Oxley Highway realignment at Rosewood Road

Review of environmental factors

Roads and Maritime Services | November 2017

NSW GOVERNMENT

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Roads and Maritime Services

HW11 Oxley Highway – Rosewood Road Realignment

Review of environmental factors

November 2017

Prepared by GeoLINK and Roads and Maritime Services

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Executive summary

The proposal

Roads and Maritime Services NSW (Roads and Maritime) proposes to realign the Oxley Highway, approximately six kilometres west of Wauchope within the Port Macquarie-Hasting local government area. The proposal includes upgrading the Oxley Highway – Rosewood Road intersection. There has been a history of traffic accidents along this section of the highway as well as regular inundation of the road in lower level areas affecting journey reliability. The proposal aims to improve road safety and journey reliability. Key features of the proposal would include:

- Shifting the road to the south and smoothing the existing curves
- Design / operating speed of 80 kilometres per hour
- Lane widths of 3.5 metres
- Shoulder sealed width of one metre wide and 0.5 metre verge
- Desirable pavement design life of 20 years.

The proposed alignment traverses road formation and Traveling Stock Reserve adjacent the existing Oxley Highway as well as a portion of private property to the south that would have to be acquired by Roads and Maritime.

Need for the proposal

The Oxley Highway is an important strategic highway which links Port Macquarie and the Pacific Highway to the New England Tableland, New England Highway and regional centres of Armidale and Tamworth. It is particularly important for tourist and heavy vehicles, and during road closure periods along the respective highways.

The Oxley Highway carries a number of significant values for a range of road users, supporting vehicles ranging from large freight vehicles, to local traffic in light vehicles. The existing alignment of the Oxley Highway between Rosewood Road and Huntingdon Road is of a low standard. The alignment has radius curves ranging from 60 metres to 200 metres with narrow shoulders. A number of crashes have occurred in the locality, primarily within the section just at the west of Rosewood Road. This section of road is also subject to flooding with water flow across the road occurring.

Roads and Maritime are responsible for managing road related transport infrastructure and providing safe and efficient access for the road network for the people of NSW and this proposal would help Roads and Maritime in meeting various strategic and operational objectives to improve road safety.

Proposal objectives and development criteria

The objectives of the proposal include:

- Improve road safety and reduce the accident rate on this section of the Oxley Highway
- Improve journey reliability by eliminating overtopping of flood water over this section of the Oxley Highway.

The development criteria for the proposal include:

- Ability of the option to satisfy the proposal objectives
- Cost
- Constructability
- Impacts on road users
- Impacts on the environment
- Impacts on heritage values
- Impacts on stakeholders and neighbours.

Options considered

Four alignment options were assessed:

- Option 1 – this option avoids the existing alignment (except at the tie-ins with the existing highway), generally requires low volumes of cut and fill (compared to the other options) and fewer culvert extension and new culverts to be constructed. It meets the stated objectives and criteria. Both of the accesses to Paddock Road would be impacted by this option.
- Option 2 – this option predominantly follows the existing alignment and offers minimal safety improvements (due to retaining relatively high-risk curves) over the current alignment. This option also intersects the current highway at multiple points (in addition to the tie-ins). Both of the accesses to Paddock Road would be impacted by this option.
- Option 3 – this option includes a long straight connected by two small radius curves which is a potential safety risk. Both of the accesses to Paddock Road would be impacted by this option.
- Option 4 – this alignment option runs to the north and south of the existing highway and would intersect the existing highway at multiple points (in addition to the tie-ins). This option would require significantly more fill material to be imported than the other options (and thus a significantly higher cost) and would require a relatively high level of traffic management compare to other options. This option would require that one of the two existing accesses to a local road (Paddock Road) be removed, while second access may be potentially exposed to hazard during cutting works.

Option 1 is the preferred option; it includes design features (eg curves of appropriate radius) to improve safety of the road and cross drainage (in the form of appropriate capacity culverts) to eliminate flooding and thus satisfies the project objectives. Option 1 also satisfies each of the development criteria.

Statutory and planning framework

All relevant statutory planning instruments have been examined in relation to the proposal. Development consent is not required for the subject activity by virtue of Clause 94 of State Environmental Planning Policy (Infrastructure) 2007(ISEPP). However, the proposal becomes an 'activity' for the purposes of Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and is subject to an environmental impact assessment (this REF).

The *Biodiversity Conservation Act 2016* (BC Act) and its supporting regulations commenced on 25 August 2017. The BC Act repeals the Threatened Species Conservation Act 1995 along with other natural resource management legislation. The BC Act sets out the assessment framework for threatened species and ecological communities. However, transitional arrangements are in place, including those for pending Part 5 Assessments under the EP&A Act. Pursuant to Section 29 of the Biodiversity Conservation (Savings and Transitional) Regulation 2017, as this Part 5 assessment began before the commencement of the BC Act (on 25 August 2017), the transitional arrangements and therefore former planning provisions apply, subject to the Proponent commencing to carry out the activity within 18 months after the commencement of the new BC Act (being 25 February 2019).

Community and stakeholder consultation

Targeted stakeholder and community consultation is proposed. Planned traffic disruptions during the proposed work would also be advised through advertising using the Roads and Maritime traffic alert system, as well as other means identified via a consultation strategy developed for the proposal.

Consultation with the Aboriginal community for this project has involved two main components. These include consultation in relation to Aboriginal Cultural Heritage Consultation and Investigation (PACHCI) procedures and also acquisition of land for the project that is owned by the Bunyah Local Aboriginal Land Council. The Roads and Maritime Property Section are managing the acquisition of land and ongoing consultation will occur with Bunyah Local Aboriginal Land Council (land holder).

Consultation has been initiated with Port Macquarie-Hastings Council and relevant government agencies. Roads and Maritime would continue to liaise with Port Macquarie-Hastings Council with regard to any further design revisions / the final design and what is planned for the redundant road reserve area once the Highway has been realigned.

Roads and Maritime would continue to liaise with Department of Industry - Lands and Forestry and Local Land Services NSW as relevant. Any landowner that relies on access to a Crown Road (eg The Paddock Road) would also be consulted.

Environmental impacts

The main environmental impacts of the proposal are summarised as follows:

- There are a number of potential ecological impacts related to the removal of vegetation and habitat (including habitat for threatened species) during the construction phase. Recommended mitigation measures include several additional safeguards that are intended to reduce risk of fauna mortality and removal of habitat associated with the removal of a significant number of habitat trees. Such measures include those associated with a two-step clearing process and the installation of nest-boxes to compensate for removal of hollow- bearing trees.
- The proposal is not likely to significantly impact threatened species, populations or ecological communities or their habitats, within the meaning of the *Threatened Species Conservation Act 1995*, the *Fisheries Management Act 1994* or the *Environment Protection and Biodiversity Conservation Act 1999*
- Potential impacts to water quality, hydrology and flooding that could arise from the proposal include:
    - Changes in hydrology of the ephemeral drainage lines
    - Erosion and sedimentation that may affect ephemeral drainage lines that flow to the Hastings River
    - Turbidity and sedimentation of local aquatic habitats and waterways
    - Pollution of local water quality from machinery, construction materials and spills.
- Potential impacts to soils, erosion and sedimentation may occur during construction works and establishment / utilisation of the site compound. Given the steep nature of some areas of the site, the potential for high rainfall events (and associated high flow events in the drainage lines) and the erodible soils noted earlier, there is significant risk of erosion where management controls are not in place. However, the effective implementation of sedimentation and erosion controls can effectively reduce such risks and avoid the dispersion of soils and particles.

Other potential environmental impacts would be generally minor in nature. A variety of safeguards have been developed to minimise the risk and potential magnitude of potential impacts posed by the proposal to the environment. The proposal would have a number of positive environmental impacts namely including improvements to road safety and efficiency.

Justification and conclusion

With effective implementation of the safeguards and management measures listed within this REF, environmental impacts associated with undertaking the construction works would be minor. Unavoidable impacts required for the works (eg vegetation removal) are not substantial and would not significantly affect the local environment. Overall the social, economic and public interest factors would benefit from the proposal as road safety and travel times would be improved.

The proposed realignment of the Oxley Highway at Rosewood Road is subject to assessment under Part 5 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 of wilderness areas, critical habitat, impacts on threatened species, populations and ecological communities and their habitats and other protected fauna and native plants. It has also considered potential impacts to matters of national environmental significance listed under the Federal EPBC Act.

A number of potential environmental impacts from the proposal have been avoided or reduced during the concept design development and options assessment. The proposal as described in the REF best meets the project objectives but would still result in some impacts on biodiversity, soil and water, traffic and noise and vibration. Safeguards and management measures as detailed in this REF would ameliorate or minimise these expected impacts. The proposal would also improve safety and driving conditions and reduce travel times. On balance the proposal is considered justified and the following conclusions are made.

Significance of impact under NSW legislation
The proposal would be unlikely to cause a significant impact on the environment. Therefore it is not necessary for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning under Part 5.1 of the EP&A Act. A Species Impact Statement is not required. The proposal is subject to assessment under Part 5 of the EP&A Act. Consent from Council is not required.

Significance of impact under Australian legislation
The proposal is not likely to have a significant impact on matters of national environmental significance or the environment of Commonwealth land within the meaning of the *Environment Protection and Biodiversity Conservation Act 1999*. A referral to the Australian Department of the Environment is not required.

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1 Introduction

1.1 Proposal identification

Roads and Maritime Services NSW (Roads and Maritime) propose to realign the Oxley Highway, approximately six kilometres west of Wauchope within the Port Macquarie-Hasting local government area. The proposal includes upgrading the Oxley Highway – Rosewood Road intersection. There has been a history of traffic accidents along this section of the highway as well as regular inundation of the road in lower level areas affecting journey reliability. The proposal aims to improve road safety and journey reliability. Key features of the proposal would include:

- Shifting the road to the south and smoothing the existing curves
- Design / operating speed of 80 kilometres per hour
- Lane widths of 3.5 metres
- Shoulder sealed width of one metre wide and 0.5 metre verge
- Desirable pavement design life of 20 years.

The proposed alignment traverses road formation and Traveling Stock Reserve adjacent the existing Oxley Highway as well as a portion of private property to the south that would have to be acquired by Roads and Maritime.

The location of the proposal is shown in Figure 1–1 and an overview of the proposal is provided in Figure 1–2. A full description of the proposal in contained within Chapter 3.

Information shown is for illustrative purposes only

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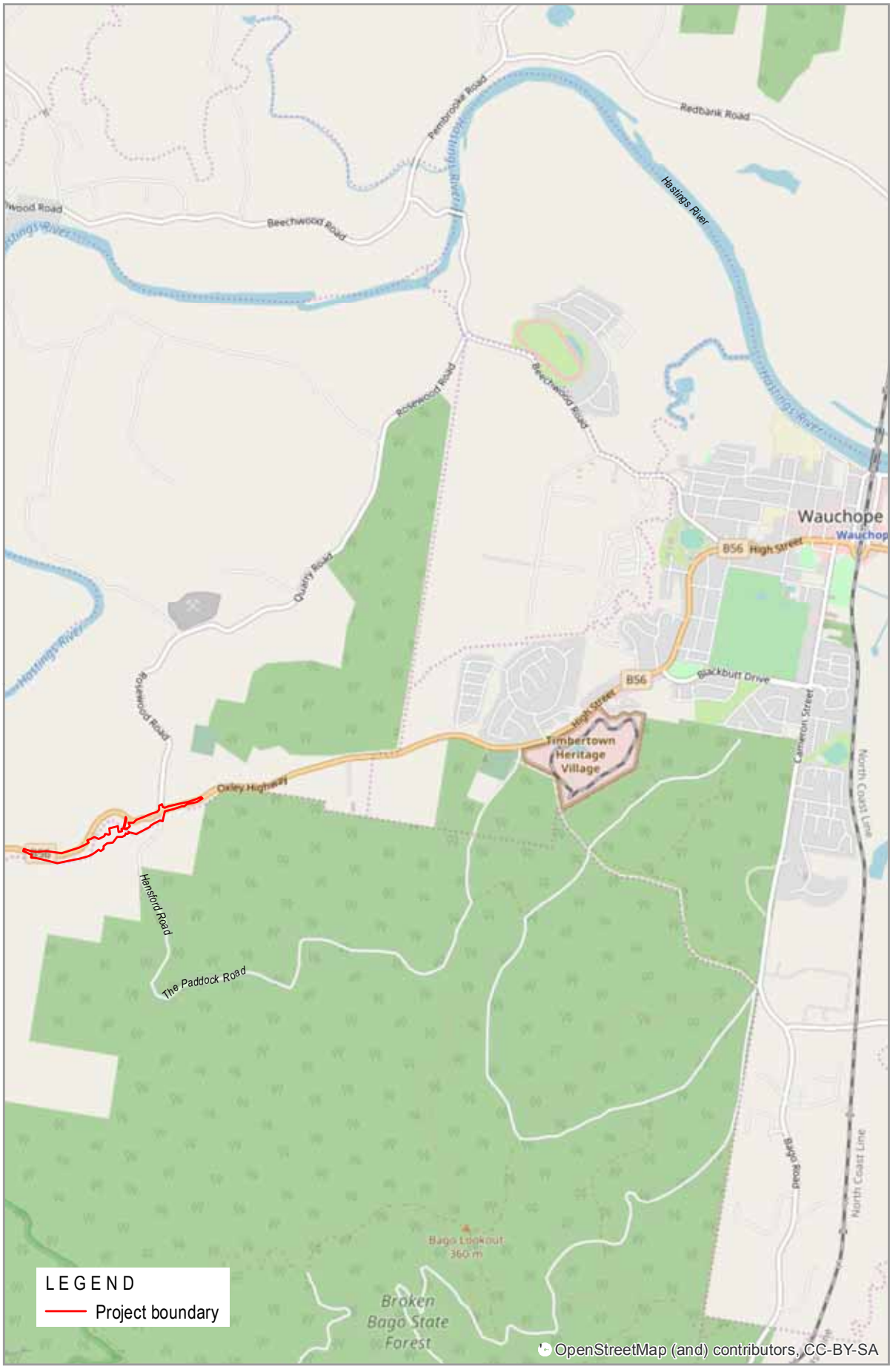
Source of base data:OpenStreetMap



