise impact is likely to occur during some of the higher noise generating work activities. It should however be noted that during most activities, Noise levels provided in Table 6-19 are representative of work at the closest point to a receiver.

During standard daytime hours, no exceedances of the NML are predicted at any receivers during work at the compound locations (W.0001 to W.0004). During the daytime, residential receivers within NCA04 and NCA06 would only exceed the NML by up to 6 dBA during milling and re-sheeting work (W.0008). However, during the night-time period, exceedances of up to 25 dBA are predicted within these NCAs due to existing low ambient background noise levels during the night time.

During road work activities (e.g. milling and re-sheeting - W.0008) exceedances of up to 25 dBA are predicted to nearby sensitive receivers primarily with in NCA02, NCA03, NCA05 and NCA07 due to the proximity of the sensitive receivers to the road.

Night-time work exceedances of up to 41 dBA are predicted at residential receivers for various work activities. These exceedances would only be apparent when work would be within about two kilometres of a sensitive receiver.

Of all sensitive receivers identified, the sensitive receiver at 336 Appin Rd, Appin is predicted to be highly affected (greater than 75 dBA) as a result of the proposal. This receiver is the closest receiver to the road (about 15 meters from the road) across the study area. The impact would be likely experienced during milling and re-sheeting of the road. This level of impact is only predicted to occur when work would be carried out directly next to the receiver.

For most work activities, it is expected that noise levels would potentially be lower than predicted at the most-exposed receiver, as the noise levels presented in this report are based on a realistic worst-case assessment.

Predicted NML exceedances across the proposal area for all receiver types and noise contours are provided in Appendix F.

Sleep disturbance

A worst-case scenario of a concrete saw being used during the night-time period would likely impact all receivers and as a result exceed the sleep disturbance screening criteria of 45 dBA for work occurring within close proximity to each sensitive receiver.

In line with the ICNG reference to the EPA's *Environmental Criteria for Road Traffic Noise* (ECRTN1999), maximum internal noise levels below 55 dBA are unlikely to result in an awakening reaction. This is also consistent with guidance contained in the EPA's NSW *Road Noise Policy* (RNP 2011) which concludes that:

Maximum internal noise levels below 50 dBA to 55 dBA are unlikely to awaken people from sleep'. It is generally accepted that internal noise levels in a dwelling with the windows open are 10 dB lower than external noise levels.

Therefore, based on a worst case minimum attenuation of 10 dB, with windows open, it is predicted that this internal noise level may be exceeded at up to 62 nearby sensitive receivers across the study area. However, not all predicted receivers would be impacted at the same time, as work would progressively be carried out along Appin Road.

During less noise intensive activities about four sensitive receivers are predicted to exceed internal noise levels.

Where practicable, noise intensive activities should be carried during standard daytime hours. However, as discussed in section 3.2.2 above it is anticipated that some work activities would be carried out during the night-time period. Safeguards and management measures as detailed in section 6.5.5 below would be implemented to minimise these exceedances where possible.

Operation

The operational noise assessment has been divided into the main Appin Road safety work (from NCA01 to NCA07).

Appin Road safety improvement

The proposal would not result in additional vehicles travelling along Appin Road or travelling closer to properties located directly next to Appin Road. Table 6-20 summarises the predicted noise level for the building with the largest increase across each NCA.

Results of the operational assessment show that the proposal is predicted to result in a negligible change in existing road traffic noise levels within the study area. In all cases the predicted increase is less than 2 dB criteria at the most affected locations of each building. As such, there is no requirement to consider additional noise safeguards or management measures from the proposed safety improvement work along Appin Road between Brian Road and Gilead.

NCA	Use	Predicted noise le	Triggered for noise			
		Daytime LAeq(15 hour)	Night time LAeq(9 hour)	Increase	mitigation treatment	
NCA01	Residential	42	38	+0.3	No	
NCA02	Residential	57	52	+0.1	No	
NCA03	Residential	64	60	+0.2	No	
NCA04	Residential	47	42	+0.1	No	
NCA05	Residential	61	56	+0.2	No	
NCA06	Residential	62	58	+0.2	No	
NCA07	Residential	65	60	+0.1	No	
NI-L-A	Description of the state of the set of the state	a factor for a self at a state of the self second	and the second state of the second state	and the same service the service of the service of	ta a al NOA	

Table 6-20: Predicated operational noise levels

Note 1: Predicted noise level is the level predicted for the residence with the greatest increase in noise level in each NCA

6.5.5 Safeguards and management measures

Table 6-21 lists the noise and vibration safeguards and management measures that would be implemented to account for the impact identified in section 6.5.4.

Table 6-21: Noise and vibration safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Noise and vibration	 A Noise and Vibration Management Plan (NVMP) will be prepared and implemented as part of the CEMP. The NVMP will generally follow the approach in the Interim Construction Noise Guideline (ICNG) (DECC, 2009) and identify: All potential significant noise and vibration generating activities associated with the activity Feasible and reasonable mitigation measures to be implemented, taking into account <i>Beyond the</i> <i>Pavement: urban design</i> <i>policy, process and</i> <i>principles</i> (Roads and Maritime 2014) A monitoring program to assess performance against relevant noise and vibration criteria Arrangements for consultation with affected neighbours and sensitive receivers, including notification and complaint handling procedures Contingency measures to be implemented in the event of noncompliance with noise and vibration criteria. 	Contractor	Detailed design / preconstruction	Standard safeguard NV1 Section 4.6 of QA G36 Environment Protection
Construction noise and vibration	All sensitive receivers (e.g. local residents) likely to be affected will be notified at least seven days prior to	Contractor	Construction	Standard safeguard NV2

Impact	Environmental safeguards	Responsibility	Timing	Reference
	 commencement of any work associated with the activity that may have an adverse noise or vibration impact. The notification will provide details of: The proposal The construction period and construction hours Contact information for project management staff Complaint and incident reporting How to obtain further information. 			
Construction noise	 Work will be undertaken in accordance with the <i>Construction Noise and Vibration Guideline</i> (Roads and Maritime 2016) Stationary and directional noise sources will be orientated away from sensitive receivers Vehicles, obstacles and stockpiles will be utilised on site to provide shielding to receivers, especially for static noise sources Equipment that has noise levels equal to or less than the sound power levels provided in Appendix F will be used The simultaneous use of high noise generating equipment will be limited during construction The use will also be limited to standard hours where possible Plant will be switched off when not in use Plant, tools and equipment will be used such that noise is reduced to the minimum 	Contractor	Construction	Standard safeguard NV3

Impact	Environmental safeguards	Responsibility	Timing	Reference
	required.			
Construction traffic noise	The NVMP would include provisions to reduce the potential impact of construction traffic noise including:	Contractor	Construction	Standard safeguard NV4
	• Restricting travel routes to and from the site to using the main roads (e.g. arterial roads) and to avoid local roads and roads where residential receivers are potentially impacted			
	 Prohibiting the use of engine / compression brakes in or near residential areas 			
	 Promoting driving behaviour that reduces the potential noise impact 			
	 Prohibiting idling of plant and equipment engines near residential receivers when not in use 			
	• Strategic positioning of site accesses to minimise the chance of trucks passing by residential receivers, especially at night.			
Construction vibration	Lower powered equipment will be used when working in close proximity to vibration sensitive receivers where possible	Contractor	Construction	Standard safeguard NV5
	Building condition /dilapidation surveys will be completed both before and after the work and attended vibration monitoring undertaken when work is proposed within the specified safe working distances			
	Where work is required within the nominated safe working distance, additional vibration mitigation measures detailed in			

Impact	Environmental safeguards	Responsibility	Timing	Reference
	Appendix F will be considered.			
Noise and vibration complaints	Attended noise and/or vibration monitoring will be undertaken following a complaint. Report the monitoring results as soon as possible. In the case that exceedances of the management levels are recorded, review the situation and identify means to reduce the impacts to noise and vibration sensitive receivers. This is to include revision to the CNVMP where required.	Contractor	Construction	Standard safeguard NV6
Operational noise mitigation	 Mitigation measures to minimise operational noise will be investigated, including: Quieter pavement surfaces and suitability of such pavement types for through lanes and areas of acceleration, deceleration and turning movements Property treatments for residually affected receivers where feasible and reasonable 	Roads and Maritime	Detailed design	Standard safeguard NV7
Property treatments	Where at property treatments are identified, consider implementing these at the commencement of construction. These treatments would alleviate any noise concerns/complaints during the construction period.	Contractor	Construction	Standard safeguard NV8

6.6 Aboriginal heritage

An Aboriginal Archaeological Survey and Assessment Report by Eco Logical Australia has been prepared for the proposal to meet the requirements of Division 5.1 of the NSW EP&A Act.

6.6.1 Methodology

An assessment of Aboriginal heritage has been carried out in accordance with Stage 2 of the Roads and Maritime Procedure for Aboriginal Cultural Heritage and Consultation Investigation (PACHCI) guidelines.

An archaeological survey was carried in accordance with Stage 2 PACHCI guidelines and *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (DECCW 2010) on 6 August 2018. The survey was carried by Ecological Australia and representatives of the Tharawal Local Aboriginal Land Council (Tharawal LALC). Areas addressed by the survey are identified in Table 6-22.

Table 6-22: Survey units

Survey Unit	Location
SU1	East and west sides of the road reserve, extending from Appin Road and Brian Road intersection to the driveway of 515 Appin Road (opposite Belltrees Kennels)
SU2	East and west sides of the road reserve, extending north from 515 Appin Road (opposite Belltrees Kennels) to the driveway for the Beulah property (SHR listed #00368)
SU3	Cleared paddocks with re-growth eucalypts within and directly next to the road corridor. SU 3 extends out of the proposal footprint, past the Mount Gilead lead in area in order to survey the Mount Gilead Property PAD (AHIMS ID #52-2-3768) located to the north of the proposal footprint

6.6.2 Existing environment

The proposal is located within the Campbelltown and Wollondilly Local Government Area, the Parish of Manangle and Appin, and the County of Cumberland. It is contained within the boundaries of the Tharawal LALC. An extensive search of the AHIMS database was undertaken on 24 July 2018. The search identified 97 sites as being within one kilometre of the proposal footprint. There are no recorded sites within the proposal footprint. The closest recorded sites to the proposal are the registered AHIMS number 52-2-2266 and number 52-2-3768. The majority of registered Aboriginal sites are located to the east and west of Appin Road, scattered along Georges River and within Mount Gilead respectively.

6.6.3 Potential impact

There is a low potential for Aboriginal archaeological sites within the study area as the area contains no landforms that would be considered archaeologically sensitive. The area has been considerably modified to build the road. There are no major watercourses that intersect the proposal, therefore limiting the potential for Aboriginal sites to be present along Appin Road. No shell middens, hearths, or potential burial areas were observed during the field survey. Overall there are no identified Aboriginal heritage concerns within the proposal footprint.

6.6.4 Safeguards and management measures

Table 6-23 lists the Aboriginal heritage safeguards and management measures that would be implemented to account for the impact identified in section 6.3.3.

Impact	Environmental safeguards	Responsibility	Timing	Reference
Aboriginal heritage finds	The Standard Management Procedure - Unexpected Heritage Items (Roads and Maritime 2015c) will be followed in the event that an unknown or potential Aboriginal object/s, including skeletal remains, is found during construction. This applies where Roads and Maritime 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 re- commence once the requirements of that Procedure have been satisfied.	Contractor	Detailed design / preconstruction	Standard safeguard AH1 Section 4.9 of QA G36 Environment Protection

Table 6-23: Aboriginal heritage safeguards and management measures

6.7 Non-Aboriginal heritage

A Statement of Heritage Impact (SoHI) has been prepared by Advisian for the proposal in accordance with the *NSW Heritage Office & Department of Urban Affairs and Planning NSW Heritage Manual* (1996) and NSW *Heritage Office Statements of Heritage Impact* (NSW Heritage Office 2002) (refer to Appendix H).

6.7.1 Methodology

The purpose of the SoHI is to assess the potential impact to non-Aboriginal heritage values as a result of the proposal. The assessment includes:

- Review of relevant legislative, regulatory, local, State and Commonwealth statutory and non-statutory planning controls
- Review of the Australian Heritage Database, NSW State Heritage Inventory, Roads and Maritime Section 170 Heritage and Conservation Register and Schedule 5 of Campbelltown LEP and Wollondilly LEP
- Review of The Burra Charter
- Review of the Office of Environment and Heritage Statements of Heritage Impact guidelines

- Review of the Roads and Maritime Cultural Heritage Guidelines and Unexpected Heritage Items Procedure
- Review of the potential impact to sites of historic and archaeological heritage (Casey & Lowe 2018)
- Review of Engineering Drawings, prepared by Roads and Maritime
- Review of the Strategic Road Design Report for the proposal
- Consultation with Roads and Maritime
- Identification of the potential impact on heritage significance and identification of mitigation measures.

A site inspection of the proposal footprint was conducted by Advisian on 14 June 2018. The aim of this inspection was to identify the nature of Appin Road and the overall impact of the proposal on heritage items in the locality.

6.7.2 Existing environment

Heritage listed items

There are no listed heritage items under Schedule 5 of the Campbelltown LEP and Wollondilly LEP located within Appin Road. Further, there are no heritage conservation areas located in or within the vicinity of the proposal.

There are five heritage listed items (refer to Table 6-24) located within the vicinity of the proposal. These are:

- Beulah (Item I368), listed under Schedule 5 of the Campbelltown LEP. This item is listed on the State Heritage Register (SHR368)
- Brookdale site (Item I54) listed under Schedule 5 of the Campbelltown LEP
- Hume monument (Item I56) listed under Schedule 5 of the Campbelltown LEP
- Humewood Forest (Item I53) listed under Schedule 5 of the Campbelltown LEP. This item is also listed as (original portion 77 of Beulah) on the State Heritage Inventory
- Meadowvale listed under Schedule 4 of the Interim Development Order No.15 City of Campbelltown (IDO15).