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North

Location of The Proposal

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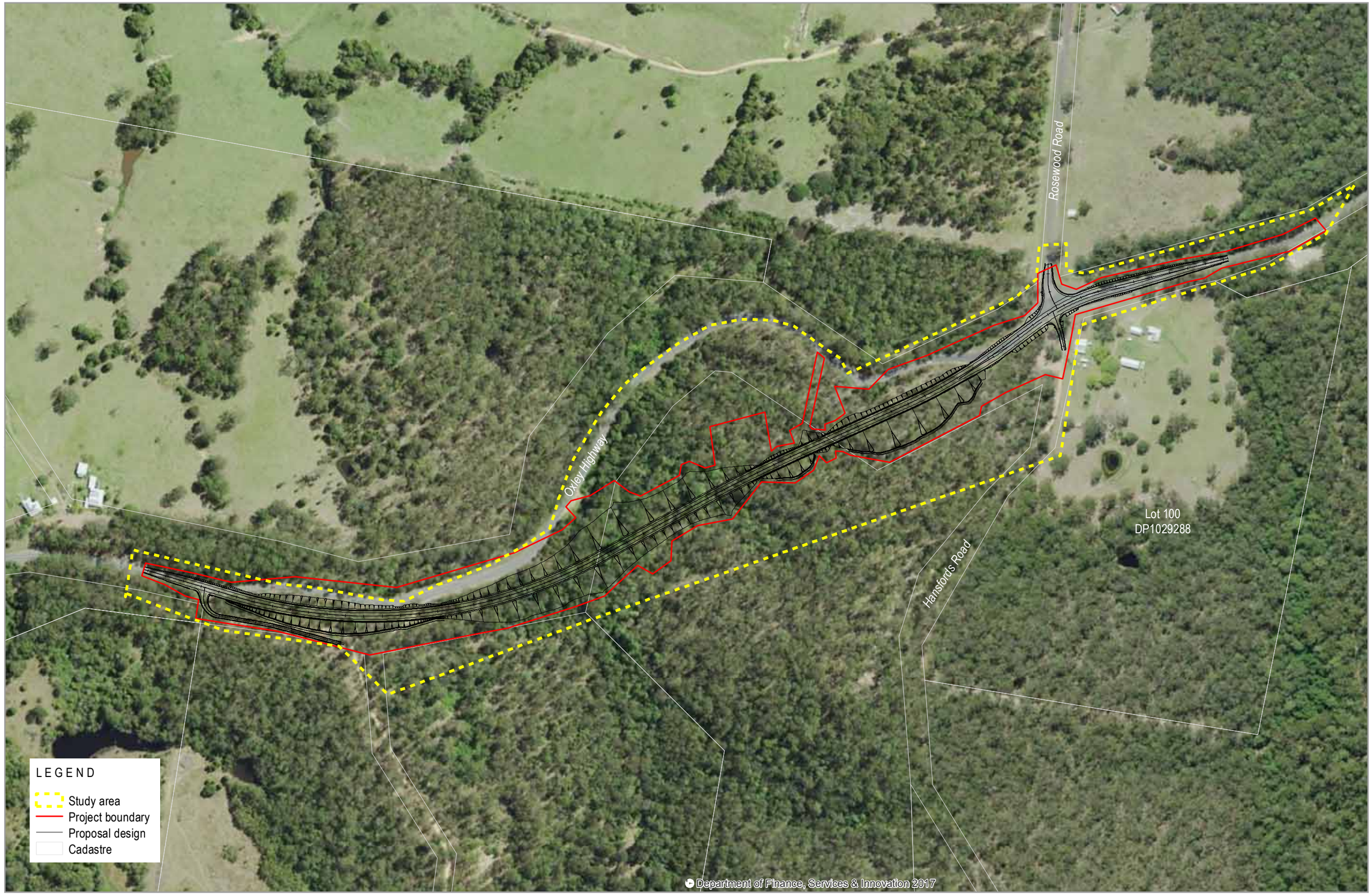

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North

The Proposal

1.2 Purpose of the report

This review of environmental factors (REF) has been prepared by GeoLINK on behalf of Roads and Maritime (Northern Directorate). For the purposes of these works, Roads and Maritime is the proponent and the determining authority under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

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

The description of the proposed work and associated environmental impacts have 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), the *Threatened Species Conservation Act 1995* (TSC 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 111 of the EP&A Act 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 Part 5.1 of the EP&A Act
- The significance of any impact on threatened species as defined by the TSC Act and/or FM Act, in section 5A of the EP&A Act (now repealed) and therefore the requirement for a Species Impact Statement (note transitional arrangements mean former planning provisions remain applicable for pending Part 5 assessments)
- 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, to make a referral to the Australian Government Department of the Environment 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

2.1.1 Background

The Oxley Highway is an important strategic highway which links Port Macquarie and the Pacific Highway to the New England Tableland, New England Highway and regional centres of Armidale and Tamworth. The Oxley Highway also continues west beyond Tamworth, through Gunnedah and on to link with the Newell Highway. It is particularly important for tourist and heavy vehicles, and during road closure periods along the respective highways.

From a local perspective, the subject section of the Oxley Highway provides a valuable tourist route for its scenic and linkage values. It also provides an important road network for local industries including agriculture and timber harvesting.

Overall the Oxley Highway carries a number of significant values for a range of road users, supporting vehicles ranging from large freight vehicles, to local traffic in light vehicles.
The existing alignment of the Oxley Highway between Rosewood Road and Huntingdon Road is of a low standard. The alignment has radius curves ranging from 60 metres to 200 metres with narrow shoulders. A number of crashes have occurred in the locality, primarily within the section just at the west of Rosewood Road. This section of road is also subject to flooding with water flow across the road occurring. The affected culvert number is 511050.

Roads and Maritime are responsible for managing road related transport infrastructure and providing safe and efficient access for the road network for the people of NSW. The proposal incorporates Roads and Maritime's environment policy (2012), which states that:

> *Roads and Maritime Services is committed to carrying out its business in an environmentally responsible manner by effectively identifying and managing any risks which may potentially impact the environment. Roads and Maritime Services will take all reasonably practical steps to ensure there is continuous improvement in environmental performance, including ongoing communication and awareness raising, active reporting of environmental incidents and continuous learning from experience.*

2.1.2 NSW 2021

In September 2011, the NSW Government released NSW 2021, which is a 10-year strategic plan setting immediate priorities for action and guiding resource allocation through the NSW Budget. NSW 2021 has 32 goals. Goals relevant to the proposal are listed in Table 2–1.

Table 2–1: NSW 2021 goals relevant to the proposal

Return quality services	10. Improve Road Safety

This proposal would help Roads and Maritime in meeting this goal through improving road safety through a section of the Oxley Highway associated with a history of road accidents.

2.1.3 Blueprint update 2011

The Blueprint (RTA 2011) directs the Roads and Maritime in achieving corporate objectives, including those specified in NSW 2021. It is a single-agency strategic planning document which focuses on the Roads and Maritime's start on the goals set by NSW 2021. The Blueprint highlights the need for improvements to the safety and maintenance of the state's roads. Subsequently, the proposal concurs with the objectives of the RTA Blueprint

2.1.4 NSW Road Safety Strategy

The NSW Road Safety Strategy 2012-2021 sets the direction of road safety in NSW. NSW is committed to reducing fatalities to at least 4.3 per 100,000 population by 2016 together with at least a 30 per cent reduction in fatalities and serious injuries between 2012 and 2021. This proposal would help in meeting this goal through improving road safety through a section of the Oxley Highway associated with a history of road accidents.

2.1.5 Oxley Highway Route Safety Review 2015

The Oxley Highway Route Safety Review (Centre for Road Safety 2015) was a multidisciplinary and consultative process that allowed for the adoption of an integrated approach to improving road safety. It identified a number of safety concerns at numerous sections of the Oxley Highway including west of Wauchope. The review made a number of recommendation including improving road alignment and road shoulders, particularly in higher risk locations. The report recommended the following:

> *Improve the road alignment and road shoulders, particularly at locations where the terrain and topography is unique and different from the rest of the highway. At these locations low radius curves can be improved by reconstructing the curve to increase the radius (where practical) and sealing the width of the shoulder around the outside of the curve. This should also include the provision of a smooth and consistent crossfall through the curves*.

The proposal aims to realign the highway including curves of increased radius and thus addresses the above recommendation of the Oxley Highway Safety Review.

2.1.6 Oxley Highway Draft Corridor Strategy March 2016

The corridor strategy sets out how the NSW Government will manage road transport along the Oxley Highway in the long-term from Port Macquarie to Nevertire. The corridor strategy will be delivered over a 20-year timeframe, in line with the NSW Long Term Transport Master Plan (LTTMP), Regional Transport Plans and other relevant national and State planning frameworks. From road safety and transport efficiency to asset maintenance issues, this strategy sets the direction for managing the Oxley Highway into the future including the implementation of the Rosewood Road Realignment project.

2.2 Existing infrastructure

The Oxley Highway between Rosewood Road and Huntingdon Road is a two-way, single carriageway that traverses heavily timbered coastal regions, with steep winding grades through the eastern escarpment west of Wauchope. The highway in this section is of a low standard. The alignment has radius curves ranging from 60 metres to 200 metres with narrow shoulders. A number of crashes have occurred primarily in the section just at the west of Rosewood Road. This section of road is also subject to flooding with water flow across the road. The affected culvert number is 511050.

2.3 Proposal objectives and development criteria

2.3.1 Proposal objectives

The objectives of the proposal include:

- Improve road safety and reduce the accident rate on this section of the Oxley Highway
- Improve journey reliability by eliminating overtopping of flood water over this section of the Oxley Highway.

2.3.2 Development criteria

The development criteria for the proposal include:

A. Ability of the option to satisfy the proposal objectives
B. Cost
C. Constructability
D. Impacts on road users
E. Impacts on the environment
F. Impacts on heritage values
G. Impacts on stakeholders and neighbours.

2.4 Alternatives and options considered

2.4.1 Methodology for selection of preferred option

Several options for the realignment of the Oxley Highway have been considered by Roads and Maritime Services including a 'do nothing' option. Each of the identified options was considered against the objectives stated in Section 2.3.1 and the criteria listed in Section 2.3.2.

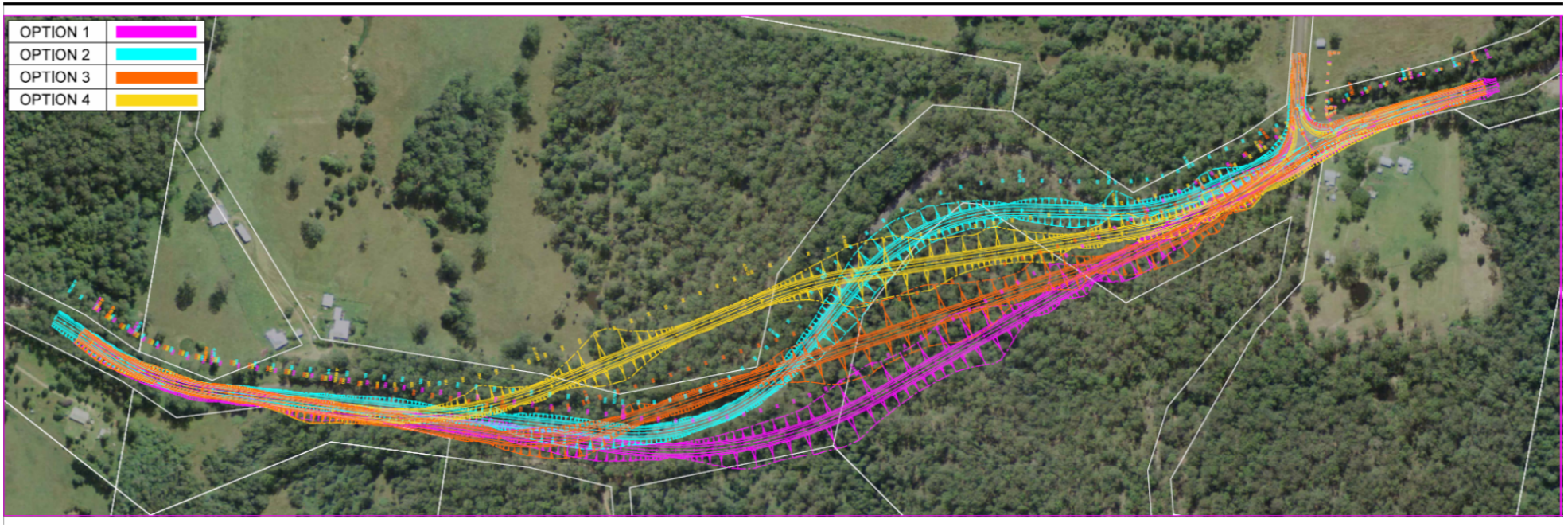
2.4.2 Identified options

Do nothing option: This option involves leaving the relevant section of the Oxley Highway in its current alignment. The 'do nothing' option therefore does not meet the objectives of the strategies outlined in Section 2.1 (ie the NSW 2021 and Blueprint Update 2011 strategies).

Four alignment options (presented in Figure 2–1) were assessed:

- Option 1 – this option avoids the existing alignment (except at the tie-ins with the existing highway), generally requires low volumes of cut and fill (compared to the other options) and fewer culvert extension and new culverts to be constructed. It meets the objectives stated in Section 2.3.1 and the criteria listed in Section 2.3.2. Both of the accesses to Paddock Road would be impacted this option.
- Option 2 – this option predominantly follows the existing alignment and offers minimal safety improvements (due to retaining relatively high-risk curves) over the current alignment. This option also intersects the current highway at multiple points (in addition to the tie-ins). Both of the accesses to Paddock Road would be impacted by this option.
- Option 3 – this option includes a long straight connected by to small radius curves which is a potential safety risk. Both of the accesses to Paddock Road would be impacted this option.
- Option 4 – this alignment option runs to the north and south of the existing highway and would intersect the existing highway at multiple points (in addition to the tie-ins). This option would require significantly more fill material to be imported than the other options (and thus a significantly higher cost) and would require a relatively high level of traffic management compare to other options. This option would require that one of the two existing accesses to a local road (Paddock Road) would need to be removed, while second access may be potentially exposed to hazard during cutting works.

Figure 2–1: Alignment options



2.4.3 Analysis of options

An options assessment matrix (Table 2–2) was undertaken to compare each option against the options consideration criteria (listed from A-G in Section 2.3.2). The results are discussed further below.

Table 2–2: Options assessment matrix

Option	Criteria						
	A	B	C	D	E	F	G
Do nothing	X	✓	✓	X	✓	✓	X
Option 1	✓	✓	✓	✓	✓	✓	✓*
Option 2	X	X	X	X	✓	✓	✓*
Option 3	✓	X	X	✓	✓	✓	✓*
Option 4	✓	✓	X	X	✓	✓	✓*

*While accesses to Paddock Road would be impacted by this option, impacts to neighbours could be managed through appropriate controls.

The 'do nothing' option and realignment options 2 – 4 do not meet the objective of the proposal to improve road safety and reduce the accident rate on this section of the Oxley Highway. They also each fail one or more of the other criteria that were used in the option assessment as follows:

Do nothing option

- Does not satisfy proposal objectives
- Unacceptable impacts on road users
- Unacceptable impacts on stakeholders and neighbours.

Option1 satisfies the proposal objectives and the constructability requirements and has an acceptable impact on road users and neighbours.

Option 2

- Does not satisfy proposal safety objective
- Considerable constructability challenges associated with intersecting existing carriageway. These require considerable expenditure to resolve.
- Significant impacts on road users associated with required levels of traffic management (ie need to reduce traffic to one lane when works occurring on / near existing carriageway).

Option 3

- Does not satisfy proposals safety objective.
- Considerable constructability challenges associated with intersecting existing carriageway. These require considerable expenditure to resolve.

Option 4

- Does not satisfy proposal safety objective
- Unacceptable cost due to need to import large amounts of material as fill
- Considerable constructability challenges associated with intersecting existing carriageway
- Significant impacts on road users associated with required levels of traffic management (ie need to reduce traffic to one lane when works occurring on / near existing carriageway).

2.5 Preferred option

Option 1 is the preferred option; it includes design features (eg curves of appropriate radius) to improve safety of the road and cross drainage (in the form of appropriate capacity culverts) to eliminate flooding and thus satisfies the project objectives. Option 1 also satisfies each of the development criteria.

Traffic management to allow the required work to be undertaken would be required in accordance with an approved traffic management plan (TMP), including appropriate stakeholder and public notice to minimise socio-economic impacts. The TMP would address management of potential impacts to neighbours accessing Paddock Road.

The nature of the proposal is such that environmental mitigation measures are available to reduce any negative impacts to local biodiversity.

The objectives of the EP&A Act encourage Ecologically Sustainable Development (ESD). The 'integration' principle of ESD requires the integration of economic, social development and environmental considerations into the decision making process for all developments. These factors are consistent with the preferred options for the proposal.

2.6 Design refinements

Since Option 1 was identified as the preferred option, the route has been refined to account for engineering and cost constraints. Given that the refined route falls within the footprint, all assessments undertaken prior to the refinement remain valid. The alignment indicated in the various figures and discussed within the text here forth is the refined Option 1.

3 Description of the proposal

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

3.1 The proposal

Roads and Maritime proposes to realign the Oxley Highway, about six kilometres west of Wauchope in the Port Macquarie-Hasting local government area. The proposal includes upgrading the Oxley Highway – Rosewood Road interstation. There has been a history of traffic accidents along this section of the highway as well as regular inundation of the road in lower level areas affecting journey reliability. The proposal therefore aims to improve road safety and journey reliability by straightening the road and raising the road so that it is more immune to flood water.

The proposed alignment traverses road formation and Traveling Stock Reserve adjacent the existing Oxley Highway as well as a portion of private property to the south that would be have to be acquired by Roads and Maritime.

The proposal is shown in Figure 1–2 and Figure 3–1.

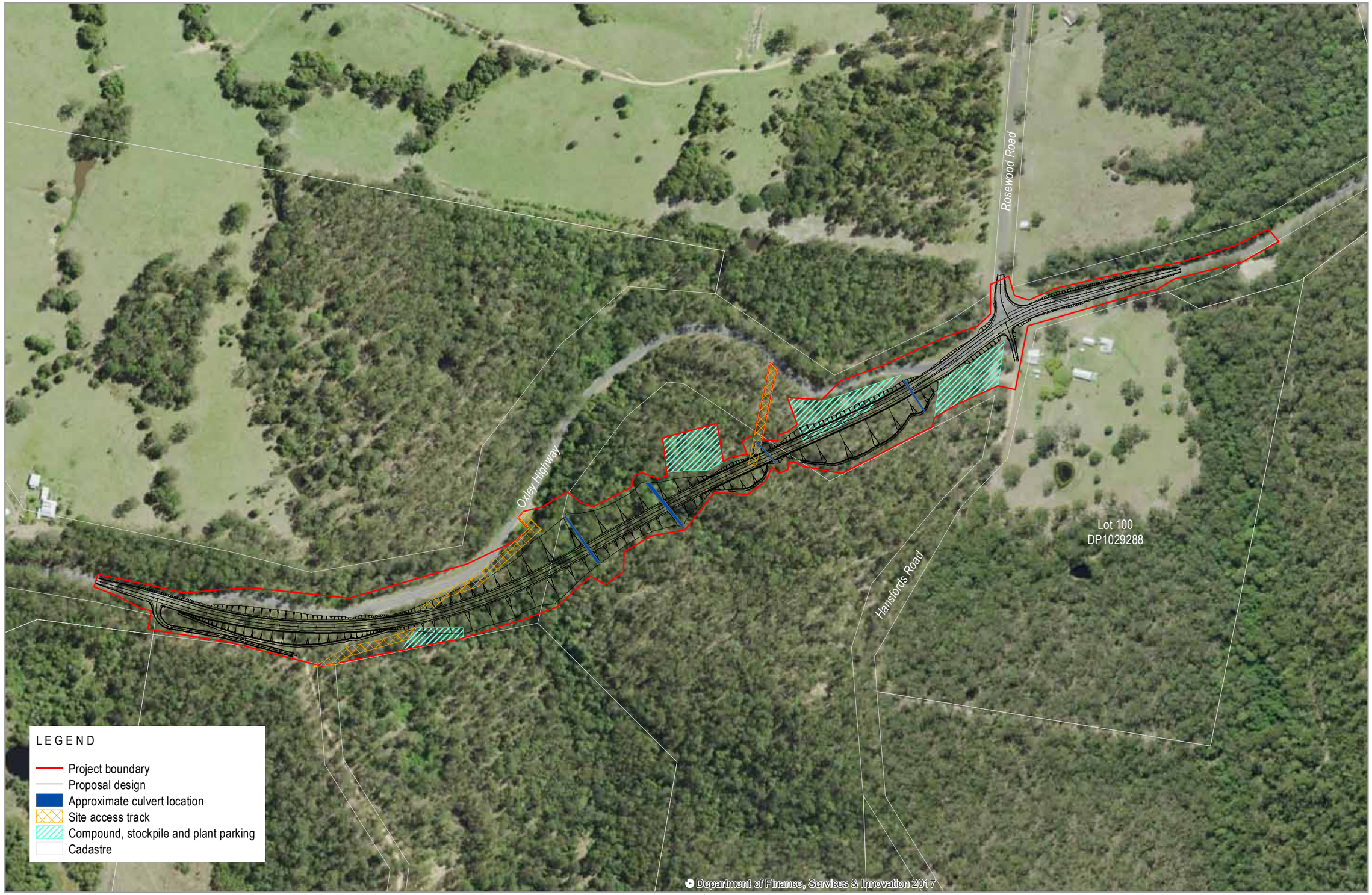
Key features of the proposal would include:

- Realignment of approximately 1.25 kilometres of road
- The footprint of the final road would be approximately 60,000 square metres
- Maximum vertical grades of 6 per cent
- Four new culverts, as follows:
    - A deeply incised drainage line would require a culvert under the road formation and a minor realignment up to a maximum of 20 metres upstream and downstream of the road; the culvert would likely comprise one box culvert constructed as a cast in-situ slab with precast culvert units. The headwall and wing-walls would be either cast in-situ or precast
    - The other three new culverts would be pipe culverts of minimum 600 millimetre diameter and probably made from precast reinforced concrete.
- Three culvert extensions would be required; at chainages 4920, 5620 and 5800
- Two existing culverts would be required to be extended
- One or more temporary sediment basins to manage site water quality during construction may be required. No sediment or water quality basin would be required once the project was finished
- Embankments with a 2:1 (or steeper) slope would likely be required for cut and fill batters. Batters would be stabilised by application of topsoil and re-vegetation wherever practical. Where re-vegetation is not deemed practical, alternative stabilisation methods such as rock revetment may be applied
- Longitudinal drainage including catch drains at top of batters, table drains (unlined and concrete lined), concrete kerb and guttering, subsoil lines, batter drains and ancillary items such as scour protection
- Tie-ins at each end of the proposed realignment of up to 300 metres. Tie-ins would be two lanes (with two-way traffic) upon completion. During construction of (and near to) the tie-ins, there would be potential for one lane, alternate flow under traffic control or traffic lights during construction (on a 24/7 basis)
- New rural boundary fencing along the proposed property acquisition boundary to the south of the realignment
- Safety barrier at the top of fills where the batter is steeper than 4:1
- One permanent and two temporary compounds, plant parking areas and stockpile sites (within the assessed footprint)

- Access tracks these would be kept within construction footprint where possible. An existing track off the existing highway would also be utilised. Benches may be required to be placed on batters to facilitate future maintenance needs.
- A borrow pit may be required to supplement fill requirements. Import of fill may be required from another RMS project at Spencers Cutting project located approximately six kilometres east of Wauchope.
- Storage of the old road pavement in situ for potential future use as quality fill or select material.

Information shown is for illustrative purposes only

Drawn by: AB Checked by: RE Reviewed by: JC Date: 20/11/2017
Source of base data:SixMap



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Proposal Features

3.2 Design

3.2.1 Design criteria

The concept design for the proposal is based on the following design criteria:

- Design speed 80 kilometres per hour
- Typical cross section is two 3.5 metre lanes
- 1.5 metre sealed shoulders
- 0.5 metre verge
- Gravel pavement
- Safety barriers on top of fills where fill is less than 4:1 slope
- Batter slopes expected to be 2:1 cut and fill but cut batters may be steepened depending on geotechnical conditions.

A typical cross-section of the alignment is presented in Appendix A.

3.2.2 Engineering constraints

The following engineering constraints would need to be addressed:

- Topography; the alignment traverses multiple incised gullies and would require considerable earthworks as described further in Section 3.3
- Volumes of fill required for the proposal would exceed material generated from the cuts and thus the proposal includes an option for importing fill as described in Section 3.3.4
- The gullies and ephemeral drainage lines would require installation of culverts (as described in Section 3.1) and environmental controls to recue risk of impacts to waterways (as described further in Section 6.2).

3.3 Construction activities

3.3.1 Work methodology

The following activities would be undertaken in carrying out the proposed works:

- Installation and operation of traffic control including single lane alternate flow operation of the Oxley Highway for extended periods (up to 12 months)
- Geotechnical investigation including seismic testing
- Relocation of boundary fencing (once property adjustments are complete)
- Installation and removal of temporary site compound facilities and temporary stockpile sites
- Installation and removal of temporary environmental protection measures
- Vegetation and tree removal
- Stripping, temporary stockpiling and placement of topsoil
- Installation of drainage lines, structures and ancillary works (scour protection)
- Blasting (possible), ripping and excavation of earthworks and rock cutting
- Crushing of excavated rock
- Installation of surface and subsurface drainage
- Relocation, importation and placement of earth and rock fill (note: imported earthworks are likely to be sourced from another RMS site to the east of Wauchope Spencer's Cutting and will require hauling through town)
- Import and placement of road pavement (note: imported pavement material is likely to be sourced from quarries located to the east or south of Wauchope and will require hauling through town)
- Sealing and line marking of road pavement
- Installation of road furniture including guideposts, safety barrier and signage
- Traffic switch to new alignment when required
- Salvage of road pavement material from existing road formation.

3.3.2 Construction hours and duration

The proposal would begin in February 2018 with an anticipated duration of approximately 18 months.

Work would be undertaken during extended working hours detailed below:

Monday – Friday	7:00am to 6:00pm
Saturday	8:00am to 5:00pm
Sunday and Public Holidays	No work

However, work may be undertaken outside of the extended hours on weekends or nights to minimise traffic impacts on the community. If it is determined that work outside the nominated hours is required, an assessment would be undertaken to determine the safeguards and mitigations required. Noisy works will be undertaken in accordance with RMS "Construction Noise and Vibration Guideline" August 2016.

Additionally traffic control with portable traffic signals or manual operation will be implemented where traffic control is proposed overnight and on weekends.

3.3.3 Plant and equipment

The main equipment and plant required for the proposal would include:

- Drill rigs and explosives for blasting (possible)
- Excavator with bucket, rock hammer / pick and mulch head
- Dozer with ripper
- Gravel crushing and screening plant
- Graders
- Rollers
- Bob cat
- Trucks
- Post driver
- Chainsaw
- Power tools
- Spray seal truck
- Mulcher / chipper
- Concrete truck
- Concrete vibrator.

It should be noted that the above list is not exhaustive and that the exact equipment requirements would be determined during construction planning.

3.3.4 Earthworks

Earthworks would include:

- Removal of vegetation and topsoil
- Significant amounts of cut and fill
- Excavation and/or filling to reshape table drains
- Widening of fill embankments at culvert sites
- Boxing out road shoulders for widening.

At the time of writing this report, it was not possible to accurately estimate earthwork volumes required for the proposal as the exact alignment is subject to change. These changes could result in large changes in the amount of cut and/or fill required. However, it is estimated that approximately 51,000 cubic metres of material would be taken from the cuts whilst there would be approximately 54,000 cubic metres of material would be required for fill. The shortfall volume would potentially be imported from Spencers Cutting as described in Section 3.1. It is noted that these volumes may also be subject to change due to difficulties of accurate prediction of amounts of rock and unsuitable material produced during construction.

3.3.5 Source and quantity of materials

The shortfall volume of general fill would potentially be imported from Spencers Cutting as described in Section 3.1. Imported pavement material would likely be sourced from quarries also located to the east of Wauchope. Where possible, select fill will be sourced from on-site with potential off-site sources from licensed quarries including Sancrox Quarry and Milligans Road Quarry.

3.3.6 Traffic management and access

The likely number of vehicular movements per day during construction would be up to 50 heavy vehicles and 30 light vehicles.

Traffic routes for material transport from off-site sources (where required) would be as follows:

- Spencers Cutting project (RMS project): via Oxley Highway, through Wauchope
- Sancrox Quarry: via Sancrox Road, Rawdon Island Road and Oxley Highway or Sancrox Road, Pacific Highway and Oxley Highway
- Milligans Road Quarry: via Bago Road to Wauchope and Oxley Highway.