Name	LEP number	SHR number	Significance
Beulah	1368	Not applicable	Local
Brookdale site	154	Not applicable	Local
Hume monument	156	SHR368	Local
Humewood Forest	153	Not applicable	State/Local
Meadowvale	Not applicable	Not applicable	Interim Development Order No.15 - City of Campbelltown

Table 6-24: LEP and SHR and LEP items located within the proposal footprint
Archaeological potential and significance

Humewood Forest

The Statement of Significance for Humewood Forest under the LEP listing is described as follows:

Humewood Forest is of historical, aesthetic and research significance as a rare surviving stand of Eucalyptus maculata (Spotted Gum). The land is in original condition, comprising Portion 77 of the property Beulah, and is closely associated with that property (also a heritage item). Humewood Forest has historical association with the family of Francis Rawden Hume, who owned this portion from 1823 till 1969, when a trust under the Will of Ellen Clayton Hume (1870-1936) was dissolved. The aesthetic value of the forest is high and is enhanced by the continuation of forest across Appin Rd to the East.

The timber beam bridge over Woodhouse Creek between the current area of 'Beulah' and the Humewood Forest is believed to be the only example of its type in private ownership and the only one known to retain a full set of stringer girders intact. It is a rare remnant of Australia's oldest surviving form of bridge construction but its current condition is unknown.

The forest is considered to have significant ecological research potential.

Brookdale site

The Statement of Significance for Brookdale site under the state listing is described as follows:

Brookdale is of historic significance as the location of the home of important explorer Hamilton Hume and the place where many of his most significant explorations assembled and departed from. Although the house has been demolished and parts of the site have been cultivated, the footprint of the buildings can still be seen and it is likely that relics from this period have survived below ground. This is the only surviving physical evidence of the home of this important historical figure.

The property also has historic significance as one of the group owned by the Hume family in the Gilead area in the early 19th Century.

The open rural setting of the site is aesthetically significant and facilitates an appreciation of the spatial characteristics and aesthetic qualities of the early 19th Century pastoral landscape of NSW. These spatial qualities of the site and its setting contrast significantly with the complex hill-scape of the northern part of Campbelltown LGA.

The site, including homestead and outbuildings, has remained undeveloped since abandonment and demonstrates a high level of research and archaeological potential.

Beulah

The Statement of Significance for Beulah under the state heritage listing is described as follows:

"Beulah is of State historical significance as an entire cultural landscape containing early Colonial structures - homestead group and stone bridge - remnant 19th century farm and garden layout, an octagonal pavilion or summer house as a major focal element and a remnant spotted gum (Corymbia maculata) forest as a result of early conservation planning (Morris & Britton, 2000, 72). The land was part of land grants promised in 1821 which appear to have been occupied by a building by 1822 (documentary record of Governor Macquarie visit to the district), though the current buildings date from 1835-1839.

The property includes an 1830s timber bridge across Woodhouse Creek (linking to the associated item Humewood Forest). The property has historical association with the family of Francis Rawdon

Appin Road Safety Improvements, Brian Rd, Appin to Gilead Review of Environmental Factors Hume (brother of Hamilton Hume and co-explorer) and his descendants - particularly his son John Kennedy Hume and his family, and his daughter Ellen Clayton Hume (d. 1936).

Francis Rawdon Hume was the original land grantee of Portion 77 of the property, and the entire 200 acre property was in the ownership of the Hume family for 90 years from 1846-1936. The house is of aesthetic significance as a rare and fine example of the Old Colonial Georgian style in its original historic setting.

The property has the potential for a high level of archaeological research significance to reveal details of the layout and use of an early colonial pastoral property.

Meadowvale

A historical description of the item was obtained from the Campbelltown City Council's Local Heritage Register and is described as follows:

This building stands on the original grant of 40.5 ha (100 acres) made to Andrew Hume in 1812 and called by him "Hume Mount" later known as "Humewood" then "Rockwood" before "Meadowvale." It is not known when the buildings where erected though the stone cottage may have been the original homestead. Governor Macquarie visited the farm in 1815.

The Main house was built c. 1830 and then the name was changed to Meadowvale when sold to A.D. Ross c. 1900. The kitchen was then built. Some major alterations to the attic storey have change[d] its original appearance. Doors and windows have also been replaced. Both exterior and interior walls are about 18" thick. There are large open fireplaces surrounded by cedar panelling and mantle. The doorways are low and there are six panelled cedar doors. There is a single storey with at the rear of the house, an underground cellar and in the 1860's there was an old stone barracks for the convicts.

Meadowvale is considered to be of heritage significance as "an early Hume house with colonial characteristics.

Potential consideration of Appin Road as a S170 heritage listed item

The non-Aboriginal Heritage report (Casey & Lowe 2018) assessed the heritage significance of Appin Road against the seven criteria adopted by the NSW Heritage Council as described in the *NSW Heritage Manual* - Assessing heritage significance for Historical Archaeological Sites and 'Relics' (NSW Government 2009). The assessment determined that Appin Road within the study area and any potential early 19th century roadbuilding together with other potential archaeological remains has the potential to be of local heritage significance.

It is recommended that Roads and Maritime consider an assessment of the heritage significance of Appin Road, including the study area, to establish its heritage significance and inclusion on the Roads and Maritime S170 Heritage and Conservation Register.

6.7.3 Potential impact

This assessment of the potential impact for the proposal has been carried out in relation to the relevant provisions of the following:

- Clause 5.10 of the respective local environmental plans
- Clause 19 of IDO15
- NSW Heritage Manual's Statements of Heritage Impact Guidelines

• The relevant Articles of The Burra Charter.

Local environmental plans

The objectives of clause 5.10 of the Campbelltown LEP and Wollondilly LEP are satisfied for the northern area of the proposal near Beulah Reserve and at the property directly next to the site containing an endangered ecological community and Koala habitat, as the safety improvements are designed to minimise the impact to mature trees along the road corridor. It is noted that Humewood Forest is located in Beulah Reserve.

The proposed compound curve realignment and northbound overtaking lane would not obscure the Hume monument and Brookdale site which are both located in the immediate vicinity of the proposal.

Clause 19 of Interim Development Order 15

Meadowvale is located about two kilometres west of the proposal. Under clause 19 *A person shall not, in respect of a building, work, relic or place that is an item of the environmental heritage.* Meadowvale is considered to have high archaeological potential. The item would not be impacted by the proposal.

Heritage branch assessment guideline

The proposal is considered to be compatible within its context and setting, and respect the heritage significance of heritage items located in the vicinity of the proposal. The proposal would have a minimal adverse impact on the heritage significance of heritage items and its significant elements. The work would facilitate upgrades compatible with the roads existing use to satisfy the Roads and Maritime objectives for the proposal and improve road safety.

Shoulder widening along either the eastern and western site boundary near Beulah Reserve would create a significant adverse impact on adjacent land containing endangered ecological communities and Koala habitat (eastern side) and the Beulah Reserve biobank site (western side). Humewood Forest is located in Beulah Reserve. The item's curtilage extends to the site boundary.

Eucalyptus maculata (Spotted Gum) are significant elements of the heritage item, graded as "Exceptional." The intact cluster of Spotted Gum directly contributes to the heritage item's historical, aesthetic, research and rarity values.

The potentially detrimental impact on heritage significance is mitigated by road widening on both sides of the site and narrowing the offset to the safety barrier on both sides of the site near Beulah Reserve to about 2.9 metres from the painted edge line. This would avoid property acquisition at this location.

Further, the 'clear zone' width on both sides of the site near Beulah Reserve would be reduced to about 4.5 metres. This would minimise the need for tree clearing. Thus, the proposal would be respectful of the heritage significance of "Humewood Forest", and sensitive to the conservation of EECs within the study area and biobank site.

The large curtilage of Meadowvale runs directly next to the road. Tree clearing and installation of a safety barrier is proposed along the curtilage boundary to the site. It is anticipated that the proposal would likely have no impact on the heritage significance of the property and its curtilage.

The proposal would have no heritage impact on the heritage significance of the Hume Monument and the Brookdale site.

The Burra Charters Articles

The proposal is assessed with regards to the key relevant Articles of The Burra Charter.

Article 7: Use

The Hume Monument functions as a local landmark that marks the location of Hamilton Hume's homestead (Brookdale site) and the beginning of his historically significant expeditions. Further, the Hume Monument is of historic, cultural and social significance within the LGA. The proposed three metre wide shoulder lane near the monument would allow a continuation and enhancement of practices that contribute to and allow visitors to experience the cultural significance of place near Hume monument and Brookdale site.

Article 8: Setting

The mature trees within Humewood Forest and the EECs located within the property directly next to the road are central to the historic, aesthetic and scientific values of the place and the surrounding landscape character. The distinctive tree canopy also informs the visual setting. The proposal would ensure that any impact to mature trees along both sides of the road near Beulah Reserve is minimised and the cultural significance of place is conserved.

Article 9: Setting

The physical location of the Hume Monument is part of its cultural significance. This item is located within a largely intact cultural landscape representative of 1800s open rural farming practices with significant aesthetic value. The monument would not be impacted by the proposal.

Article 21: Adaptation

The proposal would upgrade existing road infrastructure and services to support an existing use and improve road safety. The site is located within a culturally significant landscape. The magnitude of the proposed additions to place would not significantly impact its cultural significance.

The proposal would require acquisition of property next to the road as identified in section 3.4 above. This would include the clearing of vegetation including mature trees along sections of the road. The design does provide for minimal impact on the significant natural fabric of Humewood Forest and the EECs located within the study area.

Article 22: New work

The proposal would readily be identifiable to the existing road corridor.

Article 24: Retaining association and meanings

Hamilton Hume is a significant figure in the cultural and social history of the Campbelltown LGA. The Hume family is associated with properties in the area, including the "Brookdale" homestead. *"Hume monument", "Meadowvale"* and what remains of *"Brookdale site"* connect the present community to Campbelltown's historical figures. The proposal would not impact these heritage items.

The meanings that a place evokes are personal. The place surrounding *"Hume monument" and the "Brookdale site"* likely signifies traditional farming practices, given its rural farmland setting with views to distant ridgelines and landscape forms. Further, *"Humewood Forest"*, with its intact cluster of Spotted Gum, may signify a place of ecological survival. The proposal would respect these qualities. It is unclear what spiritual values are attributed to place.

Overall, it is considered that on heritage grounds, the proposal is supported as it would not significantly alter the heritage significance of listed heritage items and/or the associated fabric, character and setting and views to and from each item. The proposal would conserve the heritage value of the area and meet the specific objectives of improving the safety of the road corridor for users.

6.7.4 Safeguards and management measures

Table 6-25 lists the non-Aboriginal heritage safeguards and management measures that would be implemented to account for the impact identified in section 6.7.3.

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

Impact	Environmental safeguards	Responsibility	Timing	Reference
Non-Aboriginal heritage finds	The Standard Management Procedure - Unexpected Heritage Items (Roads and Maritime 2015c) will be followed in the event that any unexpected heritage items, archaeological remains or potential relics of Non- Aboriginal origin are encountered. Work will only re-commence once the requirements of that Procedure have been satisfied.	Contractor	Detail design/ Pre- construction	Standard safeguard H1 Section 4.10 of QA G36 Environment Protection
Non-Aboriginal heritage	Archival recording of listed heritage items prior to modification of any aspect of the road shall be undertaken for the proposal	Roads and Maritime	Detail design/ Pre- construction	Standard safeguard H2

6.8 Landscape character and visual impact

This section summarises the landscape character and visual impact that is likely to occur when building and operating the proposal. A Landscape Character and Visual Impact Assessment has been prepared by Advisian (refer to Appendix I).

6.8.1 Methodology

The Environmental Impact Assessment Practice Note: *the Guidelines for Landscape Character and Visual Impact Assessment* (EIA-N04, Roads and Maritime 2013) guided the landscape character and visual impact assessment. This included:

- Identifying and establishing the existing character and sensitivity of the surrounding landscape
- Defining the study area where it would be possible to see the proposal

• Considering how building and operating the proposal would potentially impact on the area's sensitive landscape values, residents, workers and other sensitive users in the vicinity of the proposal.

The landscape character and visual impact assessment used the impact ratings outlined in the above guidance to determine:

- The sensitivity of each landscape character zone and representative viewpoint to changes in the form, setting, and composition of the landscape through the introduction or removal of components (i.e. removal of trees or introduction of road infrastructure)
- The scale of change in the landscape and to people's views that would be introduced in building and operating the proposal.

6.8.2 Existing environment

The existing landform of Appin Road within the proposal footprint is generally flat with gentle undulating slopes that dip and incline through its natural setting. Elevation at the proposal slightly increases from south to north. The site is surrounded by land that is largely zoned "RU2 Rural landscape". Built form within the southern portion of the proposal footprint includes low density residential housing and small to medium sized businesses. Agricultural and farming-based practices also occur directly next to the road. Within the northern section of the proposal the landscape transitions from open farmland to remnant bushland.

The Road corridor has been modified and mostly cleared for construction of the existing road. The presence of Ashfield Shale of the Wianamatta Group and small areas of Hawkesbury sandstone (refer to section 6.1.5) beneath the proposal has resulted in sections of weathered sandstone and shale visible in cuttings at parts of the road reserve.

The proposal footprint and surrounds have been assessed and two landscape character zones (LCZ) have been established:

- LCZ1: Bushland
- LCZ2: Open farmland.

Table 6-26 describes each zone's characteristics, and its sensitivity to change.

Table 6-26: Landscape character zones

Zone	Land use characteristics	Sensitivity to change
LCZ1 bushland	Character is defined by its ecological value (refer to section 6.2) as remnant bushland within Beulah Reserve.	Moderate sensitivity due to its ecological valuable flora and fauna and is of high visual character.
LCZ2 open farmland	Characteristic of an open, generally flat landform. Overall landscape pattern is created by regular and uniform pasture land, with scattered remnant native roadside trees, shrubs and small sections of bushland providing filtered views Absence of built form, however this zone includes low density residential housing Generally open views, which provide scenic character.	Moderate sensitivity due to large extents of open ground and limited trees and relatively low volume of development within the zone.

Visual amenity

Viewpoints and receivers

The extent of views where it would be possible to see the proposed safety improvements along Appin road are limited by both the area's topography and natural and/or manmade features that act as a visual barrier to the road. Receivers within the proposal footprint include users of Appin Road, residents, commercial receivers and other sensitive receivers. Receivers are predominantly located in the southern part of the proposal footprint on both sides of Appin Road. Views to the road from housing directly next to the road are obscured by garden fences at the rear of properties.

Viewpoints for the assessment have been selected to best represent groups of receivers along Appin Road. These viewpoints represent key locations in the proposed footprint where the impact of the proposal is potentially at its greatest. Viewpoints were selected to represent the visual receivers of the proposal. Each viewpoint's sensitivity to change was also determined based on their relativity to one another.

Views at night

The majority of Appin Road within the proposal footprint does not contain street lighting. Undeveloped areas surrounding the northern portion of the proposal footprint have few light sources, leading to low light levels in this area. The southern portion of the proposal footprint also contains limited lighting sources along the road.

6.8.3 Potential impact

Construction

Landscape character

Impact to the landscape character during construction would depend on the location, scale and type of activity being carried out. Key activities that would temporarily impact landscape character are discussed in section 3.2.

Impact to the landscape character during construction would occur through the staged introduction of new roadside infrastructure and the removal of vegetation at the side of the road. This would include the movement of equipment and machinery to and from the ancillary site to the location of the work activity, a temporary increase in traffic congestion; amenity effects such as dust, noise and vibration generation; the presence of construction equipment; and use of bollards, fencing and hoardings.

Road widening improvements would likely have the greatest impact on the area's landscape values given the scale of the work within the existing road corridor. The impact would be most notable within LCZ1 where sensitivity to change is assessed as greatest.

Visual amenity

Similar to the impact to landscape character, the impact to visual amenity with the study area would be generated during construction. Despite the sensitivity of local receivers, an impact to the visual amenity with the study area is likely to only occur during construction. Any impact is expected to be intermittent and short-term. While some receivers that look directly onto the proposal may experience some longer periods of visual impact as a result of construction, overall, the impact is not considered to be significant.

Light spill and night time work

Certain activities would be required to take place at night given the need to partially close the existing road. Additional site lighting would be needed to undertake any night work for visibility and safety reasons; both for the workers and the public. The introduced light would likely be in the form of high-power site lights and vehicle lights. These lights are typically white in nature and character. They can be shielded and directed to prevent spill and backscatter.

The duration of night work would be temporary and short-term with respite periods determined in accordance with Roads and Maritime guidelines and community consultation. Light spill from night-time work would be minimised as much as reasonably practicable with priority given to maintaining safe visibility for work personnel. Confirming whether there would be an impact would depend on the location of the light relative to the nearby sensitive adjacent receivers.

Operation

Landscape character

Overall, it is concluded that the landscape character would be impacted the greatest where the removal of vegetation would occur along Appin Road as part of the proposed safety improvement work. The impact to landscape character in other zones would not change significantly as it would continue to be dominated by a road.

Visual amenity

New road infrastructure, including the widened Appin Road and associated vegetation removal, would negatively impact the visual amenity of surrounding receivers. The impact is generally greatest where fauna fencing may be required for the proposal. However, these receivers would also benefit from the safety enhancements along the road.

Visibility for much of the alignment is limited to road users, which would have temporary views as receivers pass through the area.

Operation: light spill

The lighting design would be confirmed at the detailed design stage. It is likely to involve a contemporary design that may involve the inclusion of LED lighting within the proposed U-turn bays. This is typically a white light and designed in a way that directs light onto the road surface. This would reduce light spill, back scatter and up scatter.

Fauna fencing

As described in section 1.1, a fauna fence is proposed with part of the northern section of the proposal footprint. This would be further designed during the detailed design phase for the proposal.

For installation and maintenance of the fence, a buffer area along these sections of the road would be required. To minimise visual impact through the removal of vegetation, it is proposed that the corridor for the fence would be include within the 4.5 metre or five metre clearzone for the proposal, with the removal of vegetation restricted where possible.

6.8.4 Safeguards and management measures

Table 6-27 lists the landscape character and visual impact safeguards and management measures that would be implemented to account for the impact identified in section 6.8.3.

Table 6-27: Landscape character and visual impact safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Landscape character and visual impact	An Urban Design Plan will be prepared to support the final detailed design and implemented as part of the CEMP. The Urban Design Plan will present an integrated urban design for the proposal, providing practical detail on the application of design principles and objectives identified in the environmental assessment. The Plan will include design treatments for:	Contractor	Detailed design / Pre- construction	Standard safeguard UD1
	 Location and identification of existing vegetation and proposed landscaped areas, including species to be used 			
	 Built elements including retaining walls and noise walls 			
	 Fixtures such as seating, lighting, fencing and signs 			
	• Details of the staging of landscape work taking account of related environmental controls such as erosion and sedimentation controls and drainage			
	 Procedures for monitoring and maintaining landscaped areas 			
	The Urban Design Plan will be prepared in accordance with relevant guidelines, including:			
	• Beyond the Pavement urban design policy,			

Impact	Environmental safeguards	Responsibility	Timing	Reference
	process and principles (Roads and Maritime, 2014)			
	Landscape Guideline (RTA, 2008)			
	 Noise Wall Design Guidelines (RTA, 2006) 			
	• Shotcrete Design Guideline (RTA, 2005).			
Operational light spill impact	The lighting design specification will be developed to minimise light spill and light glare in accordance with the provisions of AS4282-1997 Control of the Obtrusive Effect of Outdoor Lighting (Standards Australia, 1997). This may require the use of directional lighting, cut-offs or filters.	Roads and Maritime	Detailed design	Standard safeguard UD2
Operational visual and amenity impact	Where feasible and reasonable, opportunities to reduce the visual impact of built structures would be implemented through design, and selection of materials and colours.	Roads and Maritime	Detailed design	Standard safeguard UD3
Construction light spill impact	Measures to minimise the use and spill from temporary and construction lighting will be introduced onsite.	Contractor	Construction	Standard safeguard UD4

6.9 Socio-economic and land use

This section details the potential socio-economic and land use impact likely to occur or associated with the proposal.

6.9.1 Methodology

The socio-economic assessment was prepared in accordance with the *Environmental Impact Assessment Practice Note: Socio-economic assessment: EIA-N05* (Roads and Maritime 2013). The proposal occurs on an arterial road and is anticipated to have a minimal localised impact to the communities surrounding Appin Road. As such, a basic level of socioeconomic assessment was applied.

The socio-economic assessment:

- Identified the existing socio-economic characteristics of the study area through desktop research, reviewing secondary-source quantitative data, undertaking limited primary research, in particular referring to:
 - Census data (Australian Bureau of Statistics Census Quick Stats 2016)
 - Publicly available information on local community structure and patterns such as that derived from Campbelltown City Council's website.
- Reviewed the outcome of other assessments containing relevant socio-economic themes, namely:
 - Traffic and access (refer to section 6.4)
 - Noise and vibration (refer to section 6.5)
 - Non-Aboriginal and Aboriginal heritage (refer to section 6.7 and Appendix G)
 - Landscape character and visual impact (refer to section 6.8).
- Considered a range of land use and property information, including:
 - Existing and future land uses in the area
 - Property acquisition or leasing requirements
 - The temporary and permanent public and private property impact
 - · Conflict of consistency with land use zoning provisions in the area
 - Identified the adverse impact that would need safeguarding or management.

Study area

The socio-economic and land use study area considered the demographics, social fabric and economic characteristics within the Appin - Rosemeadow statistical area including the suburb of St Helens Park (north east of Appin Road). The study also considered to a limited extent, the broader Campbelltown City Council LGA, Wollondilly Shire Council LGA and Greater Sydney Region as defined by the Australian Bureau of Statistics Census Data.

Predominately land within the study area is zoned RU2: Rural Landscape, with the exception of some land zone that are classified as DM: Deferred Matter, RE1: Public Recreation and R2: Low Density Residential.

The existing land uses in the study area, which are reflected in the current zoning policies and development controls described in section 4.1, include:

- Low-level rural bushland next to the northern portions of the proposal area
- Low-density residential areas to the south of the proposal area
- Large commercial and rural premises to the south of the proposal area.

6.9.2 Existing environment

As discussed in section 2.1, Appin Road is a key arterial road, connecting motorists travelling between South Western Sydney and the Illawarra. Locally the road services the areas of Appin and Gilead, as well as the greater areas surrounding the proposal.

Population and growth

The population and growth data (Australian Bureau of Statistics 2011 and 2016) for the area is as follows:

- Campbelltown City LGA was about 146,000 in 2011 and 157,000 in 2016, equating to an increase in population of about eight per cent
 - The Rosemeadow St Helens Park statistical area had an approximate population of about 13,800 in 2011 and 14,300 in 2016, equating to an increase in population of about four per cent
- Wollondilly Shire LGA was about 43,000 in 2011 and 48,500 in 2016, equating to an increase in population of about 13 per cent
 - The Appin Cataract Darkes Forest statistical area had an approximate population of about 1,800 in 2011 and 2,500 in 2016, equating to an increase in population of about 38 per cent.

In 2016, the study area's population makeup can be generally defined as being of a higher portion of families with young children and a lower proportion of persons at post retirement age compared to the broader Greater Sydney Region population.

The overall low increase in the population surrounding the proposal is by and large reflective of the proposal area's population density and large areas of remaining agricultural and bushland land. Population growth in the area is forecast to increase, with the release and rezoning of land at Mount Gilead providing additional housing in the area. Combined with new land releases at Menangle Park and Wilton Junction up to 35,000 new homes and new infrastructure (i.e. schools, public transport, road upgrades and green space) are planned for the Greater Macarthur Priority Growth Area (Department of Planning and Environment 2016).

Socio-economic characteristics

As of 2016, about 61 per cent of the residential population surrounding the proposal were in full-time employment with about 26 per cent in part-time employment. Unemployment across the study area was about eight per cent, higher than the Greater Sydney Region of six per cent.

In general, the main occupations of people living in the area include clerical and administrative workers (1,502), technicians and trades (1,390), machinery operators and drivers (1,262), labourers (1,169), community and personal services workers (1,149) and professionals (1,144).

Surrounding areas to the proposal have a median weekly income of about \$630 per week. Compared to the state (\$664) and national (\$662) median incomes, weekly incomes are slightly lower.

Community values

Appin Road is a major arterial route that links to other major roads including the Hume Motorway, Campbelltown Road and Narellan Road. The road traverses through residential and bushland surrounds.

Community values held by local residents and workers include:

• Employment security for local residents and workers

- Maintained local character, amenity and natural setting
- Road access and connectivity to facilities and services.

Land use changes and development

The land located directly next to the study area is zoned as RU2: Rural Landscape except for areas located towards the northern boundary classified as DM: Deferred Matter, RE1: Public Recreation and R2: Low Density Residential.

The proposal is not likely to reduce or alter the visibility of local businesses, tourist attractions or farms.

Property

As noted in section 3.4 about 20,618 square-metres of land would need to be acquired to build the proposal. This would include a mixture of public and private land. Table 3-6 describes the land acquisition required for both land classifications in more detail.

Public infrastructure

Public infrastructure along Appin Road is described in section 2.2 of this REF. Public infrastructure beyond the proposal that may be indirectly influenced include community support facilities (e.g. child care facilities, public recreational areas (e.g. St Helens Park Reserve) and other community facilities (e.g. Rosemeadow Anglican Church).

The proposal is not expected to result in any impact s to public infrastructure located in or within the study area.

6.9.3 Potential impact

The proposal objectives are to upgrade Appin Road, which would improve road safety and efficiency. This would have associated economic benefits locally and regionally, improving travel times and reducing congestion. A reduction in commuting time and additional road safety features would likely reduce the number and severity of crashes, in doing so also reduce a range of associated costs to the community. However, to achieve these benefits there would also be temporary impact to the community throughout the construction period and also when it is operational. These are identified below.

Construction

Socio-economic characteristics

Partial land acquisition is required from eight properties adjoining Appin Road, involving six properties on the western frontage and two properties on the eastern frontage. The total land acquisition area is about 20,672 square-metres.

There may also be the need for minor property adjustments such as adjustments to driveways and entrances as a result of the proposal.

Additionally, there would be some likely temporary socio-economic impact and benefit to the local community from building the proposal such as:

• Community and social impact: community members, including families with young children which dominate the demographic landscape in the area, may experience minor travel delays during their

commute to and from educational and recreational facilities. However, the scale of the changes is unlikely to significantly alter people's travel or commuting habits

- Worker travel impact: motorists and other road users may experience minor travel delays during peark travel times (refer to section 6.4.3). However, the scale of the changes is unlikely to affect people's travel or commuting habits
- Income and employment benefit: there may be some opportunity for localised employment while the proposal is being built as described below.

Construction along Appin Road may reduce public interaction with small local businesses located along Appin Road, that rely on exposure to high volumes of passing traffic (e.g. Belltrees Kennels animal care services (514 Appin Rd, Gilead, 2560). Direct access would be maintained to all properties within the study area.