It is noted that type and quantity of material that would be imported from off-site sources would depend on actual volumes and material required and that these may vary from current estimates

3.4 Ancillary facilities

A number of ancillary facilities would be required to support the construction of the proposal. Whilst the exact location of these facilities has not been determined at the time of writing (due to ongoing design changes), the facilities would be located in accordance with a number of principals intended to reduce the risk of environmental impact. The indicative locations of the facilities (indicated in Figure 3–1) have considered the ecological, heritage, hydrological and social constraints of the site. The proposed ancillary facilities described below would be operated within the standard construction hours described in Section 3.3.2.

- Site compound – the site compound would contain / be used for site offices, toilets, light and heavy vehicle parking and storage / laydown of materials (including chemicals and fuel) and plant. It would be located within the assessed proposal footprint. An indicative location is indicated in Figure 3–1. The final location of the compound would meet the following criteria:
    - At least 40 metres away from the nearest waterway
    - Of low ecological and heritage conservation significance
    - At least 100 metres away from residential dwellings and other land uses that may be sensitive to noise
    - Of relatively level ground
    - Outside the 1 in 10 year ARI floodplain.
- Stockpiles – stockpiles including topsoil, engineered fill, unsuitable fill and mulch would be within the assessed proposal footprint. The generation of materials to be stockpiled may occur during the installation of sediment basins, stripping of topsoil, clearing and mulching of vegetation and general excavation. Stockpiles would be managed in accordance with the RMS *Stockpile Site Management Procedure* and the *QA Specification R44 – Earthworks*
- An indicative location is indicated in Figure 3–1. The final locations of the stockpiles would meet the following criteria:
    - Be located at least 15 metres clear of all areas of possible concentrated water flow
    - Be located at least 10 metres from a waterway (except mulch)
    - In accordance with the Roads and Maritime Technical Procedure: Mulch Management:
        - Mulch stockpiles are to be located more than 20 metres from a watercourse and outside the 1 in 10 year ARI floodplain (if in place for <1 month)
        - Mulch stockpiles are to be located more than 50 metres from a watercourse and outside the 1 in 10 year ARI floodplain (if in place for >1 month)
    - Be located on land with slopes less than 10 per cent
    - Be of low ecological and heritage conservation significance.

- Borrow pit – a borrow pit may be required in the case of the aforementioned quarries not providing suitable material (and suitable material being identified on-site). A borrow pit would be within the assessed proposal footprint; an indicative location is indicated in Figure 3–1. The final locations of the borrow pit, if required, would meet the following criteria:
    - Be located at least five metres clear of all areas of possible concentrated water flow
    - Be located at least 30 metres from a waterway
    - Be located on land with slopes less than 10 per cent
    - Be of low ecological and heritage conservation significance.

Access tracks would also be required; these would be kept within the approved proposal boundary where possible. An existing access track (approximate location indicated in Figure 3–1) would be used where practical.

3.5 Public utility adjustment

Overhead powerlines and underground telecommunications cross the Oxley Highway near Rosewood Road to a single property on the southern side of highway. The proposal, however, would not require the adjustment of these (or any other) utilities. No impact to services to surrounding utilities or services is expected.

3.6 Property acquisition

The proposal would require the acquisition of land owned by the Bunyah Local Aboriginal Land Council (BLALC). Roads and Maritime have consulted with the BLALC and reached agreement with regard to transfer of the required portion of land (indicated in Figure 3–2) which described in Table 3-1.

The proposal would also require the acquisition of a portion of Travelling Stock Reserve which is managed by the NSW Local Land Services. Roads and Maritime are consulting with NSW Local Land Service with regard to transfer of the required portion of land indicated in Figure 3–2 and described in Table 3–1.

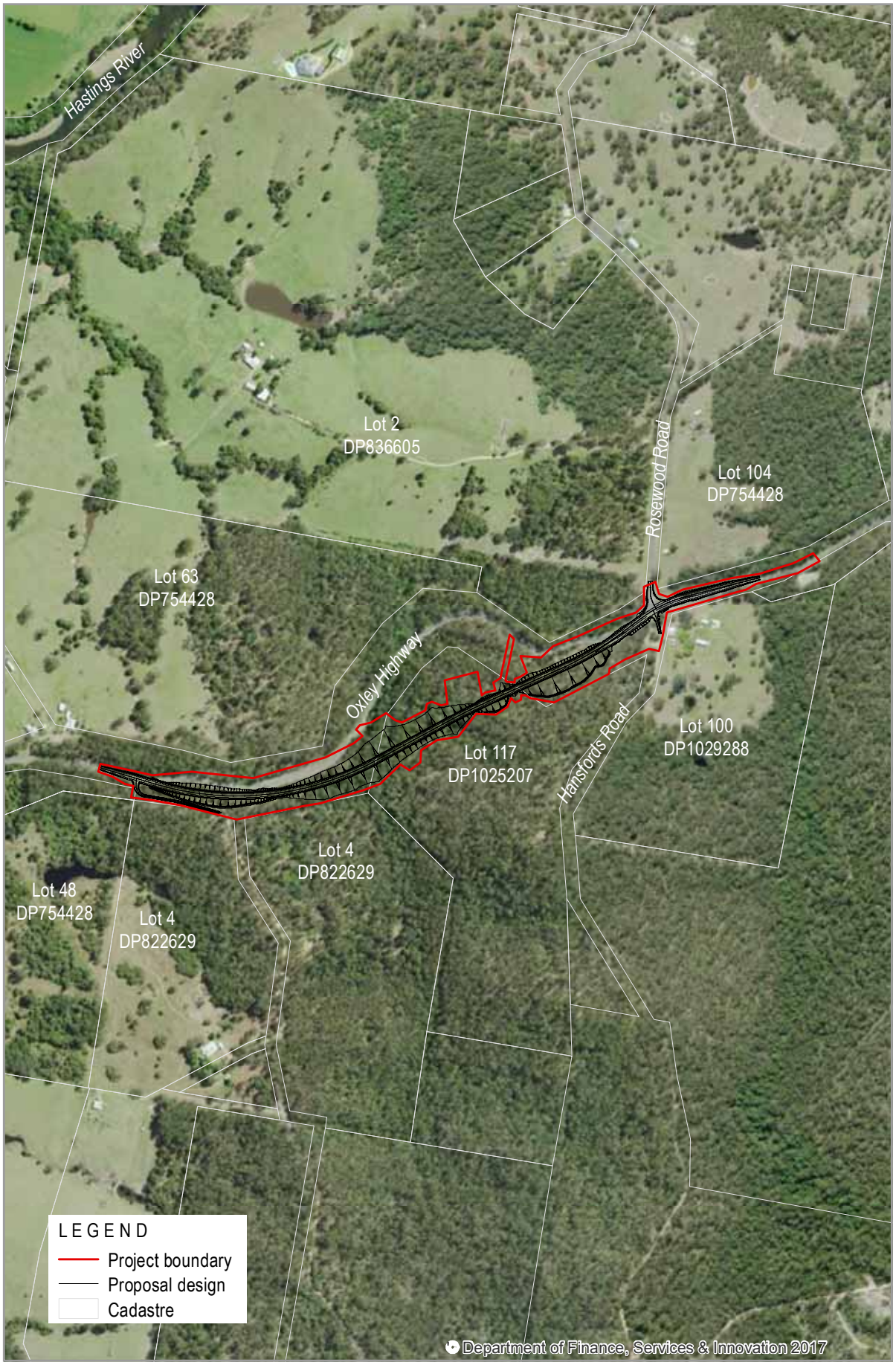
All property acquisition would be undertaken in accordance with the *Land Acquisition Information Guide* (Roads and Maritime, 2012) and the *Land Acquisition (Just Terms Compensation) Act 1991*.

Table 3–1: Proposed property acquisition

Area ID	Description	Total area	Acquisition type	Current owner	Lot and DP	Land use zone (LEP)
1	Forested area to the south of the existing highway; owned by the Bunyah Local Aboriginal Land Council	3,77 ha would be acquired	Potential acquisition	Bunyah Local Aboriginal Land Council	Lot 117 DP1025207	RU1 – Primary Production
2	Travelling Stock Reserve. Cleared and vegetated areas alongside existing highway	Land acquisition to be determined	Potential acquisition	Crown Lands	NA	RU1 – Primary Production

Information shown is for illustrative purposes only

Drawn by: AB Checked by: RE Reviewed by: JC Date: 20/11/2017
Source of base data:SixMap



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Proposed Property Acquisition

4 Statutory and planning framework

4.1 Environmental Planning and Assessment Act 1979

4.1.1 State Environmental Planning Policies

State Environmental Planning Policy (Infrastructure) 2007

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

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

In this clause (94 (2)) *and clause 96, a reference to development for the purpose of road infrastructure facilities includes a reference to development for any of the following purposes if the development is in connection with a road or road infrastructure facilities:*

(a) construction works (whether or not in a heritage conservation area), including:
- *(i) temporary buildings or facilities for the management of construction, if they are in or adjacent to a road corridor, and*
- *(ii) creation of embankments, and*
- *(iii) extraction of extractive materials and stockpiling of those materials, if:*
  - *(A) the extraction and stockpiling are ancillary to road construction, or*
  - *(B) the materials are used solely for road construction and the extraction and stockpiling take place in or adjacent to a road corridor, and*
- *(iv) temporary crushing or concrete batching plants, if they are used solely for road construction and are on or adjacent to a road corridor, and*
- *(v) temporary roads that are used solely during road construction,*

(b) emergency works, or routine maintenance works, carried out on an existing public road or on land that is adjacent to such a road (including on land to which State Environmental Planning Policy No 14—Coastal Wetlands or State Environmental Planning Policy No 26—Littoral Rainforests applies but, if they are on such land, only if any adverse effect on the land is restricted to the minimum possible to allow the works to be carried out),

(c) alterations or additions to an existing road (such as widening, duplication or reconstruction of lanes, changing the alignment or strengthening of the road),

(d) environmental management works, if the works are in or adjacent to a road corridor.

As the proposal is for a road and road infrastructure facilities and is to be carried out by or on behalf of Roads and Maritime NSW, it can be assessed under Part 5 of the *Environmental Planning and Assessment Act 1979*. Development consent is not required.

The proposal is not located on land reserved under the *National Parks and Wildlife Act 1974* and does not affect land or development regulated by State Environmental Planning Policy No. 14 - Coastal Wetlands, State Environmental Planning Policy No. 26 - Littoral Rainforests, State Environmental Planning Policy (State and Regional Development) 2011 or State Environmental Planning Policy (State Significant Precincts) 2005 (formerly known as Major Development).

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 14 – Coastal Wetlands
State Environmental Planning Policy 14 (SEPP14) aims to ensure coastal wetlands are preserved and protected in the environmental and economic interests of the state. The closest SEPP 14 Coastal Wetlands are located approximately 11 kilometres from the site. It is not expected the work would have any impact on any SEPP14 Coastal Wetlands.

State Environmental Planning Policy 26 – Littoral Rainforest
State Environmental Planning Policy 26 (SEPP 26) aims to provide a mechanism for the consideration of applications for development that is likely to damage or destroy littoral rainforest areas with a view to the preservation of those areas in their natural state. The closest SEPP 26 Littoral Rainforest occurs approximately 23 kilometres away from the site. The proposal would not impact on any areas of SEPP 26 Littoral Rainforest.

State Environmental Planning Policy 44 – Koala Habitat Protection
State Environmental Planning Policy 44 (SEPP 44) aims to encourage the conservation and management of natural vegetation areas that provide habitat for Koalas, to ensure permanent free-living populations would be maintained over their present range. Clause 6 of SEPP 44 states that the SEPP applies only to land 'in relation to which a development application has been made'. Clause 94 of ISEPP precludes the proposal from requiring consent therefore Part 2 of SEPP 44 does not apply to the proposal. It is Roads and Maritime policy, however, to consider environmental issues relating to their work to the fullest extent possible, including impacts on Koalas. The proposal requires removal of habitat which contains the Schedule 2 Koala feed tree Tallowwood, with very low numbers of Tallowwood likely to require removal (less than 10). The site is unlikely to represent potential Koala habitat (as per the definitions in SEPP 44) as Tallowwood occur very infrequently and do not comprise >15 per cent of the forest canopy.

No Koalas were recorded at the site and no Koala activity cells are mapped at or in close proximity to the site (refer to *Port Macquarie-Hastings Koala Habitat and Population Assessment*, Biolink 2013). On this basis, impacts to occupied Koala habitat are likely to be relatively low.

State Environmental Planning Policy 71 – Coastal Protection
State Environmental Planning Policy 71 (SEPP 71) predominately aims to protect and manage the natural, cultural, recreational and economic attributes of the New South Wales coastal zone. The site is not situated within the SEPP 71 coastal zone, which is located approximately six kilometres north-east of the site. No impacts would occur.

State Environmental Planning Policy (Rural Lands) 2008
State Environmental Planning Policy (Rural Lands) 2008 aims to facilitate the orderly and economic use and development of rural lands for rural and related purposes. Part of this objective relates to the maintenance of the social, economic and environmental welfare of the state and the reduction of land use conflicts.

The proposal would not impose any significant environmental impacts to local agricultural land.

4.1.2 Local Environmental Plans

Post Macquarie-Hastings Local Environmental Plan 2011
The proposal is located on land that is covered by the Post Macquarie-Hastings Local Environmental Plan (LEP) 2011.

The site comprises the following zoning:
- RU1 – Primary Production.

The RU1 – Primary Production zone includes the following objectives Pursuant to the LEP:
- *To encourage sustainable primary industry production by maintaining and enhancing the natural resource base*
- *To encourage diversity in primary industry enterprises and systems appropriate for the area*

- *To minimise the fragmentation and alienation of resource lands*
- *To minimise conflict between land uses within this zone and land uses within adjoining zones.*

The proposal is not directly consistent with the zone objectives as they are targeted toward primary industry activities, however the proposal for the realignment / upgrade of a road would not contradict or hinder the achievement of these objectives in the context of the LEP.

The LEP mapping does not identify any heritage items within or immediately adjacent to the site, however there is a listed heritage item (I040 – Crossroads Cemetery off Rosewood Road) located approximately 450 metres north-east of the proposed site and works. This would not be impacted by the proposal and no further consideration is required.

The proposal is precluded from requiring development consent under Clause 94 of the ISEPP which overrides the provisions of the LEP.