The identified property acquisition impact to property owners would be managed through mitigation and safeguard measures outlined in Table 6-28. The acquisition process for all required land would be carried out under the appropriate Roads and Maritime policies. As such the economic impact on individual property owners is not expected to be substantial.

The impact associated with the work described in this REF is likely to be relatively minor and temporary in nature. Therefore, the socio-economic impact from the proposal is considered to be negligible.

Community values

Travel delays along Appin Road while the proposal is being built are described above. The local community would be affected by the proposal's amenity impact as a direct result of work activities taking place. However, given the impact would be temporary it is considered that the proposal would have no material impact on the area's community values.

Land use changes and development

Land use next to Appin Road is likely to be affected during construction activities required for the proposal including excavation, installation and positioning/movement of heavy equipment. As a result, the land use impact to be expected in the study area may include:

- Temporary loss of land use through creation of temporary construction workstation compounds.
- Permanent property acquisition.

Operation

Socio-economic characteristics

Once built the proposal would provide:

- A safer roadway that would potentially reduce the number and severity of road crashes along Appin Road
- Potential minor improvements in travel times to and from the area.

Social infrastructure

The proposal would have no direct impact on social infrastructure in the local area during operation.

Safety barriers on a painted median near the southbound overtaking lane would prevent right turn in/turn out access to about nine properties adjoining Appin Road. U-turn facilities would be constructed on both sides of Appin Road to compensate for loss of right turn movements. This arrangement is not proposed for the northbound overtaking lane since right turn access to only one property (588 Appin Road) would be affected and there is scope to reposition the driveway entrance to accommodate resident access needs.

The proposal is unlikely to have a direct, quantifiable impact on the economy.

Community values

The local landscape character would be changed through clearing of road side vegetation to achieve better clear zones with the installation of safety barriers where appropriate. These road improvements would be executed according to urban design standards aimed at maintaining local character, amenity and natural setting.

Land use changes and development

The proposal would potentially result in a safer and more efficient road between Campbelltown and the Illawarra region.

6.9.4 Safeguards and management measures

Table 6-28 lists the socio-economic safeguards and management measures that would be implemented to account for the impact identified in section 6.9.3.

Impact	Environmental safeguards	Responsibility	Timing	Reference
Socio-economic	 A Communication Plan 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): 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 CSEP will be prepared using Road and Maritimes' 	Roads Contactor	Detailed design / Pre- construction	Standard safeguard SE1

Table 6-28: Socio-economic safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
	Stakeholder engagement toolkit			
Property acquisition	All property acquisition will be carried out in accordance with the Land Acquisition Information Guide (Roads and Maritime, 2012) and the Land Acquisition (Just Terms Compensation) Act 1991.	Roads and Maritime	Preconstruction and construction	Standard safeguard SE2
Impact on business and the community during construction	Road users, including freight companies will be informed of changed conditions, including likely disruptions to access during construction.	Contractor	Construction	Standard safeguard SE3
Community impact during construction across the study area	Consultation will be undertaken with potentially affected residences prior to the commencement of and during work in accordance with the Roads and Maritime's Community Involvement and Communications Resource Manual. Consultation will include but not limited to door knocks, newsletters or letter box drops providing information on the proposed work, working hours and a contact name and number for more information or to register complaints.	Roads and Maritime/ Contractor	Preconstruction and construction	Standard safeguard SE4
Emergency Access	Access for emergency vehicles will be maintained at all times during construction. Any site- specific requirements will be determined in consultation with the relevant emergency services agency.	Contractor	Construction	Standard safeguard SE5
Impact to properties	Consultation will be carried out with all affected property owners during detailed design and construction to develop and implement measures to mitigate the impact on land use viability, infrastructure and severance.	Roads and Maritime	Detailed Design	Standard safeguard SE6

Impact	Environmental safeguards	Responsibility	Timing	Reference
Temporary utility service interruption	Residents and businesses will be notified before any utility interruption.	Contractor	Preconstruction	Standard safeguard SE7
Utility relocation and adjustment	 A utility management plan will be prepared to include: Utility company consultation Maintenance and emergency access requirements Construction staging and programming conflicts. 	Roads and Maritime / Contractor	Pre- construction / Construction	Standard safeguard SE8

6.10 Waste management and resource use

6.10.1 Methodology

The assessment considered the impact associated with:

- Resource use and materials management during construction
- Waste generation, management and disposal during construction
- The operational waste and resource management strategy
- The proposals ability to respond to waste management and resource conservation plans, policies and guidelines.

The basis of the assessment was to consider the hierarchy of waste avoidance and primary resource use in favour of reduction, reuse and recycling, consistent with the NSW *Waste Avoidance and Resource Recovery Act 2001*.

6.10.2 Existing environment

Along the length of Appin Road dumped construction materials, domestic waste and general litter were observed during a site visit. The concentration of these materials was greatest in the southern portion of the site, in the less populated areas and close to the fence line hidden from general line of sight. Most rubbish identified was observed to be general litter or general construction and household materials such as bricks, concrete, wood and insulation materials. The quantity and isolation of rubbish was not considered evidence of uncontrolled dumping and is unlikely to present any environmental concerns or risks to human health.

6.10.3 Potential impact

Construction

The activities as part of the proposal would require the use of a number of resources, including:

- Material required for road surfaces such as asphalt, concrete, aggregate and other fill materials
- Material required for construction of ancillary infrastructure (i.e. safety barriers)
- Construction water and other operational construction resources.

Whilst the construction of the proposal would result in some increased demand on local and regional resources, the development of the proposal alone would not result in any resource becoming scarce or in short supply within the local or greater regional area. Resource requirements, particularly for water and general construction materials, would be determined during detailed design. Most of the waste generated would either be recycled or disposed offsite as general solid waste (depending on its type). Suspected contaminated waste, harmful materials or classifiable special wastes would be managed in accordance with the *Contaminated Land Management Act 1997* and other relevant legislation.

Where waste materials generated by the proposal cannot be reused on site, disposal would be required. Disposal of wastes would be undertaken in accordance with the DECC's (2014) *Waste Classification Guidelines: Parts 1 and 2* and to a suitably licensed waste facility.

Generated waste has the potential to affect the local environment if it is not managed appropriately. The potential impact includes:

- Runoff resulting from:
 - Accidental spillages
 - Stockpile mismanagement
 - Waste transfer
 - Poor waste storage
- Ground contamination resulting from:
 - Untreated excavated contaminated material leaching into the surrounding environment
 - Accidental spillages
 - Incorrect disposal of waste materials
 - Amenity impact through littering
 - Potential waste misclassification
 - Excessive waste being diverted to landfill.

Any associated impact would be managed and minimised by implementing the safeguard measures (refer to Table 6-29).

Operation

Materials required to maintain and repair the operational road would be minimal and consistent with any operational major road in the State. The volumes of waste generated from maintaining and repairing the operational road is expected to be minimal, however opportunities would be taken, when possible, to use:

- More durable materials to limit maintenance and frequency of replacement
- Existing materials onsite such as signposts
- Recycled and low energy intensive materials
- Low pollution and low environmentally degradative materials where they are performance and cost effective.

Similarly, the above approach for waste management and minimisation would be used in the construction stage to ensure that the impact is minimised and wastes are classified, treated and disposed of effectively and sustainably.

6.10.4 Safeguards and management measures

Table 6-29 lists the waste management and resource use safeguards and management measures that would be implemented to account for the impact identified in section 6.10.3.

Impact	Environmental safeguards	Responsibility	Timing	Reference
General Waste Management	 A Waste Management Plan (WMP) will be prepared and implemented as part of the CEMP. The WMP will include but not be limited to: Measures to avoid and minimise waste associated with the proposal Classification of wastes and management options (re-use, recycle, stockpile, disposal) Statutory approvals required for managing both on and off-site waste, or application of any relevant resource recovery exemptions Procedures for storage, transport and disposal Monitoring, record keeping and reporting 	Contactor	Detailed design / preconstruction	Standard safeguard WM1

Impact	Environmental safeguards	Responsibility	Timing	Reference
	taking into account the Environmental Procedure - Management of Wastes on Roads and Maritime Services Land (Roads and Maritime, 2014) and relevant Roads and Maritime Waste Fact Sheets.			
General waste impact	Waste accumulation, littering and general tidiness will be monitored during routine site inspections	Contactor	Construction	Standard safeguard WM2
Resource minimisation	Recycled, durable, and low embodied energy products will be used to reduce primary resource demand in instances where the materials are cost and performance competitive and comparable in environmental performance (e.g. where quality control specifications allow).	Contractor	Construction	Standard safeguard WM3

6.11 Other impact

6.11.1 Existing environment and potential impact

Table 6-30: Other impact - existing environment and potential impacts

Impact	Existing environmental	Potential impact
Air Quality	Existing ambient air quality of the study area based on Campbelltown regional data indicates relatively consistent and 'good-to-very-good" air quality (Office of Environment and Heritage, NSW Air Quality Index, 2018). Likely contributions to poorer air quality in the region are road traffic emissions and natural effects such as bushfires throughout summer.	 The air quality impact associated with the building of the proposal includes: Dust generation due to the disturbance, movement, storage, loading, transfer and transportation of spoil and when excavations and exposed surfaces are left open. Uncontrolled dust emissions may result in a nuisance impact to nearby sensitive receivers. This may in turn cause community complaints. Dust generation can be effectively managed and a safeguard is recommended in section 6.11.2, as a result of the potential air quality impact from the proposal is considered to be temporary and minor in nature Traffic and equipment emissions during construction would result in a temporary and short-term reduction of local air

Impact	Existing environmental	Potential impact
		 quality. However, the potential impact is considered negligible and unlikely to result in an adverse impact to human health Odour may be generated from mixing and applying asphalt and line marking. The potential odour impact may affect nearby sensitive receivers in the immediate vicinity to the road work. The short-term and temporary impact would not likely be significant. The air quality impact associated with the operation of the proposal is not considered to be negligible.
Greenhouse gas and climate change	Transport emissions are currently the second largest component of NSW greenhouse gas emissions. The major source of transport emissions is road transport which accounts for 86 per cent of all NSW transport emissions (Australian Greenhouse Emissions Information System, 2014). Road transport includes private passenger vehicles (cars and motorcycles), light commercial vehicles, rigid trucks, articulated trucks and buses. This reflects the importance of motor vehicles for both passenger and freight transport within the state.	Given the scale of this proposal, the minor contribution to greenhouse gas emissions are not considered to be significant. Further consideration of the climate change impact would be carried out during detailed design.
Hazard and Risk	Hazardous materials and dangerous goods storage or handling of such materials does not currently occur within the study area. Identified road side waste present within the study area is addressed in section 6.2. Fuel and oil spills may occur as a result from vehicle passing through the study area.	Small quantities and inventories of hazardous materials and dangerous goods would be required during construction. As a result, the transportation, use and storage of these materials would occur. A potential impact to soil and water quality and workforce safety may result from spills or inappropriate and inadequate handling and storage of material. The potential impact is not considered to be significant given the implantation of relevant legislation to manage such risks. Relevant legislation includes the National Codes of Practice and Australian Standards for the storage and handling of dangerous goods and materials. Such guidelines in conjunction with the recommended safeguards described in section 6.11.2 would potentially reduce the occurrence of an incident on the site.
Hazard and Risk	Bushland: The proposal is adjacent to bushland, therefore the area may be prone to	Bushfires whether they are preventative burning, wildfire or unintentionally ignited, would result in the loss of vegetation, fauna and habitats. Bushfires can result in property damage; and pose a risk to the safety and health of the workforce, road

Impact	Existing environmental	Potential impact
	bushfires.	users and local residences due to heat, smoke and ash generation. With the implementation of recommended safeguards in place as outlined in section 6.11.2, the potential impact from a fire is not likely to be significant.

6.11.2 Safeguards and management measures

Table 6-31 lists the safeguards and management measures for the minor environmental impact that would be implemented to account for the impact identified in Table 6-30.

Table 6-31 Other impact - safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Air quality	 The CEMP will incorporate an Air Quality Management Plan (AQMP) for the proposal. The AQMP will include, but not be limited to: A procedure for monitoring dust onsite and weather conditions An identification procedure for potential sources of air pollution and mitigation measures for likely scenarios such as imposing speed limits throughout the proposal footprint and site compounds Maintaining air quality management objectives consistent with any relevant published EPA and/or OEH guidelines Compliance with Stockpile Site Management Guidelines (Roads and Maritime 2015b) Methods to manage work during strong winds or other adverse weather conditions such as reducing active earthwork on hot windy days Implement a vehicle, plant and machinery maintenance program to comply with manufacturers specifications and ensure compliance with the NSW Protection of Environment Operations Act 1997 A progressive rehabilitation strategy for 	Contractor	Pre- construction	AQ1
	exposed surfaces.			
Greenhouse gas and climate change	Detailed design will consider opportunities to reduce building and construction material quantities and use appropriate materials	Contractor	Detailed design / pre- construction	GHG1

Appin Road Safety Improvements, Brian Rd, Appin to Gilead Review of Environmental Factors

Impact	Environmental safeguards	Responsibility	Timing	Reference
	wherever reasonable and feasible. Pavement design will ensure resilience against extreme temperature and intense and more frequent rainfall events.			
Hazard and Risk	 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: 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. The HRMP will be prepared in accordance with relevant guidelines and standards, including relevant Safe Work Australia Codes of Practice, and EPA or Office of Environment and Heritage publications. 	Contractor	Detailed design / pre- construction	HAZ1
Hazard and Risk	Where possible, hazardous materials and dangerous goods, avoided or substituted for less hazardous alternatives throughout the construction process. Where this is not possible, in the case for necessary fuels, oils and fluids required for activities in the proposal for example, the appropriate management and handling procedures will be implemented as part of the CEMP. This will include a Hazard and Risk Management Plan (HRMP) and Waste Management Plan (WMP) which will include, but not be limited to measures to avoid the generation of hazardous wastes, and the appropriate procedures for their storage, transport and disposal. The WMP will be	Contractor	Pre- construction	HAZ2

Impact	Environmental safeguards	Responsibility	Timing	Reference
	prepared taking into account the Environmental Procedure - Management of Wastes on Roads and Maritime Services Land (Roads and Maritime 2014f), and other relevant Roads and Maritime hazardous materials and dangerous goods handling procedures to reduce environmental and worker risk such as Managing the risks of working with bitumen and bituminous products (Roads and Maritime 2013). The appropriate management and removal of existing hazardous materials and dangerous goods identified adjacent to the proposed work in the form of asbestos containing materials (ACM) and synthetic fibre materials (SFM) is addressed in Section 6.2.4			

6.12 Cumulative impact

This section describes the assessed cumulative impact that may occur as the combined result of other committed and approved planning proposals located near to this proposal.