4.2 Other relevant NSW legislation

Table 4–1 lists other NSW legislation that is relevant to the assessment of the proposal and comments on their implications for the proposal.

Table 4–1: Other relevant NSW legislation

Legislation	Section(s)	Comment
Fisheries Management Act 1994	Section 199	The proposal involves excavation and installation of culverts in and near water courses, therefore written notification by a public authority (other than a local government authority) must be provided to the Minister (Department of Primary Industries - DPI) for dredging and reclamation work on land that is permanently or intermittently submerged by water. NSW Fisheries was consulted and confirmed that water features that intersect the subject section of the Oxley Highway are not Key Fish Habitat and the proposed works do not trigger referral under the *Fisheries Management Act 1994.* Yippin Creek, which is Key Fish Habitat, is toward the eastern end of the project. Should this be affected, then re-referral of the project to DPI Fisheries will be required in accordance with the *Fisheries Management Act 1994.*

Legislation	Section(s)	Comment
	Sections 219-220	A permit is required when barriers to the movement of fish including water course crossings are to be constructed or modified (with regard to Key Fish Habitat). The proposal involves works within and near water courses, the installation of water course crossings (culverts) and the minor realignment of a drainage line. However, NSW Fisheries has confirmed that water features that intersect the subject section of the Oxley Highway are not Key Fish Habitat and the proposed works do not trigger referral under the *Fisheries Management Act 1994.* Yippin Creek, which is Key Fish Habitat, is toward the eastern end of the project. Should this be affected, then re-referral of the project to DPI Fisheries will be required in accordance with the *Fisheries Management Act 1994.*
	Sections 204-205	It is not expected that any mangroves, seagrass or other marine vegetation would be damaged as a result of the proposal therefore a Permit to Harm is not required from DPI prior to commencement.
	Schedules 4, 4A, 5 and 6	The proposal is considered unlikely to have a significant impact on any threatened aquatic species or communities listed under Schedules 4, 4A, 5 and 6 of the FM Act.
Heritage Act 1977		This section of the Oxley Highway and Rosewood Road are not listed on Roads and Maritime's s170 Heritage and Conservation Register and are not of heritage significance.
National Parks and Wildlife Act 1974	Sections 118D(2)(b)(ii)	It is an offence to cause damage to habitat of threatened species, endangered populations or endangered ecological communities unless it was essential for the carrying out of an activity in accordance with an approval of a determining authority within the meaning of Part 5 of that Act if the determining authority has complied with that Part. This REF forms the Part 5 assessment however every measure would be implemented to minimise impacts to habitat of threatened species, endangered populations or endangered ecological communities.
	Sections 87(1), 90	The provisions of the Act are unlikely to be triggered by the proposal. Indigenous heritage investigations by RMS found that the proposal is unlikely to have an impact on indigenous heritage. Work would cease if an artefact or place of significance is disturbed or encountered during the proposal and the appropriate Local Aboriginal Land Council (LALC) and OEH Cultural Heritage Division notified immediately.

Legislation	Section(s)	Comment
Biosecurity Act 2015		In NSW, the administration of noxious weed control is the responsibility of the Minister for Primary Industries under the Biosecurity Act 2015 (BA Act). The Act is implemented and enforced by the Local Control Authority for the area, usually local government or NSW Agencies. Roads and Maritime are therefore required to control noxious weeds on land under their control. A search of the DPI noxious weed declarations (16 March 2017) within the Port Macquarie-Hastings LGA control area listed 150 species, of which several occur at the site (Lantana, Annual Ragweed, Camphor Laurel, Fireweed). For all plants that are regulated, including Annual Ragweed and Camphor Laurel the BA Act states that there is a general biosecurity duty to ensure the biosecurity risk is prevented, eliminated or minimised, so far as is reasonably practicable. For Lantana and Fireweed – the mandatory provision includes that importation or sale is illegal in NSW.
Protection of the Environment Operations Act 1997		No Protection of the Environment Policies (PEPs) are relevant to the proposal. Licenses would be required pursuant to the *Protection of the Environment Operations Act 1997* if Scheduled Activities listed under the Act are undertaken (also refer to Section 7.3 of this report). The Roads and Maritime staff and/or contractors working on behalf of the Roads and Maritime are required to notify OEH when a 'pollution incident' occurs that is likely to impact upon the environment.
	Section 115	It is an offence to negligently dispose of waste in a manner that harms the environment. Waste would be managed in accordance with the *Waste Avoidance and Resource Recovery Act 2001*. The proposal would aim to reduce the environmental impact of dumping waste and include mechanisms to recover resources and reduce the production of waste where possible.
	Section 120	It is an offence to pollute any waters of the State. The REF includes safeguard and mitigation measures to ensure that the proposal does not result in pollution of waters.
	Section 143	A signed s143 Notice must be submitted prior to transporting waste generated by or for Roads and Maritime to a place that is not owned by Roads and Maritime and is not a licensed landfill or resource recovery facility.

Legislation	Section(s)	Comment
Threatened Species Conservation Act 1995 (repealed by BC Act; however transitional provisions apply as outlined below)	Schedules 1, 1A, 2 and 3	A Biodiversity Assessment has been undertaken and schedules of threatened species, populations and ecological communities were assessed and are unlikely to be significantly impacted upon by the proposal (refer to Section 6.1 and Appendix D). The Biodiversity Assessment states that no treated flora were recorded, however three threatened fauna species (Eastern Bentwing-bat, Glossy Black-cockatoo, Little Bentwing-bat) were recorded at the site, with potential that several other threatened fauna species may occur on an opportunistic or seasonal basis. Mitigation measures are recommended to manage potential impacts to biodiversity. The proposal would contribute to the KTPs 'clearing of native vegetation', 'Loss of hollow-bearing trees' and 'Removal of dead wood and dead trees'. However, no significant impact or risk to subject species in the local context is likely. No other KTPs would be noticeably contributed to by the proposal.
Water Management Act 2000	Section 91 (2)	Work within waterfront lands or those comprising of extraction or management of water may be subject to approval if they constitute a 'controlled activity'. Roads and Maritime is, however, exempt from the need to obtain a Controlled Activity Approval. The site comprises a permanent watercourse and several ephemeral watercourses. Should Roads and Maritime seek to extract water from water lands or its associated tributaries, a permit under s56 would be required.
Crown Lands Act 1989		As 'The Paddock Road' is a Crown road, the *Crown Lands Act 1989* is applicable. Roads and Maritime will need to consult with Department of Industry – Lands in regard to the works and potential impacts (including potential closure of one branch) on this road, as well as any other requirements. The subject section of the Oxley Highway road reserve is also Crown Land and/or a Traveling Stock reserve. Roads and Maritime have and will continue to consult with Department of Industry – Lands and Local Land Services as applicable.

Legislation	Section(s)	Comment
Local Land Services Act 2013	Part 5A Land Management (native vegetation)	Provisions of the Act apply to clearing native vegetation in rural parts of the State (including the RU1 Zone). Pursuant to Section 60O (*Clearing authorised under other legislation*), *for the purposes of this Part, the clearing of native vegetation in a regulated rural area is authorised under other legislation in any of the following cases:* *(b) Other planning authorisation - The clearing was:* *(ii) an activity carried out by a determining authority within the meaning of Part 5 of that Act after compliance with that Part, or* *(iii) authorised by an approval of a determining authority within the meaning of Part 5 of that Act granted after compliance with that Part.* As the proposal is a Part 5 Activity, the vegetation clearing is authorised under other legislation (namely Part 5 of the EP&A Act).
Biodiversity Conservation Act 2016	Part 7 and Clause 7.8	The *Biodiversity Conservation Act 2016* (BC Act) came into effect on 25 August 2017 and replaces the *Threatened Species Conservation Act 1995*, *Native Vegetation Act 2003* and *National Parks and Wildlife Act 1974* (animal and plant provisions only); and the *Local Land Services Act 2013* (LLS Act) will be amended. Public authorities may elect to include a biodiversity development assessment report for development under Part 5 of the EP&A Act, and to be subject to the new biodiversity offsets scheme. However, as noted under the transitional arrangements (refer below), former planning provisions apply to the project, and assessments have been completed in accordance with this.
	Schedules 1, 2 and 3	Section 7.3 of the BC Act requires a test of significance for determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats. As noted under the transitional arrangements (refer below), former planning provisions apply to the project.

Legislation	Section(s)	Comment
Biodiversity Conservation (Savings and Transitional) Regulation 2017	Section 29 (Former planning provisions continue to apply to pending Part 5 assessment and certain modifications of activities)	The former planning provisions continue to apply (and Part 7 of the new Act does not apply) to (as relevant): *(a) an environmental impact assessment that is a pending Part 5 assessment.* At Section 27, a pending Part 5 assessment of an activity for which the proponent is also the determining authority, means: *(b) an environmental impact assessment of the activity that began under Part 5 of the Environmental Planning and Assessment Act 1979 before the commencement of the new Act (but only if the proponent commences to carry out the activity within 18 months after the commencement of the new Act).* As this Part 5 assessment began before the commencement of the *Biodiversity Conservation Act 2016* (on 25 August 2017), the transitional arrangements and therefore former planning provisions apply, subject to the proponent (Roads and Maritime) commencing to carry out the activity within 18 months after the commencement of the new Act (being 25 February 2019).
Native Title Act 1994 (NSW)	Section 103	Notification is required to any representative Aboriginal / Torres Strait Islander bodies for an area concerned where an act is to take place. There are no active registrations or determinations for Native Title Claims within the Port Macquarie-Hastings LGA.

4.3 Commonwealth legislation

4.3.1 Environment Protection and Biodiversity Conservation Act 1999

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

Potential impacts to these biodiversity matters are also considered as part of chapter 6 of the REF and Appendix D (Biodiversity Assessment).

Based on the assessments undertaken and the findings outlined in this REF, the proposal is unlikely to result in significant impacts to matters of national environmental significance. Accordingly, the proposal has not been referred to the Commonwealth Government Department of the Environment and Energy.

Findings – matters of national environmental significance (other than biodiversity matters)

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

Findings – nationally listed biodiversity matters

The assessment of the proposal's impact on nationally listed threatened species, populations, endangered ecological communities and migratory species found that there is unlikely to be a significant impact on relevant matters of national environmental significance. Chapter 6 of the REF describes the safeguards and management measures to be applied.

4.3.2 Native Title Act 1993

There are no active registrations or determinations for Native Title Claims within the Port Macquarie-Hastings LGA.

4.4 Confirmation of statutory position

The proposal is categorised as development for the purpose of a road and/or road infrastructure facilities and is being carried out by or on behalf of a public authority. Under 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 Part 5 of the EP&A Act.

Roads and Maritime is the determining authority for the proposal. This REF fulfils Roads and Maritime's obligation under clause 111 of the EP&A Act 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.

The *Biodiversity Conservation Act 2016* (BC Act) and its supporting regulations commenced on 25 August 2017. However, transitional arrangements are in place, including those for pending Part 5 Assessments under the EP&A Act. Pursuant to Section 29 of the Biodiversity Conservation (Savings and Transitional) Regulation 2017, as this Part 5 assessment began before the commencement of the BC Act (on 25 August 2017), the transitional arrangements and therefore former planning provisions apply, subject to the Proponent commencing to carry out the activity within 18 months after the commencement of the new BC Act (being 25 February 2019).

5 Consultation

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

5.1 Consultation strategy

The works form part of a larger strategy by Roads and Maritime to improve the Oxley Highway. Roads and Maritime have communicated this strategy through a route safety review and community updates and information over a number of years. Recent information has included completed, current and planned improvements and works, including the subject proposal. Such initiatives would continue periodically as the Oxley Highway improvements continue.

A communications officer has been appointed to the proposal. A project-specific consultation strategy would be developed and implemented in accordance with the Roads and Maritime *Community Involvement – Practice Notes and Resource Manual and Roads and Maritime Minor Project procedure, Communications for minor projects (ILC-MP-TP0-301)*. The consultation strategy would identify stakeholders and proposed communication methods to effectively engage and inform the relevant and affected stockholders and community.

A determination has been sought for the proposal to not be placed on public exhibition. It is considered appropriate and justified not to display the REF for the following reasons:

- The community has been informed of the intent of Roads and Maritime to progressively undertake road improvements / upgrades within the area, including the Oxley Highway. As discussed in section 5.2, the proposal would generally be consistent with past consultation and community expectations regarding the works
- Consultation with directly affected parties would result in appropriately targeted consultation outcomes
- The proposal is unlikely to cause significant concern within the community, and general notification to the broader community as well as targeted consultation with directly affected stakeholders would be appropriate given the context.

5.2 Community involvement

As mentioned previously, the works form part of a larger strategy by Roads and Maritime to improve the Oxley Highway. Roads and Maritime have communicated this intension and strategy through a route safety review and relevant community updates and information packages over a number of years.

Roads and Maritime and Centre for Road Safety (CRS) have previously sought feedback on:

- Locations on the Oxley Highway where people think road safety is a problem
- Near miss crash locations along the Oxley Highway
- General road safety issues on the Oxley Highway.

The comment period closed on 13 December 2013. Community feedback was collated via an online mapping tool. Email, post and community information sessions were conducted in Warren, Tamworth, Gunnedah, Walcha and Wauchope during November 2013.

From the Oxley Highway safety review, comments posted on the community engagement website and made at the community workshops focussed on road safety on the length of the Oxley Highway from the Pacific Highway to the Mitchell Highway. The key road safety issues raised by the community at the workshops are summarised below:

- Access and limited vision to some properties was raised as a safety issue
- Submissions concerning curves at the end of some straights on the eastern escarpment were raised as a road safety issue. It was suggested that these curves had higher crash rates

- One submission suggested a realignment of the full length of the eastern escarpment
- The road alignment and width were significant issues raised in relation to the section of highway between the Pacific Highway and the New England Highway.

The subject project responds to such matters in the context of a pronounced bend near Rosewood Road, west of Wauchope. More specifically for the subject project, given the rural context and relatively small number of directly affected parties / landholders, not placing the proposal on public exhibition is justified. Roads and Maritime have and will continue to undertake targeted stakeholder consultation with relevant members of the community and those directly impacted by the proposal.

As part of the targeted consultation, relevant (including adjoining) landholders have been contacted via letter and telephone. Notification of website updates would also occur when relevant.

Emergency services would be notified via letter, as would the Wauchope Chamber of Commerce.