6.12.1 Study area

The study area has been determined through consideration of cumulative impact in the context of the potential sources of impact outlined in section 6 of this assessment and the extent of residual impact of other activities within the nearby locality. A search of the following databases was completed to identify any proposal and/or project which may result in a cumulative impact with the proposal:

- Department of Planning and Environment Major Project Register and priority growth areas website
- Sydney Central Joint Regional Planning Panel
- Campbelltown City Council Development Application Register
- Wollondilly Shire Council Development Application Register.

Potential overlaps in the construction and operational schedule between this proposal, and those nearby has also been considered wherever possible. The proposed work would likely commence around 2019/2020 and be completed over a 12-18 month period. This assessment has only considered projects that were considered to be of sufficient scale to create foreseeable potential cumulative impact to the local receiving environment that are common to this proposal. Planning proposals that are considered to be either minor in nature (e.g. internal or minor external alterations or single dwelling developments) or outside of the locality common to this proposal and therefore would not expected to contribute to any cumulative impact.

6.12.2 Regional program of work

A search of the Major Projects Assessment register identified no existing or proposed major project work within the broader Campbelltown and Illawarra regions that would likely align with the construction of the proposal.

6.12.3 Other local planning proposals and developments

Known planning proposals that are currently being considered for approval or have been approved and potentially built within the timeframe of this proposal are detailed in Table 6-32. Minor planning proposals and all other proposals located beyond two kilometres from the study area have been excluded from this REF as discussed in section 6.12.1.

Table 6-32: Past, present and future projects

Proposal/Project (Development Applications)	Location	Status	Details
Mount Gilead (PP_2012_CAMPB_002_00)	Mount Gilead	• Approved	 Rezoning of a 210-hectare site at Mount Gilead for urban development purposes The development proposes to provide 1,500 residential allotments with and average size of 700 square metre This proposal is to facilitate the requirements outlined in the rezoning and development approval for Mount Gilead
Residential Apartment Development (389/2017/DA/RA	74 Fern Avenue, Bradbury	Council review	 2.24 ha Subdivision Property boundary with Appin Road Proposed to develop 134 residences including alterations to and the use of "Raith House", a heritage listed residence sold as part of the redevelopment Currently under DA review from Campbelltown City Council Zoned 2(b) – Residential B Zone
Airds Bradbury Renewal Project. Stage 4 Subdivision (497/2017/DA-SW) Airds, Bradbury Stage 6 Subdivision (2138/2017/DA-SW)	Briar Rd, Waterhouse Pl, Kingston Pl, Merino Cres and Dorchester Park, Airds, Bradbury	Council review	 Stage one and two completed in 2015 and 2016 Stage 4 subdivision proposing subdivision into one hundred and eighty allotments, subdivision work and future development lots

Appin Road Safety Improvements, Brian Rd, Appin to Gilead Review of Environmental Factors

Proposal/Project (Development Applications)	Location	Status	Details
			• Stage 6 subdivision into one hundred and forty-four residential allotments and associated civil work for the Airds Bradbury Renewal Project
Appin Road Upgrade, Mount Gilead to Ambarvale	Mount Gilead to Ambarvale	Roads and Maritime Services review	• Proposed staged upgrade of a 5.4-kilometre section of Appin between Mount Gilead in the south, and the intersection of St Johns Road, Ambarvale in the north
Spring Farm Parkway Stage 1	Menangle Park	Roads and Maritime Services review	• Proposed east-west arterial link road that would ultimately service several future residential land releases within the Greater Macarthur Priority Growth Area

Greater Macarthur Growth Area

The Greater Macarthur Priority Growth Area developed by the Department of Planning and Environment comprises seven planned precincts between Glenfield to Macarthur. The Campbelltown-Macarthur region outlines key actions to support ongoing development in the region including new housing, local employment opportunities, infrastructure and the protection of the environment and heritage of the region.

The new land release development currently identified in the area including at Mount Gilead would likely continue to be development over the next 20 to 30 years. The proposed upgrade to Appin Road would assist in improving the current safety of Appin Road.

6.12.4 Potential impact

It is expected that over the construction period for the proposal that:

- The Mount Gilead subdivision and development may commence work in line with the timeframe of this proposal
- The residential apartment development at 74 Fern Avenue, Bradbury which is located to the north of
 proposal would likely be approved and may commence site preparation work and/or construction in line
 with the timeframe of this proposal
- Stage 4 and Stage 6 of the Airds Bradbury Renewal Project would likely be approved and may commence site preparation and construction in line with the timeframe of this proposal
- Stage 2 and 3 of the proposed staged upgrade of Appin is located directly next to this proposal and may commence work in line with the timeframe of this proposal.

Table 6-33: Potential cumulative impacts during the building of the proposal

Impact	Cumulative impact
Cumulative traffic impact	
 Proposal contribution: A maximum of 50 light vehicle movements and 50 heavy vehicle movements daily during peak construction Other development contributions: It is expected that light and heavy vehicle movements would form part of planning proposals in the area. 	Vehicle movements from this proposal is considered to have a minimal impact on delays and overall performance (refer to section 6.4). Vehicle movements during construction of this proposal and other known and/or proposed work in the vicinity of the study area are likely to travel along major roads within the area, including Appin Road. The road network in the area including Appin Road carriesabout 750 per hour vehicles in peak periods. Cumulative traffic disruptions across the local road network are not expected to result in major delays during the building of the proposal. Vehicle movements would be managed in accordance with the requirements of the TMC and may include staged access to the site across the day to ensure minimal disruptions to overall flow of traffic in the area.
Cumulative socio-economic imp	act
 Proposal contribution: Removal of vegetation Earthwork Increased construction 	The potential cumulative amenity impact may affect local road users travelling through this proposal during construction. Other roadside work along Appin Road and the Mount Gilead development may potentially exacerbate the visual impact to the area.
 Local amenity impacts Other development contributions: 	
Removal of vegetationEarthworkIncreased construction	
trafficAmenity impacts	

Operational

Once operational, this proposal would provide the required road safety upgrades to all road users in connection with the proposed upgrade of Appin Road between Mount Gilead to Ambarvale. The final detail of the internal layout and configuration of the future Mount Gilead subdivision is not yet finalised, therefore any operation impact as a result of the subdivision at Mount Gilead is currently unknown.

Future major development work would continue to be built in the area over the next 20 to 30 years. It would be the responsibility of the proponent to other planning proposals to assess any potential cumulative impact with this proposal if they were to become operational before this proposal. Otherwise, if this proposal is fully operational at the time of preparing future development applications, the road would be assessed as part of the existing environment.

6.12.5 Safeguards and management measures

Direct safeguards and the management of the cumulative impact can be difficult to manage given the nature and duration of work carried out across multiple work sites can vary greatly during construction. However, there would be an opportunity for Roads and Maritime to work with other developments and consider the cumulative impact to the local environment. Table 6-33 lists the safeguards and management measures that would be implemented to account for the potential cumulative impact identified above.

Impact	Environmental safeguards	Responsibility	Timing	Reference
Cumulative impacts	 Other major developments within the area will be consulted with prior to the commencement of work. This may include: Obtaining construction work information including the duration of proposed work activities and the likely impact Identifying and implementing safeguards and management measures (e.g. dust and traffic management controls) to minimise the cumulative impact Managing the interfaces of the proposal's staging and programming in combination with other planning proposal occurring in the area. 	Roads and Maritime	Pre- construction/ construction	CI1
Cumulative impact	All environmental management plans will be prepared to consider other developments that are in progress in the area.	Contractor	Pre- construction	Cl2

Table 6-34: Cumulative impact safeguards and management measures

7. Environmental management

This chapter describes how the proposal will be managed to reduce potential environmental impact throughout detailed design, construction and operation. A framework for managing the potential impact is provided. A summary of site-specific environmental safeguards is provided and the licence and/or approval requirements required prior to construction are also listed.

7.1 Environmental management plans

A number of safeguards and management measures have been identified in the REF in order to mitigate the potential environmental impact, including social impact, which could potentially arise as a result of the proposal. Should the proposal proceed, safeguards and management measures identified in this REF would be incorporated into the detailed design and applied during the construction and operation (as required) of the proposal.

A Construction Environmental Management Plan (CEMP) and any required sub-plans to the CEMP will be prepared to describe the safeguards and management measures. The CEMP will provide a framework for establishing how these safeguards and mitigation measures will be implemented including who will be responsible for their implementation.

The CEMP will be prepared prior to construction of the proposal and must be reviewed and certified by Roads and Maritime, prior to the commencement of any on-site work. The CEMP would be a working document, subject to ongoing change and updated as required to respond to specific on-site requirements. The CEMP will be developed in accordance with the specifications set out in *Specification G36 - Environmental Protection (Management System)*, QA Specification G38 – Soil and Water Management (Soil and Water Plan), QA Specification G40 – Clearing and Grubbing, QA Specification G10 - Traffic Management].

7.2 Summary of safeguards and management measures

Environmental safeguards and management measures outlined in this REF will be incorporated into the detailed design phase of the proposal, the proposals construction environmental management plan and operational phases if the proposal proceeds and should it be approved. These safeguards and management measures will minimise any potential adverse impact arising from the proposed work on the local and surrounding environment. The safeguards and management measures are summarised in Table 7-1

Table 7-1: Summary of safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Biodiversity	 A Flora and Fauna Management Plan will be prepared in accordance with Roads and Maritime's <i>Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects</i> (RTA 2011b) and implemented as part of the CEMP. It will include, but not be limited to: 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 Guideline</i> (RTA, 2008) Pre-clearing survey requirements Procedures for unexpected threatened species finds and fauna handling Protocols to manage weeds and pathogens. 	Contractor	Detailed design / Pre-construction	Standard safeguard B1 Section 4.8 of QA G36 Environment Protection
Biodiversity	Measures to further avoid and minimise the construction footprint and native vegetation or habitat removal will be investigated during detailed design and implemented where practicable and feasible.	Contractor	Detailed design / Pre-construction	Standard safeguard B2
General biodiversity mitigation	Ensure any fauna encountered onsite would be managed in accordance with <i>Biodiversity Guidelines, Guide 9</i> (fauna handling) (Roads and Maritime, 2016)	Contractor	Pre-construction	Standard safeguard B3
General biodiversity mitigation	The pre-clearing survey as part of the Flora and Fauna Management Plan shall:Confirm clearing boundaries, exclusion zones, protected habitat	Contractor	Pre-construction	Standard safeguard B4

Impact	Environmental safeguards	Responsibility	Timing	Reference
	 features and revegetation areas prior to starting work Identify, in toolbox talks, where biodiversity controls are located on the site. 			
Invasive and noxious weed management	 A Weed Management Plan will be prepared in accordance with Biodiversity Guidelines, Guide 6 (Roads and Maritime, 2016) and include: The Identification of weeds on site (confirmed during pre- clearing survey) Weed management priorities and objectives Exclusion zones, protected habitat features and revegetation areas prior to starting work within or directly next to the site The location of weed infested areas Weed control methods Measures to prevent the spread of weeds, including machinery hygiene procedures and disposal requirements A monitoring program to measure the success of weed management Communication with local Council noxious weed representative. 	Contractor	Pre-construction	Standard safeguard B5
Pathogen management	Ensure the Flora and Fauna Management Plan includes management measures to control and/or prevent the introduction and/or spread of disease causing agents such as bacteria and fungi in accordance with the <i>Biodiversity Guidelines, Guide 7</i> (Roads and Maritime, 2016).	Contractor	Pre-construction	Standard safeguard B6

Impact	Environmental safeguards	Responsibility	Timing	Reference
Unexpected find	If unexpected flora or fauna are discovered on site stop work immediately and implement the Roads and Maritime Unexpected Threatened Species Find Procedure in the Biodiversity Guidelines, Guide 1 (Roads and Maritime, 2016b).	Contractor	Construction	Standard safeguard B7
Fauna Injury and mortality management	 In the invent of a fauna injury or mortality during building the proposal, implement the following controls: Manage fauna in accordance with Biodiversity Guidelines, <i>Guide 9</i> (Roads and Maritime, 2016b) Remove any habitat in accordance with <i>Biodiversity Guidelines, Guide 4</i> (Roads and Maritime, 2016b). 	Contractor	Construction	Standard safeguard B8
Native vegetation removal Threatened species habitat and habitat features	 Native vegetation removal will be minimised through detailed design Implement the following controls under the Flora and Fauna Management Plan: Pre-clearing survey requirements in accordance with <i>Biodiversity Guidelines, Guide 1</i> (Roads and Maritime, 2016b) Confirm clearing boundaries, exclusion zones, in accordance with <i>Biodiversity Guidelines, Guide 2</i> (Roads and Maritime, 2016b) Vegetation removal would be carried out in accordance with <i>Biodiviersity Guidelines, Guide 4: Clearing of vegetation and removal of bushrock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011b)</i> Reinstate native vegetation in accordance with <i>Biodiversity Guidelines, Guide 3</i> (Roads and Maritime, 2016b) 	Roads and Maritime Services; Contractor	Detailed design / Pre-construction / Post construction	Standard safeguard B9

Impact	Environmental safeguards	Responsibility	Timing	Reference
	• Reinstate habitat in accordance with <i>Biodiversity Guidelines, Guide 5 and Guide 8</i> (Roads and Maritime, 2016b).			
Koala habitat management	A fauna fencing strategy will be implemented along Appin Road in accordance with detailed design and construction drawings. A detailed fauna fencing will be prepared and included in the CEMP for the work.	Roads and Maritime Services; Contractor	Detailed design / Pre-construction	Standard safeguard B10
Groundwater dependent ecosystems	Interruptions to water flows associated with groundwater dependent ecosystems would be minimised through detailed design.	Roads and Maritime Services; Contractor	Detailed design / Pre-construction	Standard safeguard B11
Soils	A Soil and Water Management Plan (SWMP) will be prepared and implemented as part of the CEMP. The SWMP will identify all reasonably foreseeable risks relating to soil erosion and water pollution and describe how these risks will be addressed during construction.	Contractor	Detailed design / Pre-construction	Standard safeguard C1
Soils	A site specific Erosion and Sediment Control Plan/s will be prepared and implemented as part of the Soil and Water Management Plan. 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.	Contractor	Detailed design / Pre-construction	Standard safeguard C2
Contaminated land	 A Contaminated Land Management Plan will be prepared in accordance with the <i>Guideline for the Management of Contamination</i> (Roads and Maritime 2013) and implemented as part of the CEMP. The plan will include, but not be limited to: Capture and management of any surface runoff contaminated 	Contractor	Detailed design / Pre-construction	Standard safeguard C3 Section 4.2 of QA G36 Environment Protection

Impact	Environmental safeguards	Responsibility	Timing	Reference
	 by exposure to the contaminated land Measures to ensure the safety of site personnel and local communities during construction 			
Contaminated land	If contaminated areas are encountered during construction, appropriate control measures will be implemented to manage the immediate risks of contamination. All other work that may impact on the contaminated area will cease until the nature and extent of the contamination has been confirmed and any necessary site-specific controls or further actions identified in consultation with the Roads and Maritime Environment Manager and/or EPA are carried out	Contractor	Detailed design / Pre-construction	Standard safeguard C4 Section 4.2 of QA G36 Environment Protection
Contaminated land	Areas identified as containing surface lying waste will be remediated prior to construction. All waste are to be disposed of to a suitably licenced landfill facility.	Contractor	Pre-construction	Standard safeguard C5 Section 4.2 of QA G36 Environment Protection
Accidental spills and leaks	A site-specific emergency spill plan will be developed, and include spill management measures in accordance with the <i>Roads and</i> <i>Maritime 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, and notification of emergency services and relevant authorities (including Roads and Maritime and EPA officers).	Contractor	Pre-construction	Standard safeguard C6
Hydrology and flooding	The layout and detail of the drainage system including water quality treatments, discharge points, swale design and scour protection will be refined during detailed design in consultation with the Roads and Maritime Environment Branch.	Roads and Maritime	Detail design	Standard safeguard H1

Impact	Environmental safeguards	Responsibility	Timing	Reference
Hydrology and flooding	Drainage line crossing points will be designed in accordance with Guidelines for Controlled Activities: Watercourse Crossings (NSW DEC, 2008).	Roads and Maritime	Details design	Standard safeguard H2
Incident Reporting	In case of an incident, the <i>Environmental Incident Classification and Reporting Procedure</i> (Roads and Maritime Services 2016) will be followed. The RMS Contract Manager and Environment Manager will be contacted immediately.	Contractor	Construction	Standard safeguard H4
Accidental spill	An emergency spill kit will be available on-site. All personnel will be trained in its use and aware of its location.	Contractor	Pre-construction	Standard safeguard H5
Stormwater Discharge	Dirty water will not be released into drainage infrastructure and/or waterways.	Construction	Stormwater Discharge	Standard safeguard H6
Stormwater Discharge and Pollutant Loads	Water quality controls will be implemented to prevent materials, including concrete and sediment, to enter drainage infrastructure or waterways.	Contractor	Detailed design / pre-construction	Standard safeguard H7
Hydrology and flooding	The layout and detail of the drainage system including water quality treatments, discharge points, swale design and scour protection will be refined during detailed design in consultation with the Roads and Maritime Environment Branch.	Roads and Maritime	Detail design	Standard safeguard H1
Traffic and transport	 A Traffic Management Plan (TMP) will be prepared and implemented as part of the CEMP. The TMP will be prepared in accordance with the Roads and Maritime Traffic Control at Work Sites Manual (Roads and Maritime 2018) and QA Specification G10 Control of Traffic (Roads and Maritime, 2015d). The TMP will include: Confirmation of haulage routes 	Contractor	Detailed design / Pre-construction	Standard safeguard TT1 Section 4.8 of QA G36 Environment Protection
Impact	Environmental safeguards	Responsibility	Timing	Reference
-------------------------------	--	----------------	--------------	---------------------------
	Measures to maintain access to local roads and properties			
	 Site specific traffic control measures (including signage) to manage and regulate traffic movement 			
	Measures to maintain pedestrian and cyclist access			
	Requirements and methods to consult and inform the local community of impacts on the local road network			
	 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.			
Property access	Property access will be maintained where feasible and reasonable and property owners will be consulted before starting any work that may temporarily restrict or control access. (Side) road and lane closures will be minimised where feasible and reasonable.	Contractor	Construction	Standard safeguard TT2
Management at ancillary sites	 The following traffic management provisions will be provided at each ancillary facility: Appropriate 'sight distances' to allow traffic to safely enter and exit 	Contractor	Construction	Standard safeguard TT3
	Temporary painted road lines to provide delineation			

Impact	Environmental safeguards	Responsibility	Timing	Reference
	 Suitable intersection arrangements where required Other controls to separate, slow down, or temporarily stop traffic to allow for safe entry and exit 			
Noise and vibration	 A Noise and Vibration Management Plan (NVMP) will be prepared and implemented as part of the CEMP. The NVMP will generally follow the approach in the Interim Construction Noise Guideline (ICNG) (DECC, 2009) and identify: All potential significant noise and vibration generating activities associated with the activity Feasible and reasonable mitigation measures to be implemented, taking into account <i>Beyond the Pavement: urban</i> <i>design policy, process and principles</i> (Roads and Maritime 2014) A monitoring program to assess performance against relevant noise and vibration criteria Arrangements for consultation with affected neighbours and sensitive receivers, including notification and complaint handling procedures Contingency measures to be implemented in the event of noncompliance with noise and vibration criteria. 	Contractor	Detailed design / preconstruction	Standard safeguard NV1 Section 4.6 of QA G36 Environment Protection
Construction noise and vibration	All sensitive receivers (e.g. local residents) likely to be affected will be notified at least seven days prior to commencement of any work associated with the activity that may have an adverse noise or vibration impact. The notification will provide details of:	Contractor	Construction	Standard safeguard NV2

Impact	Environmental safeguards	Responsibility	Timing	Reference
	The proposal			
	The construction period and construction hours			
	Contact information for project management staff			
	Complaint and incident reporting			
	How to obtain further information.			
Construction noise	Work will be undertaken in accordance with the <i>Construction Noise</i> and <i>Vibration Guideline</i> (Roads and Maritime 2016)	Contractor	Construction	Standard safeguard NV3
	Stationary and directional noise sources will be orientated away from sensitive receivers			
	Vehicles, obstacles and stockpiles will be utilised on site to provide shielding to receivers, especially for static noise sources			
	Equipment that has noise levels equal to or less than the sound power levels provided in Appendix F will be used			
	The simultaneous use of high noise generating equipment will be limited during construction			
	The use will also be limited to standard hours where possible			
	Plant will be switched off when not in use			
	Plant, tools and equipment will be used such that noise is reduced to the minimum required.			
Construction traffic noise	The NVMP would include provisions to reduce the potential impact of construction traffic noise including:	Contractor	Construction	Standard safeguard NV4

Impact	Environmental safeguards	Responsibility	Timing	Reference
	• Restricting travel routes to and from the site to using the main roads (e.g. arterial roads) and to avoid local roads and roads where residential receivers are potentially impacted			
	Prohibiting the use of engine / compression brakes in or near residential areas			
	Promoting driving behaviour that reduces the potential noise impact			
	 Prohibiting idling of plant and equipment engines near residential receivers when not in use 			
	• Strategic positioning of site accesses to minimise the chance of trucks passing by residential receivers, especially at night.			
Construction vibration	Lower powered equipment will be used when working in close proximity to vibration sensitive receivers where possible Building condition /dilapidation surveys will be completed both before and after the work and attended vibration monitoring undertaken when work is proposed within the specified safe working distances Where work is required within the nominated safe working distance, additional vibration mitigation measures detailed in Appendix F will be considered.	Contractor	Construction	Standard safeguard NV5
Noise and vibration complaints	Attended noise and/or vibration monitoring will be undertaken following a complaint. Report the monitoring results as soon as possible. In the case that exceedances of the management levels are recorded, review the situation and identify means to reduce the impacts to noise and vibration sensitive receivers. This is to include	Contractor	Construction	Standard safeguard NV6

Impact	Environmental safeguards	Responsibility	Timing	Reference
	revision to the CNVMP where required.			
Operational noise mitigation	 Mitigation measures to minimise operational noise will be investigated, including: Quieter pavement surfaces and suitability of such pavement types for through lanes and areas of acceleration, deceleration and turning movements Property treatments for residually affected receivers where feasible and reasonable 	Roads and Maritime	Detailed design	Standard safeguard NV7
Property treatments	Where at property treatments are identified, consider implementing these at the commencement of construction. These treatments would alleviate any noise concerns/complaints during the construction period.	Contractor	Construction	Standard safeguard NV8
Aboriginal heritage finds	The Standard Management Procedure - <i>Unexpected Heritage Items</i> (Roads and Maritime 2015c) will be followed in the event that an unknown or potential Aboriginal object/s, including skeletal remains, is found during construction. This applies where Roads and Maritime 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 re-commence once the requirements of that Procedure have been satisfied.	Contractor	Detailed design / preconstruction	Standard safeguard AH1 Section 4.9 of QA G36 Environment Protection
Non-Aboriginal heritage finds	The Standard Management Procedure - Unexpected Heritage Items (Roads and Maritime 2015c) will be followed in the event that any unexpected heritage items, archaeological remains or potential relics of Non-Aboriginal origin are encountered. Work will only re-commence once the requirements of that Procedure have been satisfied.	Contractor	Detail design/ Pre- construction	Standard safeguard H1 Section 4.10 of QA G36 Environment Protection

Impact	Environmental safeguards	Responsibility	Timing	Reference
Non-Aboriginal heritage	Archival recording of listed heritage items prior to modification of any aspect of the road shall be undertaken for the proposal	Roads and Maritime	Detail design/ Pre- construction	Standard safeguard H2
Landscape character and visual impact	An Urban Design Plan will be prepared to support the final detailed design and implemented as part of the CEMP. The Urban Design Plan will present an integrated urban design for the proposal, providing practical detail on the application of design principles and objectives identified in the environmental assessment. The Plan will include design treatments for:	Contractor	Detailed design / Pre-construction	Standard safeguard UD1
	 Location and identification of existing vegetation and proposed landscaped areas, including species to be used 			
	Built elements including retaining walls and noise walls			
	• Fixtures such as seating, lighting, fencing and signs			
	 Details of the staging of landscape work taking account of related environmental controls such as erosion and sedimentation controls and drainage 			
	Procedures for monitoring and maintaining landscaped areas			
	The Urban Design Plan will be prepared in accordance with relevant guidelines, including:			
	 Beyond the Pavement urban design policy, process and principles (Roads and Maritime, 2014) 			
	Landscape Guideline (RTA, 2008)			
	Noise Wall Design Guidelines (RTA, 2006)			
	• Shotcrete Design Guideline (RTA, 2005).			