Matters raised to date during the consultation process specific to the subject proposal are listed in Table 5-1.

Table 5–1: Summary of issues raised by the community

Group	Issue raised	Response / where addressed in REF
Residents	• Landholder at 2615 Oxley Highway, Bago, requested no acquisition and no adjustment of access.	• This property is not proposed to be affected by acquisition or changes to its access (see proposal description).
Local Business	• N/A	• N/A
[others as required]	• Member of the public requested that the extent of work be as long as possible (request to maximum the extent of improvements).	• As detailed in this report and the options analysis, the project extent and scope has been determined by both the objectives to improve this section of road and also financial constraints.

5.3 Aboriginal community involvement

Consultation with the Aboriginal community for this project has involved two main components. These include consultation in relation to Aboriginal Cultural Heritage Consultation and Investigation (PACHCI) procedures and also acquisition of land for the project that is owned by the Bunyah Local Aboriginal Land Council. Roads and Maritime have met with representatives of the Bunyah Local Aboriginal Land Council, and this consultation is ongoing. The Roads and Maritime Property Section are managing the acquisition process in accordance with Roads and Maritime Services property acquisition procedures and guidelines.

A Roads and Maritime Procedure for Aboriginal Cultural Heritage Consultation and Investigation (PACHCI) was carried out by a Roads and Maritime's Aboriginal Cultural Heritage Officer who advised that the proposal was unlikely to have an impact on Aboriginal cultural heritage (refer to Appendix E).

Table 5–2: Summary of Roads and Maritime Procedure for Aboriginal Cultural Heritage Consultation and Investigation

Stage	Description
Stage 1	Initial Roads and Maritime assessment. The assessment was based on the following due diligence considerations: • *The project is unlikely to harm known Aboriginal objects or places* • *The AHIMS search did not indicate any known Aboriginal objects or places in the study area* • *The study area does not contain landscape features that indicate the presence of Aboriginal objects, based on the Office of Environment and Heritage's Due diligence Code of Practice for the Protection of Aboriginal objects in NSW and the Roads and Maritime Services' procedure* • *The cultural heritage potential of the study area appears to be reduced due to past disturbance* • *There is an absence of sandstone rock outcrops likely to contain Aboriginal art.*

5.4 ISEPP consultation

Port Macquarie-Hastings Council has been consulted. This included discussion of the concept design, including potential closure of one branch / access to "The Paddock Road". Port Macquarie-Hastings Council was formally consulted via letter about the proposal as per the requirements of clause 13 of the ISEPP on the basis that 'The Paddock Road' (which was originally thought to be a Council road) would be impacted. However, Council confirmed in a response (Appendix K) that this road was not their asset and that it was listed as a Crown Road and may be a forestry access. No objection or major concerns were raised with regard to the project by Council. Comments that have been raised as a result of this consultation are outlined below in Table 5–3.

Table 5–3: Issues raised through ISEPP consultation

Agency	Issue raised	Response / where addressed in REF
Port Macquarie-Hastings Council	• Council would appreciate being kept informed of the design development and given the opportunity to review further design revisions. • Council would also like to know what is planned for the redundant road reserve area once the Highway has been realigned. Council would be interested in gaining hardstand area within a road reserve to aid road maintenance and construction activities in the surrounding area. Any advice on this matter would be greatly appreciated.	• Future design revisions / the final design route would be provided to Council by Roads and Maritime. • Roads and Maritime has suggested that the project would be agreeable to the redundant road remaining as hardstand as long as all legislative requirements are met. Roads and Maritime would continue to engage with Council regarding this matter as necessary.

The proposal does not impact Council infrastructure, local heritage items or flood liable land, according to the requirements under clauses 13 to 15 of the ISEPP. Under clause 16 of ISEPP, the development is not identified as being specified development and no further ISEPP consultation is required.

Appendix C contains a statutory consultation checklist that documents how ISEPP consultation requirements have been considered.

5.5 Government agency and stakeholder involvement

On the advice of Port Macquarie-Hastings Council, a letter was sent via email to Forestry Corporation NSW (Craig Busby, Roading Manager – North) as Port Macquarie-Hastings Council did not identify 'The Paddock Road' as their asset and suggested it was listed as a Crown Road and may be a forestry access road. To date, no response has been received from Forestry Corporation NSW. No major impact or imposition to the use the 'The Paddock Road' is expected as the main branch would remain operational. Prior to the commencement of works, Roads and Maritime should notify Forestry Corporation NSW or Crown Lands of the works.

Local Land Services NSW and Crown Lands has/will be consulted by Roads and Maritime via telephone and in writing as required due to the existence of Crown Land and a Travelling Stock Reserve near the project location. As 'The Paddock Road' is listed as a Crown Road, the *Crown Lands Act 1989* would be applicable. Roads and Maritime consulted with Department of Industry – Lands (Crown Land) on 1 September and it was advised that two legs of The 'Paddock Road' are on land administered by another authority (either RMS or if a travelling stock reserve Local Land Services) and approval should be sought from that authority. Roads and Maritime sent a request to Local Land Services on 4 September with regard to the works any potential concerns. At the time of writing this report, no response had been received to date.

Given the site comprises a permanent watercourse and several ephemeral watercourses, and is in proximity to potential Key Fish Habitat, the Department of Primary Industries (Fisheries) was consulted about potential dredging and reclamation works, and fish passage. The response provided (in Appendix K) raised no major issues as it was confirmed that water features that intersect the subject section of the Oxley Highway are not Key Fish Habitat and the proposed works do not trigger referral under the *Fisheries Management Act 1994*. It was noted however that the works are within close proximity to Yippin Creek which is located on the eastern edge of the project boundary. If the proposed scope of works changes to incorporate any works within Yippin Creek, which is Key Fish Habitat, then re-referral of the project to DPI Fisheries will be required in accordance with the *Fisheries Management Act 1994*.

In light of the proximity of the works to Key Fish Habitat and the potential for indirect impacts it was highlighted that the works must be carried out in accordance with all applicable requirements of the Blue Book (*Managing Urban Stormwater: Soils and Construction*). The relevant environmental assessment and mitigation measures are outlined in chapter 6.

No other government agency or stakeholder consultation beyond the statutory and other consultation detailed above is required.

5.6 Ongoing or future consultation

As indicated above, targeted stakeholder and community consultation is proposed regarding the scope of work and proposed traffic disruptions. Planned traffic disruptions during the proposed work would also be advised through advertising using the Roads and Maritime traffic alert system, as well as other means identified via the consultation strategy developed for the proposal.

The Roads and Maritime Property Section are managing the acquisition of land and ongoing consultation will occur with Bunyah Local Aboriginal Land Council (land holder). The acquisition process will be in accordance with Roads and Maritime Services property acquisition procedures and guidelines.

Roads and Maritime would continue to liaise with Port Macquarie-Hastings Council with regard to further design revisions / the final design and what is planned for the redundant road reserve area once the highway has been realigned (as Council indicated it was interested in gaining hardstand area within a road reserve to aid road maintenance and construction activities in the surrounding area).

Roads and Maritime would liaise with Department of Industry - Lands and Forestry and Local Land Services NSW (as relevant) with regard to any impact to Crown Land, the Travelling Stock Reserve and The Paddock Road. Any landowner that relies on access to a Crown Road (eg 'The Paddock Road') would also be consulted.

6 Environmental assessment

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

- Potential impacts on matters of national environmental significance under the EPBC Act
- The factors specified in the 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 B.

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

6.1 Biodiversity

6.1.1 Methodology

GeoLINK were commissioned to undertake a biodiversity assessment for the proposal (Appendix D) and undertook the following:

- Prior to undertaking field surveys, searches of the following databases were completed. Database search results are provided within the biodiversity assessment at Appendix D:
    - OEH:
        - BioNet
        - Critical habitat register
        - Vegetation Types Database
    - NSW Department of Primary Industries (DPI) Fisheries:
        - Threatened Species Viewer
        - NSW WeedWise
        - Key Fish habitat mapping
        - Register of critical habitat
    - Australian Government Department of Environment :
        - Protected Matters Search Tool (PMST) for Matters of National Environmental Significance (MNES)
        - Directory of important wetlands
        - Critical habitat register
    - Australian Government Bureau of Meteorology:
        - Atlas of Groundwater Dependent Ecosystems (GDE)
- Prior to the site assessment, the following desktop review was completed:
    - Review of Koala habitat mapping and data in the *Port Macquarie-Hastings Koala Habitat and Population Assessment* (Biolink 2013)
    - Review of Council vegetation mapping (Phillips *et al.* 2013)
- The site was assessed over three days (March 20-22 2017) by Ian Colvin (GeoLINK Senior Ecologist) as follows:
    - March 20: preliminary inspection and nocturnal survey
    - March 21: vegetation survey, habitat tree assessment, Koala scat survey and nocturnal survey
    - March 22: Anabat collection and dawn bird survey.

The site assessment utilised the following methodology over approximately 13 hours in the field (not including passive Anabat survey while not present at the site):

- Random meander of vegetation communities within and adjacent to the alignment and compilation of a flora inventory using a modified Braun-Blanquet index
- Targeted survey for any threatened flora and/or Endangered Ecological Communities (EECs)

- Survey by visual inspection using binoculars, and marking of hollow-bearing trees with spray-paint and red and white flagging tape using hand held global positioning system. Each hollow-bearing tree within the realignment footprint was painted with an identification number for future reference by project surveyors
- Recording the occurrence and extent of any biosecurity risk weeds listed in the *Biosecurity Act 2015*
- Opportunistic survey of all fauna based on visual or aural observations
- Targeted Koala survey using the Spot Assessment Technique (SAT; Phillips & Callaghan 2011)
- Two nights nocturnal survey utilising the following techniques: spotlighting, Anabat detection, call playback for threatened frogs and owls.

The site assessment followed several previous days of heavy rainfall, with some local flooding. All watercourses were active and standing water persisted in some depressions and disturbed areas.

The biodiversity assessment report at Appendix D provides detailed description of vegetation surveys and targeted fauna surveys.

6.1.2 Existing environment

The study area comprises a well forested landscape which has been partially cleared and disturbed for agriculture and road construction. The site occurs within the NSW North Coast bioregion, subregion NNC07 (Macleay Hastings) as per Interim Biogeographic Regionalisation for Australia (IBRA, version 7) and lies within the Wauchope Coastal Foothills (Wcf) Mitchell Landscape (DECC 2002).

Wauchope Coastal Foothills comprise hills and ranges of the coastal fall with dendritic drainage on faulted Carboniferous lithic sandstone, siltstone, tuff and some limestone. General elevation is 50 to 460 metres, local relief is 200 metres. Red and yellow texture-contrast soils occur throughout. Dry hardwood forests of Blackbutt (*Eucalyptus pilularis*), White Mahogany (*Eucalyptus acmenoides*), Spotted Gum (*Corymbia variegata*), Forest Red Gum (*Eucalyptus tereticornis*), Grey Gum (*Eucalyptus punctata*) and Red Bloodwood (*Corymbia gummifera*) occur.

The site comprises dry sclerophyll forest on low undulating hills, with a permanent watercourse and several ephemeral watercourses. The closest conservation reserve is Bago Bluff National Park, an area of 4023 hectares which occurs approximately one kilometre west of the site. Broken Bago State Forest occurs immediately south and east of the site and connects to Bago Bluff National Park.

6.1.3 Potential impacts

The proposal would result in a number of ecological impacts related to the removal of vegetation and habitat (including habitat for threatened species) during the construction phase. Potential impacts of the work are discussed in the following points and relate to both the construction and operational stages of the proposal.

- The proposal requires the removal of native vegetation within the north of Lot 117 and the road reserve. An estimated 4.38 hectares of dry sclerophyll forest (PCT 872) would be removed. Removal of native vegetation is recognised as a Key Threatening Process (KTP) in the TSC Act.
- The proposal would remove an estimated 4.38 hectares of dry sclerophyll forest which provides known habitat for at least three threatened fauna species (Eastern Bentwing-bat, Glossy Black-cockatoo, Little Bentwing-bat), and potential habitat for a number of other threatened species identified from confirmed OEH database records. It is likely that eight hollow-bearing trees would be removed for the work.
- The main watercourse in the west of the site provides potential habitat for the Giant Barred Frog and Stuttering Frog and would also be disturbed for the installation of culverts and associated drainage.

- The work is characteristic of the following KTPs with regard to threatened fauna:
    - Clearing of native vegetation
    - Loss of hollow-bearing trees
    - Removal of dead wood and dead trees.
- No threatened flora would be removed as a result of the proposal.
- Significant impacts to waterways and aquatic habitats are not expected to result from the proposal, as the only area of impact would be where the western watercourse is bridged by culverts and associated drainage work. This area is flanked by rainforest species and no instream aquatic vegetation occurs. The culverts and related infrastructure occur along approximately 31 metres of the watercourse and would result in the removal of riparian vegetation over an estimated area of 155 square metres. Ephemeral watercourses comprise bare grassy gullies and provide poor habitat for aquatic fauna, with standing water providing habitat for frogs and invertebrates only. Impacts to waterways and aquatic habitats would include:
    - Temporary displacement of fauna (frogs and invertebrates)
    - Loss of 155 square metres of riparian and aquatic habitat, including removal of small amounts of woody debris
    - Localised turbidity and sedimentation during construction
    - Temporary obstruction to fish passage during construction
    - Modification of the watercourse if concrete lining / scour protection is implemented in the construction design.
- The proposal would result in significant fragmentation of an existing forest landscape. While this is unlikely to affect some fauna groups (birds, microbats), it may result in barriers to movement for less mobile fauna such as frogs, reptiles and ground-dwelling mammals, or gliding mammals which are unable to cross large distances (eg Feathertail Glider). As the site occurs within a well-connected landscape, it is unlikely that the proposal would limit any fauna movements within a local sense as dispersal routes to the east, west and south would remain unaffected.
- Following construction it would be expected that fauna mortality would initially occur as animals attempt to disperse across the newly aligned road. Fauna groups / species most susceptible to roadkill are likely to include macropods (Red-necked Wallaby, Eastern Grey Kangaroo), ground-dwelling mammals (Northern Brown Bandicoot, Long-eared Bandicoot), arboreal mammals (Common Brushtail Possum, Koala), birds (Tawny Frogmouth, Australian Magpie, Rainbow Lorikeet) and reptiles (Carpet Python, Eastern Water Dragon, Bearded Dragon); based on studies by Queensland Department of Main Roads (2002).
- Dispersal opportunities for aquatic fauna are unlikely to be affected as the culverts on the main watercourse would allow free movement. The culvert design ensures that fish passage would not be affected.
- The proposal would result in duplication of edge effects to the new alignment similar to that which already occur. This includes colonisation of batters and waste ground by introduced grasses and weeds (eg Pigeon Grass, Rhodes Grass, Ragweed, Cobblers Pegs), and potential for further invasion and establishment of woody weeds and climbers along vegetation edges (eg Lantana, Winter Senna, Privet, Passionfruit Vines).
- While a variety of pest species may occur in the locality (eg Common Myna, Rabbit, Feral Cat, Red Fox), the proposal would not result in any potential to increase conditions such that pest species would become more prevalent. The Red Fox is known to utilise newly created tracks and roads, however the open nature of the existing forest and existing tracks and clearings poses few limitations to the species.
- Drainage work (including pipes and culverts) would ensure that hydrology is unchanged.
- Once operational, the proposal would bring noise impacts from the existing highway closer to less disturbed areas of habitat. It would be expected that fauna species in close proximity to the existing road alignment are habituated to noise and no significant impacts to breeding or behaviour would occur during operation of the new alignment. While no street lighting is proposed, the new road would make adjacent habitat areas subject to headlight shine from passing vehicles. Adjacent habitat areas would ensure substantial areas for retreat or relocation for sensitive fauna species.