Impact	Environmental safeguards	Responsibility	Timing	Reference
Operational light spill impact	The lighting design specification will be developed to minimise light spill and light glare in accordance with the provisions of AS4282- 1997 Control of the Obtrusive Effect of Outdoor Lighting (Standards Australia, 1997). This may require the use of directional lighting, cut- offs or filters.	Roads and Maritime	Detailed design	Standard safeguard UD2
Operational visual and amenity impact	Where feasible and reasonable, opportunities to reduce the visual impact of built structures would be implemented through design, and selection of materials and colours.	Roads and Maritime	Detailed design	Standard safeguard UD3
Construction light spill impact	Measures to minimise the use and spill from temporary and construction lighting will be introduced onsite.	Contractor	Construction	Standard safeguard UD4
Socio-economic	 A Communication Plan 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): 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 CSEP will be prepared using Road and Maritimes' Stakeholder engagement toolkit . 	Roads Contactor	Detailed design / Pre-construction	Standard safeguard SE1
Property acquisition	All property acquisition will be carried out in accordance with the Land Acquisition Information Guide (Roads and Maritime, 2012) and the Land Acquisition (Just Terms Compensation) Act 1991.	Roads and Maritime	Preconstruction and construction	Standard safeguard SE2
Impact on business and the community during	Road users, including freight companies will be informed of changed conditions, including likely disruptions to access during	Contractor	Construction	Standard safeguard SE3

Impact	Environmental safeguards	Responsibility	Timing	Reference
construction	construction.			
Community impact during construction across the study area	Consultation will be undertaken with potentially affected residences prior to the commencement of and during work in accordance with the Roads and Maritime's Community Involvement and Communications Resource Manual. Consultation will include but not limited to door knocks, newsletters or letter box drops providing information on the proposed work, working hours and a contact name and number for more information or to register complaints.	Roads and Maritime/ Contractor	Preconstruction and construction	Standard safeguard SE4
Emergency Access	Access for emergency vehicles will be maintained at all times during construction. Any site-specific requirements will be determined in consultation with the relevant emergency services agency.	Contractor	Construction	Standard safeguard SE5
Impact to properties	Consultation will be carried out with all affected property owners during detailed design and construction to develop and implement measures to mitigate the impact on land use viability, infrastructure and severance.	Roads and Maritime	Detailed Design	Standard safeguard SE6
Temporary utility service interruption	Residents and businesses will be notified before any utility interruption.	Contractor	Preconstruction	Standard safeguard SE7
Utility relocation and adjustment	 A utility management plan will be prepared to include: Utility company consultation Maintenance and emergency access requirements Construction staging and programming conflicts. 	Roads and Maritime / Contractor	Pre-construction / Construction	Standard safeguard SE8
General Waste Management	A Waste Management Plan (WMP) will be prepared and implemented as part of the CEMP. The WMP will include but not be limited to:	Contactor	Detailed design / preconstruction	Standard safeguard WM1

Environmental safeguards	Responsibility	Timing	Reference
 Measures to avoid and minimise waste associated with the proposal 			
 Classification of wastes and management options (re-use, recycle, stockpile, disposal) 			
• Statutory approvals required for managing both on and off-site waste, or application of any relevant resource recovery exemptions			
Procedures for storage, transport and disposal			
Monitoring, record keeping and reporting			
The WMP will be prepared taking into account the Environmental Procedure - Management of Wastes on Roads and Maritime Services Land (Roads and Maritime, 2014) and relevant Roads and Maritime Waste Fact Sheets.			
Waste accumulation, littering and general tidiness will be monitored during routine site inspections	Contactor	Construction	Standard safeguard WM2
Recycled, durable, and low embodied energy products will be used to reduce primary resource demand in instances where the materials are cost and performance competitive and comparable in environmental performance (e.g. where quality control specifications allow).	Contractor	Construction	Standard safeguard WM3
 The CEMP will incorporate an Air Quality Management Plan (AQMP) for the proposal. The AQMP will include, but not be limited to: A procedure for monitoring dust onsite and weather conditions 	Contractor	Pre-construction	AQ1
	 Environmental safeguards Measures to avoid and minimise waste associated with the proposal Classification of wastes and management options (re-use, recycle, stockpile, disposal) Statutory approvals required for managing both on and off-site waste, or application of any relevant resource recovery exemptions Procedures for storage, transport and disposal Monitoring, record keeping and reporting The WMP will be prepared taking into account the Environmental Procedure - Management of Wastes on Roads and Maritime Services Land (Roads and Maritime, 2014) and relevant Roads and Maritime Waste Fact Sheets. Waste accumulation, littering and general tidiness will be monitored during routine site inspections Recycled, durable, and low embodied energy products will be used to reduce primary resource demand in instances where the materials are cost and performance competitive and comparable in environmental performance (e.g. where quality control specifications allow). The CEMP will incorporate an Air Quality Management Plan (AQMP) for the proposal. The AQMP will include, but not be limited to: A procedure for monitoring dust onsite and weather conditions 	Environmental safeguardsResponsibility• Measures to avoid and minimise waste associated with the proposal-• Classification of wastes and management options (re-use, recycle, stockpile, disposal)-• Statutory approvals required for managing both on and off-site waste, or application of any relevant resource recovery exemptions-• Procedures for storage, transport and disposal-• Monitoring, record keeping and reporting-The WMP will be prepared taking into account the Environmental Procedure - Management of Wastes on Roads and Maritime Services Land (Roads and Maritime, 2014) and relevant Roads and Maritime Waste Fact Sheets.ContactorWaste accumulation, littering and general tidiness will be monitored during routine site inspectionsContactorRecycled, durable, and low embodied energy products will be used to reduce primary resource demand in instances where the materials are cost and performance competitive and comparable in environmental performance (e.g. where quality control specifications allow).ContractorThe CEMP will incorporate an Air Quality Management Plan (AQMP) for the proposal. The AQMP will include, but not be limited to: A procedure for monitoring dust onsite and weather conditions Contractor	Environmental safeguardsResponsibilityTiming• Measures to avoid and minimise waste associated with the proposal• Classification of wastes and management options (re-use, recycle, stockpile, disposal)• Statutory approvals required for managing both on and off-site waste, or application of any relevant resource recovery exemptions• Frocedures for storage, transport and disposal• Frocedures for storage, transport and disposal• Monitoring, record keeping and reporting• Monitoring, record keeping and reporting• Chaster Scheets.• ContactorWaste accumulation, littering and general tidiness will be monitored during routine site inspections• ContactorConstructionRecycled, durable, and low embodied energy products will be used to reduce primary resource demand in instances where the materials are cost and performance (e.g. where quality control specifications allow).ContractorConstructionThe CEMP will incorporate an Air Quality Management Plan (AQMP) for the proposal. The AQMP will include, but not be limited to: . A procedure for monitoring dust onsite and weather conditionsContractorPre-construction

Impact	Environmental safeguards	Responsibility	Timing	Reference
	 An identification procedure for potential sources of air pollution and mitigation measures for likely scenarios such as imposing speed limits throughout the proposal footprint and site compounds Maintaining air quality management objectives consistent with any relevant published EPA and/or OEH guidelines Compliance with Stockpile Site Management Guidelines (Roads and Maritime 2015b) Methods to manage work during strong winds or other adverse weather conditions such as reducing active earthwork on hot windy days Implement a vehicle, plant and machinery maintenance program to comply with manufacturers specifications and ensure compliance with the NSW Protection of Environment Operations Act 1997 A progressive rehabilitation strategy for exposed surfaces. 			
Greenhouse gas and climate change	Detailed design will consider opportunities to reduce building and construction material quantities and use appropriate materials wherever reasonable and feasible. Pavement design will ensure resilience against extreme temperature and intense and more frequent rainfall events.	Contractor	Detailed design / pre-construction	GHG1
Hazard and Risk	 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: Details of hazards and risks associated with the activity 	Contractor	Detailed design / pre-construction	HAZ1

Impact	Environmental safeguards	Responsibility	Timing	Reference
	 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. The HRMP will be prepared in accordance with relevant guidelines and standards, including relevant Safe Work Australia Codes of Practice, and EPA or Office of Environment and Heritage publications. 			
Hazard and Risk	Where possible, hazardous materials and dangerous goods, avoided or substituted for less hazardous alternatives throughout the construction process. Where this is not possible, in the case for necessary fuels, oils and fluids required for activities in the proposal for example, the appropriate management and handling procedures will be implemented as part of the CEMP. This will include a Hazard and Risk Management Plan (HRMP) and Waste Management Plan (WMP) which will include, but not be limited to measures to avoid the generation of hazardous wastes, and the appropriate procedures for their storage, transport and disposal. The WMP will be prepared taking into account the Environmental Procedure - Management of Wastes on Roads and Maritime Services Land (Roads and Maritime 2014f), and other relevant Roads and Maritime hazardous materials and dangerous	Contractor	Pre-construction	HAZ2

Impact	Environmental safeguards	Responsibility	Timing	Reference
	goods handling procedures to reduce environmental and worker risk such as Managing the risks of working with bitumen and bituminous products (Roads and Maritime 2013). The appropriate management and removal of existing hazardous materials and dangerous goods identified adjacent to the proposed work in the form of asbestos containing materials (ACM) and synthetic fibre materials (SFM) is addressed in Section 6.2.4			
Cumulative impacts	 Other major developments within the area will be consulted with prior to the commencement of work. This may include: Obtaining construction work information including the duration of proposed work activities and the likely impact Identifying and implementing safeguards and management measures (e.g. dust and traffic management controls) to minimise the cumulative impact Managing the interfaces of the proposal's staging and programming in combination with other planning proposal occurring in the area. 	Roads and Maritime	Pre-construction/ construction	CI1
Cumulative impact	All environmental management plans will be prepared to consider other developments that are in progress in the area.	Contractor	Pre-construction	CI2

7.3 Licensing and approvals

Table 7-2 provides a list of licensing and approvals that may be required for the proposal.

Table 7-2: Summary of licensing and approvals required

Instrument	Requirement	Timing
Occupation of Sydney Water land	Licence to occupy land to carry out work	Prior to start of the activity
<i>Biodiversity Conservation Act</i> 2016	Licence to harm or pick threatened species, populations or ecological communities or damage habitat from the Chief Executive of OEH.	Prior to start of the activity
Roads Act 1993 (s138)	Road occupancy licence to dig up, erect a structure or carry out work in, on or over a road	Prior to start of the activity

8. Conclusion

This chapter provides the justification for the proposal taking into account its social, biophysical, and economic impact, the suitability of the site and whether or not the proposal is in the public interest. The proposal is also considered in the context of the objectives of the EP&A Act, including the principles of ecologically sustainable development as defined in Schedule 2 of the Environmental Planning and Assessment Regulation 2000.

8.1 Justification

Appin Road is a key arterial road connecting motorists between South Western Sydney and the Illawarra. Justification for the proposal was identified through consideration of safety concerns along the road. Following this initial identification for the road safety improvements, Roads and Maritime completed a safety and design review of the road, which identified safety concerns in a number of sections along Appin Road. This review was incorporated into objectives for the proposal, with potential options for the Appin Road safety improvements considered against these objectives. The proposal identified provides for the best outcomes against the objectives.

The proposal is subject to determination under Division 5.1 of the EP&A Act. This REF has examined and considered the impact affecting or likely to affect the environment from building and operating the proposal. The impact would predominately be short-term whilst the proposal is being built. Impact as a result of the proposal would be appropriately mitigated through the implementation of safeguards and management measures identified in this REF, which would mitigate the disruption for road users, residents and other impacted stakeholders.

The proposal would not likely result in any significant long-term impact due to changes to the existing section of the road. Any changes, however, would be offset by the benefits of improved safety for road users. Overall, the proposal is considered justified due to the long-term benefit to the local and regional community and economy and its impact which can be managed with minimal residual adverse outcomes.

This REF has examined and considered to the fullest extend impact affecting or likely to affect the environment as a result of the proposal. In conclusion, the proposal's impact is not likely to be significant and therefore preparation of an environmental impact statement under Division 5.2 of the EP&A Act is not required.

8.2 Objects of the EP&A Act

Table 8-1 summarises the objects of the EP&A Act in relation to the proposal.

Table 8-1: Objects of the EP&A Act

Object	Comment
1.3(a) To promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources.	The proposal is located within the road corridor of Appin Road, with the exception of minor areas associated with shoulder widening, the proposed U-turn bays and realignment of the road at about chainage 3100 to chainage 3550, and would not significantly impact on natural and artificial resources. There would be some impact to the environment, including clearing of vegetation, however these are safeguarded (refer to Chapter 7).
1.3(b) To facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-	Ecologically sustainable development is considered in Sections 8.2.1 to 8.2.4 below.

Object	Comment
making about environmental planning and assessment.	
1.3(c) To promote the orderly and economic use and development of land.	The proposals is predominantly contained within the existing road corridor and is consistent with the land use zoning provisions of the local environmental plan. Acquisition of land is required for the proposal; however, this would not significantly compromise the existing use and potential development of any land.
1.3(d) To promote the delivery and maintenance of affordable housing.	Not relevant to the proposal.
1.3(e) To protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats.	The proposal outlines specific safeguards and management measures that would mitigate the impact to the environment. These controls are assessed and considered to provide adequate mitigation measures to safeguard the environment to an acceptable level during the carrying out of work to build the proposal and once operational (refer to Chapter 7).
1.3(f) To promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage).	The proposal outlines specific safeguards and management measures that would protect the built and cultural heritage significance of the road (refer to section 0 and section 6.7).
1.3(g) To promote good design and amenity of the built environment.	The proposals is predominantly contained within the existing road corridor. The proposal outlines specific safeguards and management measures that would protect the amenity of the built environment (refer to section 6.8).
1.3(h) To promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants.	Not relevant to the proposal.
1.3(i) To promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State.	Not relevant to the proposal.
1.3(j) To provide increased opportunity for community participation in environmental planning and assessment.	Roads and Maritime are committed to consulting with the community and key stakeholders during the development and planning of the proposal. Roads and Maritime shall seek feedback prior to determining whether to approve and carry out the proposed safety improvement work (the proposal) Chapter 5 describes how the public would be consulted with
	as part of the ongoing environmental planning and assessment process for the proposal.

8.3 The precautionary principle

The precautionary principle has been incorporated into the assessment of the proposal to account for the assessment of the potential impact applied in this environmental assessment. Accordingly, the following precautionary measures have been adopted:

- Assessing the potential maximum vegetation clearing requirements
- Assessing a worst-case noise impact scenario for the carrying out of work at the site including identifying all potentially affected sensitive receivers within the study area

Appin Road Safety Improvements, Brian Rd, Appin to Gilead Review of Environmental Factors

- Assessing the proposal's visual impact on the local environment
- Assessing the impact and detailing appropriate safeguards and management measures for the identified impact which are unlikely to occur on site such as a major spill
- Ensuring that the impact of elements of the proposal's design that are not fully detailed are assessed during the next stage and safeguarded prior to work commencing on site.

The above has been considered under State policy and on balance the value of the land for future generations in its function as a road would provide better equity. The proposal would result in a further loss of threatened biodiversity. While this could not be replaced, its impact is being offset for future generations as described below. The ecological impact for the proposal is also considered insufficient not to affect the form, function, survival or wider condition of the biophysical values of the local area or region.

Preserving biological diversity and ecological integrity requires that ecosystems, species, and biological diversity are maintained and improved to ensure their survival. It is accepted that this proposal would result in the loss of about:

- 1.88 ha of Cumberland plain woodland
- 1.81 ha of Shale sandstone transition forest.

The above vegetation communities are protected under State and Commonwealth legislation, as they provide potential resource and habitat for threatened species, such as the Koala and Cumberland Plain Land Snail.

Both the State and the Commonwealth have published guidelines for determining if certain actions and activities would have a significant impact on the values and defining features of legally protected ecological values. Central to these guidelines are the consideration of whether the impact would have a material impact on biological diversity and ecological integrity to the point of affecting their overall conservation.

The assessments of biological diversity and ecological integrity for the proposal, which are provided in Appendix C, concluded there would be an adverse impact as a result of the proposal, however, the impact is not considered significant.

Provided safeguards and management measures detailed in section 6.1.4 are properly implemented on site prior to and maintained during the building of the proposal, the loss is considered to not have a significant impact on the conservation of Cumberland Plain Woodland or Shale Sandstone Transition Forest in the area. This is also extending to the habitat value and the species for which these communities support such as the Koala.

8.4 Improved valuation, pricing and incentive mechanisms

In the case of the proposal there is a commitment to:

- Use recycled and low-embodied energy materials where feasible and reasonable in their application to consider the lifecycle demand on natural resources and their conservation
- Source materials and dispose of waste locally where feasible and reasonable to do so to minimise the transportation impact.

Roads and Maritime has developed environmental assessment guidance to allow external parties to prepare its environmental assessment documentation. These external parties comprise specialists who are competent in environmental impact assessment and are experienced in identifying cost-effective safeguards and management measures based on a hierarchy of avoidance over mitigation.

In addition, Roads and Maritime's own in-house team of environmental specialists review all environmental assessments to ensure safeguards and management measures are cost-effective and achieve the proposal's objectives, while also achieving Roads and Maritime's environmental and organisational goals.

8.5 Conclusion

The proposed Appin Road Safety Improvements from the intersection of Appin Road and Brian Road, Appin, and extending north to about 360 metres north of Beulah Reserve, Gilead is subject to assessment under Division 5.1 of the EP&A Act. The REF has examined and taken into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the proposed activity.

This has included consideration (where relevant) of conservation agreements and plans of management under the NPW Act, joint management and biobanking agreements under the BC Act, wilderness areas, critical habitat, the impact on threatened species, populations and ecological communities and their habitats and other protected fauna and native plants. It has also considered the potential impact to matters of national environmental significance listed under the EPBC Act.

The otential environmental impact from the proposal has been identified and avoided or reduced during the strategic design development and options assessment. The proposal as described in this REF best meets the objectives of the proposal but would still result in some impact on the local environment such as noise at nearby sensitive receivers, and threatened ecological communities.

Safeguards and management measures as detailed in this REF would avoid or minimise the expected impact for the proposal. Overall the proposal would improve the safety and driving conditions for road users of Appin Road. On balance the proposal is considered justified and the following conclusions are made.

8.5.1 Significance of impact under NSW legislation

The proposal would be unlikely to cause a significant impact on the environment. Therefore, it is not necessary for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning under Division 5.2 of the EP&A Act. A Species Impact Statement is not required. The proposal is subject to assessment under Division 5.1 of the EP&A Act. Consent from Council is not required.

8.5.2 Significance of impact under Australian legislation

The proposal is not likely to have a significant impact on matters of national environmental significance or the environment of Commonwealth land within the meaning of the EPBC Act. A referral to the Australian Department of the Environment and Energy is not required.

9. Certification

This review of environmental factors provides a true and fair review of the proposal in relation to its potential effects on the environment. It addresses to the fullest extent possible all matters affecting or likely to affect the environment as a result of the proposal.

The

Greg Tallentire Principal Environmental Scientist Advisian 16 November 2018

I have examined this review of environmental factors and accept it on behalf of Roads and Maritime Services.

Allenen

Richard McHenery Project Development Manager Western Sydney Project Office 16 November 2018

10. References

Acid Sulfate Soil Management Advisory Committee, 1998, Acid Sulfate Soils Assessment Guidelines.

Advisian, 2018a, Landscape Character and Visual Impact Assessment.

Advisian, 2018b, Statement of Heritage Impact.

Australian Bureau of Statistics, 2011, ABS Census Data 2011.

Australian Bureau of Statistics, 2016, ABS Census Data 2016.

Australia Incorporated International Council on Monuments and Sites (ICOMOS), 2013, The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance.

Austroads, 2002, Guide to Road Safety.

Austraffic, 2018, Automatic traffic survey.

Bureau of Meteorology, 2016, Atlas of Groundwater Dependent Ecosystems.

Casey and Lowe, 2018, Non-Aboriginal Heritage Assessment.

Campbelltown City Council, 2009, Campbelltown City Councils Engineering Design for Development, accessed 4 October 2018,

https://www.campbelltown.nsw.gov.au/RLE/LocalEnvironment/Catchmentsriversandcreeks/WaterQ uality MonitoringProgram.

Campbelltown City Council, 2013a, Water Quality Monitoring Program, accessed 4 October 2018, <u>https://www.campbelltown.nsw.gov.au/RLE/LocalEnvironment/Catchmentsriversandcreeks/WaterQ</u> <u>ualityMonitoringProgram</u>.

Campbelltown City Council, 2013b, Campbelltown Residential Development Strategy, accessed 9 October 2018

https://www.campbelltown.nsw.gov.au/files/assets/public/documentresources/builddevelop/strategi c-planning-documents/residential-

developmentstrategy/campbelltownresidentialdevelopmentstrategy.pdf.

Campbelltown City Council, 2014, Campbelltown Local Planning Strategy, accessed 9 October 2018, <u>https://www.campbelltown.nsw.gov.au/files/assets/public/document-</u> <u>resources/builddevelop/strategicplanning-documents/local-planning-</u> <u>strategy/campbelltownlocalplanningstrategy.pdf</u>.

Commonwealth Department of the Environment, 2013, Significant Impact Guidelines 1.1: Matters of National Environmental Significance.

Department of Environment & Climate Change NSW (DECCW), 2007, Threatened Species Assessment Guidelines: The Assessment of Significance.

Department of Planning and Environment (DUAP), 1995/1996, Is an EIS Required? Best Practice Guidelines for Part 5 of the Environmental Planning and Assessment Act 1979 (Is an EIS required? guidelines).

Department of Planning and Environment, 2017, Greater Macarthur Priority Growth Area, accessed 9 October 2018, <u>http://www.planning.nsw.gov.au/Plans-for-your-area/Priority-Growth-Areas-andPrecincts/Greater-Macarthur-Priority-Growth-Area</u>.

Eco Logical Australia, 2015, Greater Macarthur Investigation Area Biodiversity Assessment.

Eco Logical Australia, 2018a, Ecological Impact Assessment.

Eco Logical Australia, 2018b, Stage 2 PACHCI Aboriginal Archaeological Survey Report.

Greater Sydney Commission, 2017, My Greater Sydney: Western District City Plan – Connecting communities, accessed 9 October 2018, *http://www.greater.sydney*.

Hazelton P.A. and Tille P.J., 1990, Soil Landscapes of the Wollongong-Port Hacking 1:100,000 Sheet map and report, Soil Conservation Service of NSW, Sydney.

Jacobs Australia, 2018, Spring Farm Parkway - Stage 1 Review of environmental factors.

Landcom, 2004, The Blue Book: Managing Urban Stormwater (MUS): Soils and Construction, Volume 1.

Landcom, 2008, The Blue Book: Managing Urban Stormwater (MUS): Soils and Construction, Volume 2.

NSW Environment Protection Authority (EPA), 2014a, Waste Classification Guidelines: Part 1: Classifying Waste.

NSW Environment Protection Authority (EPA), 2014b, Waste Classification Guidelines: Part 2: Immobilising Waste.

NSW Government, 2012, NSW State Infrastructure Strategy: First things first, accessed 13 September 2018, <u>http://www.infrastructure.nsw.gov.au/pdfs/SIS_Report_Complete_Print.pdf</u>.

NSW Government 2015, State Priorities: Making it happen, accessed 13 September 2018, https://www.nsw.gov.au/improving-nsw/premiers-priorities/.

NSW Government, 2016, Biodiversity Conservation Act.

Office of Environment and Heritage, 2011, Guidelines for Consultants Reporting on Contaminated Sites.

Office of Environment and Heritage, 2017, OEH Vegetation Information System (VIS) Classification Guidelines.

Office of Environment and Heritage, 2018, Native Vegetation of the Sydney Metropolitan Area.

Roads and Maritime, 1999, Code of Practice for Water Management: Roads and Development Management.

Roads and Maritime, 2011a, Technical Guideline: Temporary Stormwater Drainage for Road Construction.

Roads and Maritime, 2011b, *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects.*

Roads and Maritime, 2012, Land Acquisition Information Guide.

Roads and Maritime, 2013a, Environmental Impact Assessment Practice Note: The Guidelines for Landscape Character and Visual Impact Assessment EIA-N04.

Roads and Maritime, 2013b, Environmental Impact Assessment Practice Note: Socio-economic assessment: EIA-N05.

Roads and Maritime, 2014a, Appin Road Safety Review, accessed 13 September 2018, http://roadsafety.transport.nsw.gov.au/downloads/appinroad_safetyreview_032014.pdf.

Roads and Maritime, 2014b, Beyond the Pavement: urban design policy, process and principles.

Roads and Maritime, 2014c, R0600: Street Lighting Series.

Roads and Maritime, 2014d, Environmental Procedure - Management of Wastes on Roads and Maritime Services Land.

Roads and Maritime, 2015a, Noise Mitigation Guideline.

Roads and Maritime, 2015b Stockpile Site Management Guidelines.

Roads and Maritime, 2015c, The Standard Management Procedure - Unexpected Heritage Items.

Roads and Maritime, 2015d, QA Specification G10 Control of Traffic.

Roads and Maritime, 2016, Construction Noise and Vibration Guideline.

Roads and Maritime, 2018, Traffic Control at Work Sites Manual.

Roads and Maritime, undated, Water Policy.

Transport for NSW (TfNSWc), 2011, National Road Safety Strategy 2011 – 2020, accessed 13 September 2018, *http://roadsafety.gov.au/nrss/files/NRSS_2011_2020*.

Transport for NSW (TfNSWd), 2012, NSW Long Term Transport Master Plan, December 2012, accessed 13 September 2018,

https://www.transport.nsw.gov.au/sites/default/files/media/documents/2017/nsw-transportmasterplan-final.pdf.

WSP, 2018 Appin Road Upgrade, Mount Gilead to Ambarvale Review of environmental factors.

Terms and acronyms used in this REF

Term / Acronym	Description
ABS	Australian Bureau of Statistics
ACM	Asbestos Containing Material
AHIMS	Aboriginal Heritage Information Management System
ARI	Average Recurrence Interval
ASS	Acid Sulfate Soils
BC Act	Biodiversity Conservation Act 2016 (NSW)
BTEX	Benzene, toluene, ethylbenzene and xylene
CEMP	Construction environmental management plan
CNVG	Construction Noise and Vibration Guideline
DECC	Department of Environment and Climate Change
DECCW	Department of Environment, Climate Change and Water
EEC	Endangered Ecological Community
EIA	Environmental impact assessment
EIS	Environmental impact statement
EPA	Environment Protection Authority
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i> (NSW) Provides the legislative framework for land use planning and development assessment in NSW
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Commonwealth) Provides for the protection of the environment, especially matters of national environmental significance, and provides a national assessment and approvals process.
EPL	Environment Protection Licence
ESD	Ecologically sustainable development. Development which uses, conserves and enhances the resources of the community so that ecological processes on which life depends, are maintained and the total quality of life, now and in the future, can be increased
FBA	Framework for Biodiversity Assessments
FM Act	Fisheries Management Act 1994 (NSW)
HNA	Highly noise affected
Heritage Act	Heritage Act 1977 (NSW)
ICNG	Interim Construction Noise Guideline

Term / Acronym	Description
ISEPP	State Environmental Planning Policy (Infrastructure) 2007
LALC	Local Aboriginal Land Council
LCZ	Landscape Character Zone
LEP	Local Environmental Plan A type of planning instrument made under Part 3 of the EP&A Act
LGA	Local Government Area
LoS	Level of Service A qualitative measure describing operational conditions within a traffic stream and their perception by motorists and/or passengers.
NBN	National Broadband Network
NCA	Noise Catchment Area
NCG	Noise Criteria Guideline
MNES	Matters of national environmental significance under the Commonwealth EPBC Act 1999
NML	Noise Management Level
NPW Act	National Parks and Wildlife Act 1974 (NSW)
OEH	Office of environment and heritage
PACHCI	Procedure for Aboriginal Cultural Heritage Consultation and Investigation
PCT	Plant Community Type
POEO Act	Protection of the Environment Operations Act 1997
RBL	Rating background level
REF	Review of environmental factors
RNP	Road Noise Policy
Roads and Maritime	Roads and Maritime Services
SEPP	State Environmental Planning Policy A type of planning instrument made under Part 3 of the EP&A Act.
SHR	State Heritage Register
SIS	Species Impact Statement
TSC Act	Threaten Species Conservation Act (NSW)
QA Specifications	Specifications developed by Roads and Maritime Services for use with road work contracts



Customer feedback **Roads and Maritime** Locked Bag 928, North Sydney NSW 2059

Appin Road Safety Improvements, Brian Rd, Appin to Gilead Review of Environmental Factors

March 2018 RMS.18.1074 ISBN: 978-1-925093-89-6