- No significant increase in vibration during road operation is expected.

The proposal would have a minor cumulative negative effect due to the required habitat loss / modification and generation of greenhouse gas emissions during work. However, the impacts of the proposal are not substantial in a local context and would not impose a significant effect locally. Additionally the mitigation measures detailed below would ensure such impacts are minimised.

The mitigation measures tabled in Section 6.1.4 include several additional safeguards that are intended to reduce risk of fauna mortality and removal of habitat associated with the removal of a significant number of habitat trees. Such measures include those associated with a two-step clearing process and the installation of nest-boxes to compensate for removal of hollow- bearing trees.

Conclusion on significance of impacts

The proposal is not likely to significantly impact threatened species, populations or ecological communities or their habitats, within the meaning of the *Threatened Species Conservation Act 1995* or *Fisheries Management Act 1994* 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 *Environment Protection and Biodiversity Conservation Act 1999*.

6.1.4 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Biodiversity	A flora and fauna management plan will be prepared in accordance with Roads and Maritime's *Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects* (RTA, 2011) 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 *Landscape Guideline* (RTA, 2008) • Pre-clearing survey requirements • procedures for unexpected threatened species finds and fauna handling • procedures addressing relevant matters specified in the *Policy and guidelines for*	Contractor	Detailed design / Pre-construction	Core standard safeguard B1 Section 4.8 of QA *G36 Environment Protection*

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
	fish habitat conservation and management (DPI Fisheries, 2013) • Protocols to manage weeds and pathogens.			
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	Core standard safeguard B2
Biodiversity	A Nest Box strategy is to be developed in consultation with a qualified ecologist. This strategy should detail nest box design, placement and any monitoring requirements. Nest boxes would be installed to compensate for any hollow-bearing trees removed. Nest boxes would be installed at a ratio of four boxes per hollow removed (based on data collected during clearing works), hence ensuring no net loss of hollows. Nest boxes must be of types suited to fauna species likely to occur in the locality (eg parrots, microbats, small arboreal mammals) and placed in undisturbed forest areas at least 50m from the road edge. Nest boxes should be placed on the southern side of the new alignment where fauna can utilise areas of consolidated and unfragmented forest. Concurrence / agreement with adjacent property owners will be required if the acquired road reserve is insufficient to accommodate the required number of nest boxes.	Contractor	Detailed design / Pre-construction	Additional Safeguard

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Removal of native vegetation	Pre-clearing surveys will be undertaken in accordance with *Guide 1: Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Contractor	During construction	Standard Safeguard
Removal of native vegetation	Native vegetation will be re-established in accordance with Guide 3: Re-establishment of native vegetation of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011).	Contractor	Post construction	Standard Safeguard
Removal of native vegetation	The unexpected species find procedure is to be followed under *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011) if threatened ecological communities, not assessed in the biodiversity assessment, are identified in the proposal site.	Contractor	During construction	Standard Safeguard
Removal of threatened species habitat and habitat features	Habitat removal will be minimised through detailed design.	Contractor	Detailed design	Standard Safeguard
Removal of threatened species habitat and habitat features	Habitat removal will be undertaken in accordance with *Guide 4: Clearing of vegetation and removal of bushrock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Contractor	During construction	Standard Safeguard
Removal of threatened species habitat and habitat features	Habitat will be replaced or re-instated in accordance with *Guide 5: Re-use of woody debris and bush rock and Guide 8: Nest boxes of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Contractor	During construction	Standard Safeguard

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Removal of threatened species habitat and habitat features	The unexpected species find procedure is to be followed under *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011) if threatened fauna, not assessed in the biodiversity assessment, are identified in the proposal site.	Contractor	During construction	Standard Safeguard
Removal of threatened species habitat and habitat features	Vegetation clearing should be completed in a staged manner: • Stage 1 comprising clearing of non-hollow-bearing trees • Stage 2 comprising clearing of hollow-bearing trees. Stage 2 clearing must be undertaken at least the day after stage 1 clearing and preferably within one week of the stage 1 clearing around any hollow-bearing trees.	Contractor	During construction	Additional Safeguard
Removal of threatened species habitat and habitat features	An ecologist/wildlife carer must be present during stage 2 clearing and inspect all hollow-bearing trees for fauna, and capture and release fauna outside the construction footprint on the property as appropriate (eg at night for nocturnal fauna).	Contractor	During construction	Additional Safeguard
Removal of threatened species habitat and habitat features	Hollow-bearing trees must be removed carefully to reduce the potential for fauna mortality. Each tree should be 'bumped' with the excavator bucket several times and a minimum of two minutes provided prior to felling to allow any resident fauna to vacate. Should fauna be detected, additional safeguards may be identified by the project ecologist (eg additional bumps, or selective limb removal).	Contractor	During construction	Additional Safeguard

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Removal of threatened plants	Pre-clearing surveys will be undertaken in accordance with *Guide 1: Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Contractor	During construction	Standard Safeguard
Removal of threatened plants	The unexpected species find procedure is to be followed under *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011) if threatened flora species, not assessed in the biodiversity assessment, are identified in the proposal site.	Contractor	During construction	Standard Safeguard
Aquatic impacts	Aquatic habitat will be protected in accordance with *Guide 10: Aquatic habitats and riparian zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011) and Section 3.3.2 *Standard precautions and mitigation measures of the Policy and guidelines for fish habitat conservation and management Update 2013* (DPI (Fisheries NSW) 2013). All project drainage designs must be cross referenced against these documents to ensure compliance pre works commencing.	Contractor	During detailed design / Pre-Construction / During construction	Standard Safeguard
Groundwater dependent ecosystems	Interruptions to water flows associated with groundwater dependent ecosystems will be minimised through detailed design.	Contractor / RMS	Detailed design	Standard Safeguard
Changes to hydrology	Changes to existing surface water flows will be minimised through detailed design.	Contractor /RMS	Detailed design	Standard Safeguard
Fragmentation of identified habitat corridors	Connectivity measures will be implemented in accordance with the *Wildlife Connectivity Guidelines for Road Projects* (RTA 2011).	Contractor	Detailed design, during construction and post construction	Standard Safeguard

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Edge effects on adjacent native vegetation and habitat	Exclusion zones will be set up at the limit of clearing in accordance with *Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Contractor	During construction	Standard Safeguard
Injury and mortality of fauna	Fauna will be managed in accordance with *Guide 9: Fauna handling of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Contractor	During construction	Standard Safeguard
Invasion and spread of weeds	Weed species will be managed in accordance with *Guide 6: Weed management of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Contractor	During construction	Standard Safeguard
Invasion and spread of pests	Pest species will be managed within the proposal site.	Contractor	During construction	Standard Safeguard
Invasion and spread of pathogens and disease	Pathogens will be managed in accordance with *Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Contractor	During construction	Standard Safeguard
Noise, light and vibration	Shading and artificial light impacts will be minimised through detailed design.	Contractor	Detailed design	Standard Safeguard

6.1.5 Biodiversity offsets

In accordance with the Roads and Maritime *Guideline for Biodiversity Offsets* (Roads and Maritime 2011), biodiversity offsets are not considered necessary for the proposal as no native vegetation that is core habitat for any threatened species, population or community in the locality would be removed or modified.

6.2 Water Quality, hydrology and flooding

6.2.1 Existing environment

There are a number of first and second order ephemeral drainage lines (Figure 6–1) associated with gullies that transect or are proximate to the proposed alignment. During a site visit on 6 March 2017, there was no water observed within these drainage lines with the exception of a deeply incised gully in which a small pool of standing water was observed. Given the steep topography of the area and the history of flooding of the existing highway in the area, it is expected that these drainage lines experience relatively high flow events periodically (and it is noted that the capacity of the multiple existing culverts under the existing highway may be insufficient which may contribute to inundation of the existing highway). Most of the ephemeral drainage lines depicted in Figure 6–1 ultimately drain to the Hastings River, approximately one kilometre north of the site.

The proposed works are within close proximity to Yippin Creek (classified as Key Fish Habitat) which is located on the eastern edge of the project boundary

Flooding of the Hastings River occurs mainly as a result of summer to autumn weather events, although major flooding has also occurred in the winter months. In a major flood, areas are progressively inundated by local runoff backing up in creeks and drain; and finally by overbank flow. While the proposal is outside of the Port Macquarie-Hastings LGA flood planning area (which is based on a 100-year ARI plus allowance for climate change and a freeboard), as mentioned earlier the ephemeral drainage lines that transect the existing highway are known to flood (and inundate the existing highway).

Climate data from the Port Macquarie Airport, approximately 17 kilometres east, south-east of the site, provides average monthly rainfall and temperatures (BoM 2017). The climate within this region is characterised by cool to mild winters and warm summers. As indicated in Table 6.1, the mean annual rainfall 1416.7 millimetres. Typically, most of this rain occurs between November and June, peaking in February with 165.5 millimetres on average.

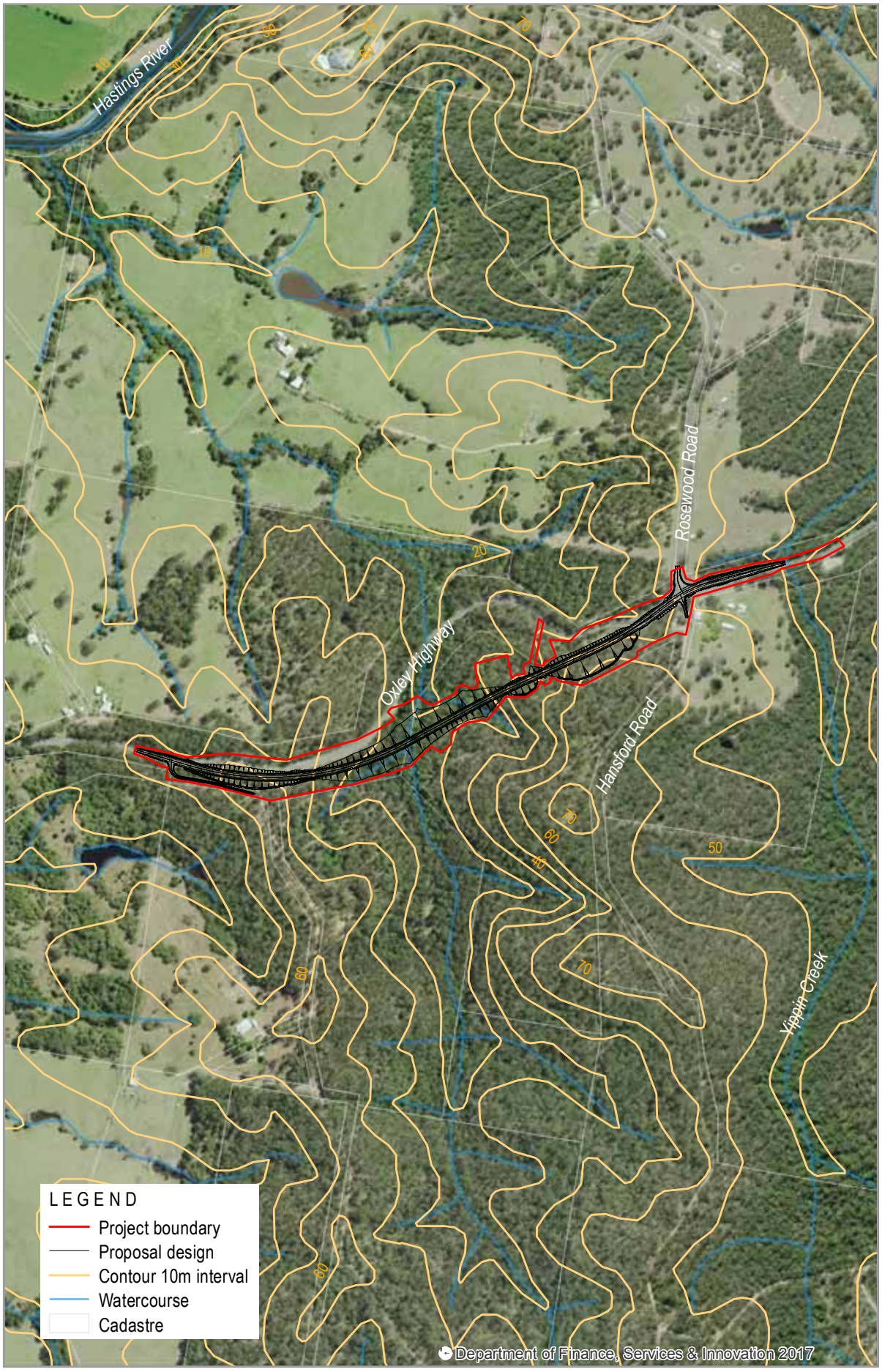
Table 6–1: Climate data for Port Macquarie (BoM 2017)

Month	Mean daily max. temp (°C)	Mean daily min temp (°C)	Mean monthly rainfall (mm)
January	27.7	18.4	155.3
February	27.6	18.4	165.5
March	26.4	16.9	158.1
April	24.3	13.9	142.5
May	21.6	10.4	116.2
June	19.5	8.2	136.6
July	18.8	6.5	64
August	20.2	6.8	69.2

Month	Mean daily max. temp (°C)	Mean daily min temp (°C)	Mean monthly rainfall (mm)
September	22.6	9.5	61.8
October	24.1	11.9	73.1
November	25.2	15.2	154.8
December	26.7	16.9	108
Annual	**23.7**	**12.8**	**1416.7**

Information shown is for illustrative purposes only

Drawn by: AB Checked by: RE Reviewed by: JC Date: 20/11/2017
Source of base data:SixMap



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North

Hydrology

6.2.2 Policy setting

Under Clause 228 of the EP&A Regulation 2000, a range of environmental impacts, including impacts to water sources and quality; flooding and drainage must be taken into account when assessing the impact of an activity for the purposes of Part 5 of the EP&A Act.

The Water Management Act 2000 is the overarching NSW legislation that provides for the sustainable and integrated management of the water sources of the State for the benefit of both present and future generations.

Clause 4.5 Competence, Training and Awareness, Clause 6.5 Soil and Water Management and Clause 6.12 Chemicals, Dangerous Goods and other potential Contaminants of RTA QA Specification G35 provides guidelines for managing water quality on Roads and Maritime projects.

6.2.3 Criteria

The most suitable performance criterion for water quality is to minimise potential surface and subsoil water impacts. This criterion would be achieved by adhering to best practice management with regards to implementing the proposal. The most suitable performance criterion with regards to flooding is to ensure the final design of the proposal does not experience flooding under a 100-year ARI flood event.

6.2.4 Potential impacts

Construction

Potential impacts to water quality, hydrology and flooding that could arise from the proposal include:

- Change in hydrology of the ephemeral drainage lines that may:
    - impact on aquatic biota (including fish and fish passage) within and upstream and downstream of the proposal area
    - exacerbate flooding of the existing highway
- Erosion and sedimentation that may affect ephemeral drainage lines that flow to the Hastings River (refer to Section 6.4)
- Turbidity and sedimentation of local aquatic habitats and waterways
- Pollution of local water quality from machinery, construction materials and spills. A variety of dispersible liquid materials would be used which pose a potential pollutant threat to local water quality. These liquids include but are not limited to diesel, unleaded petrol, machinery oils and lubricants. The nature of these liquids and their ability to disperse away from the site means that they could have a negative impact on ground or surface water on or adjacent to the site, especially during rain.

It is noted that if the proposed scope of works changes to incorporate any works within Yippin Creek, which is Key Fish Habitat, then re-referral of the project to DPI Fisheries will be required in accordance with the *Fisheries Management Act 1994*.

Operation

If the proposed culvert placement and design did not account for the existing hydrology of the site there would be risk of inundation of the new alignment during high rainfall events. However, the proposal has considered the hydrology of the site, particularly the steep topography in the area and the existing drainage lines that periodically experience high flow events related to the relatively high rainfall experienced in the area as described in Section 6.2.1.

It is not expected that following completion of the proposal the operation of the proposal would have any impact on water quality. Whilst road runoff has the potential to cause a decline in water quality in the downstream areas due to discharges of fuel, oil and rubber from the road surface during rainfall events it should be noted that this occurs under existing conditions.

6.2.5 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Water quality, hydrology and flooding	A CEMP will be prepared in accordance with the specifications set out in the *QA Specification G36 - Environmental Protection (Management) System* to guide the implementation of environmental impact mitigation measures, identify key roles and responsibilities for environmental monitoring and methods of reporting incidents.	Contractor	Detailed design / Pre-construction	Additional safeguard
	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. The SWMP will be reviewed by a soil conservationist on the Roads and Maritime list of Registered Contractors for Erosion, Sedimentation and Soil Conservation Consultancy Services. The SWMP will then be revised to address the outcomes of the review.	Contractor	Detailed design / Pre-construction	Core standard safeguard SW1 Section 2.1 of QA G38 *Soil and Water Management*
	A site specific Erosion and Sediment Control Plan will be prepared and implemented as part of the SWMP. 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	Core standard safeguard SW2 Section 2.2 of QA G38 *Soil and Water Management*

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
	Watercourse crossings shall be designed in consultation with the DPI (Fisheries NSW), EPA, DPI WATER and DoE, and where feasible and reasonable, be consistent with the Guidelines for *Controlled Activities Watercourse Crossings (Department of Water and Energy, February 2008), Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (Fairfull and Witheridge, 2003), *Policy and Guidelines for Fish Friendly Waterway Crossings* (NSW Fisheries, February 2004), and *Policy and Guidelines for Fish Habitat Conservation and Management* (DPI Fisheries, 2013). All project drainage designs must be cross referenced against these documents to ensure compliance prior to works commencing.	Contractor	Detailed design / Pre-construction	Additional safeguard
	Work must cease and all sediment control measures checked and repaired or re-installed (if required) if heavy rainfall is forecast.	PEng	During work	Additional safeguard
	Work must only commence once all erosion and sediment controls have been established. The controls would be maintained in place until the work is complete and all exposed erodible materials are stable.	PM	Pre-work	Additional safeguard
	A spill containment kit must be available at all times. All personnel must be made aware of the location of the kit and trained in its effective deployment.	PEng	During work	Additional safeguard
	If a spill occurs, the Roads and Maritime's Environmental Incident Classification and Management Procedure must be followed and the Roads and Maritime Project Manager notified as soon as practicable.	PM, PEng	Pre-work	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
	Required fuels and other liquids must be stored in self-safe chemical storage containers.	PM	Pre-work, during work	Additional safeguard
	Unnecessary storage of fuels, lubricants or other compounds on-site must be avoided.	PM, PEng	During work	Additional safeguard
	Cleaning of tools and equipment must occur within a designated wash-down bay. The wash-down bay must be placed so that water filtered through the geofabric does not flow directly into drainage lines, but is captured and allowed to soak into the ground.	PM, PEng	Pre-work, during work	Additional safeguard
	Water utilised for cleaning of tools must be minimised and obtained from a licensed location or town water supply.	PEng	During work	Additional safeguard
	All equipment must be maintained in good working order and operated according to manufacturer's specifications.	PEng	Pre-work, during work	Additional safeguard

6.3 Soils, erosion and sedimentation

6.3.1 Existing environment

The surrounding area of the site ranges from steeply sloped hills through to flat and undulating cleared flood plain areas associated with the Hastings River. The proposed alignment traverses heavily timbered areas of the eastern escarpment. The proposed alignment is mainly hilly to very hilly and intersects a number of gullies of varying grade and depth.

Soil Landscapes of the Kempsey (Land and Water Conservation1999) describe the alignment and surrounding areas as:

- Landscape of undulating and rolling low hills on Moripo Dacite
- Slopes of 3 – 32 per cent
- Relief of 30 – 90 metres
- Elevation of 20 – 60 metres.

Land Water Conservation (1999) indicate that soils of the area are moderately deep (90 – 250 centimetres) and are commonly grey-brown Podzolic soils and other brown duplex soils on the mid and upper slopes. It is noted that there is a potential water erosion hazard, associated with the soils which are dispersible and moderately to highly erodible and include sodic soils.

A search of the NSW EPA Contaminated Sites online database (see results in Appendix F) on 29 March 2017 returned no contaminated sites for the Port Macquarie-Hastings Council LGA. It is considered unlikely that there would be significant soil contamination associated with historical land use in the proposed alignment given the steep topography of much of the site.

The Port Macquarie-Hastings Council Local Environment Plan (LEP) indicates that there are no acid sulfate soils in the vicinity of the proposal.

6.3.2 History

An inspection of the site (22 March 2017) immediately after a heavy rainfall event identified some erosion associated with the gullies (it is noted that it was evident that the gullies had experienced a high flow event).

6.3.3 Policy setting

Under Clause 228 of the *EP&A Regulation 2000,* a range of environmental impacts, including impacts associated with soils, erosion and sedimentation; must be taken into account when assessing the impact of an activity for the purposes of Part 5 of the EP&A.

Clause 4.5 Competence, Training and Awareness and Clause 6.5 Soil and Water Management and 6.6 Air Quality *RTA QA Specification G35* provides guidelines for the management of soils, erosion and sediment on Roads and Maritime projects. Erosion and sediment control measures would be in accordance with the Landcom / Department of Housing Managing Urban Stormwater, *Soils and Construction Guidelines* (the Blue Book).

6.3.4 Criteria

The most suitable performance criterion for soils, erosion and sediment is to minimise the likelihood of impacts to the natural drainage lines and gullies, or impacts to the existing road infrastructure. This criterion would be achieved by adhering to best practice management of soil and water throughout construction.

6.3.5 Potential impacts

Construction

Potential impacts to soils, erosion and sedimentation may occur during construction works and establishment / utilisation of the site compound / stockpiles (eg from soils disturbances, introducing rock materials with fines or soiled equipment, water diversion resulting in scouring, etc). Given the steep nature of some areas of the site, the potential for high rainfall events (and associated high flow events in the drainage lines) and the erodible soils noted earlier, there is significant risk of erosion where management controls are not in place. However, the effective implementation of sedimentation and erosion controls can effectively reduce such risks and avoid the dispersion of soils and particles. The safeguards listed below would minimise any potential erosion of sedimentation risks.

Whilst it is considered unlikely that there would be contaminated soil within the proposed alignment there would remain a low risk of disturbance of unidentified contaminated soil during construction.

As stated earlier the Port Macquarie-Hastings Council Local Environment Plan (LEP) indicates that there are no acid sulfate soils in the vicinity of the proposal.

Operation

During operation of the proposal, there is risk of ongoing erosion upstream and downstream of the alignment if inappropriate cross drainage (ie culverts) is installed during the construction phase. The design of the proposal however, accounts for high flow events and includes cross drainage in the form of culverts as described in Section 3.

6.3.6 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Soil and erosion	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. The SWMP will be reviewed by a soil conservationist on the Roads and Maritime list of Registered Contractors for Erosion, Sedimentation and Soil Conservation Consultancy Services. The SWMP will then be revised to address the outcomes of the review.	Contractor	Detailed design / Pre-construction	Core standard safeguard SW1 Section 2.1 of QA G38 *Soil and Water Management*
	A site specific Erosion and Sediment Control Plan will be prepared and implemented as part of the SWMP. 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	Core standard safeguard SW2 Section 2.2 of QA G38 *Soil and Water Management*
	No work would commence prior to installation of appropriate sediment control structures.	PM	During work	Additional safeguard
	Erosion and sediment controls are to be checked and maintained on a regular basis (including clearing of sediment from behind barriers) and records kept and provided on request.	PM, PEng	During work	Additional safeguard
	Erosion and sediment control measures are not to be removed until the works are complete or disturbed areas are stabilised.	PM, PEng	During work	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
	Imported material for construction and for site compound/stockpile or access base materials would be sourced as clean-fill.	PM, PEng	During work	Additional safeguard
Contaminated land	A Contaminated Land Management Plan will be prepared in accordance with the *Guideline for the Management of Contamination* (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 • Further investigations required to determine the extent, concentration and type of contamination, as identified in the detailed site investigation (Phase 2) • Management of the remediation and subsequent validation of the contaminated land, including any certification required • Measures to ensure the safety of site personnel and local communities during construction.	Contractor	Detailed design / Pre-construction	Core standard safeguard C1 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 works 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.	Contractor	Detailed design / Pre-construction	Core standard safeguard C2 Section 4.2 of QA *G36 Environment Protection*

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Accidental spill	A site specific emergency spill plan will be developed, and include spill management measures in accordance with the Roads and Maritime Code of Practice for Water Management (RTA, 1999) and relevant EPA guidelines. The plan will address measures to be implemented in the event of a spill, including initial response and containment, notification of emergency services and relevant authorities (including Roads and Maritime and EPA officers).	Contractor	Detailed design / Pre-construction	Core standard safeguard C3 Section 4.3 of QA *G36 Environment Protection*

Other safeguards and management measures that would address soil impacts are identified in Section 6.2.

6.4 Traffic and access

6.4.1 Existing environment

An average of 3600 vehicles per day travel along the Oxley Highway west of Wauchope and there is a marked increase in weekend traffic volumes especially between Wauchope and Walcha which is strongly influenced by tourist and motorcycle traffic (Transport for NSW, 2015). The existing heavy vehicle usage of the Oxley Highway in the vicinity of the proposal is approximately 570 per day east of Wauchope and 300 per day west of Wauchope.

Paddock Road, at the western end of the proposal, currently joins the Oxley Highway from the south and provides access to two residences. Paddock Road splits into two roads near to the existing highway and both these roads are accessible from the existing highway. Paddock Road also provides access to the Broken Bago State Forest from the existing highway.

Rosewood Road intersects the existing highway at the east end of the proposal before becoming Hansfords Road as it continues south into the Broken Bago State Forest. Hansfords Road provides one of two accesses to the residence at 2615 Oxley Highway (Lot 100 DP1029288). Rosewood Road provides access to the existing highway for a number of residences within the Rosewood area.

6.4.2 Potential impacts

Construction

The works would results in minor and temporary traffic delays on the Oxley Highway, primarily during works associated with tie-ins. Traffic would generally be maintained throughout construction by utilising the existing road until the new section of road has been constructed. Traffic management measures would be implemented to manage traffic during connections of the new roadworks with the existing road.

Minor and temporary traffic delays may also be experienced by residents and other users of Paddock Road as well as the residents of 2615 Oxley Highway.

Traffic management to allow the required work to be undertaken would be required in accordance with an approved Traffic Management Plan (TMP), including appropriate stakeholder and public notice to minimise socio-economic impacts. The TMP would include management of potential impacts to neighbours accessing Paddock Road.

An estimated 30 light vehicle movements per day would occur during the construction phase. Material haulage would result in an estimated maximum of 1200 truck trips between the quarries (Sancrox and Milligans quarries) and the site and 1800 truck trips between the Spencers Cutting project and the site. This equates to a maximum increase of approximately 30 per cent above the existing number of truck movements on relevant sections of the Oxley Highway and other roads indicated in Section 3.3.6. It is noted that this is an upper estimate and that opportunities to reduce the volume of material fill to be imported continue to be explored. This increase in heavy vehicle movements has associated safety risks and impacts to travel time however it is considered these risks, which are temporary, could be managed via the TMP.

Operation

Impacts during the operation of the proposed realignment would be positive and would include improved safety for users of the Oxley Highway and improved reliability given the reduction of traffic delays associated with inundation from flood events.

Access to private properties would not be affected by the proposal during the operation phase.

6.4.3 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
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* (RTA, 2010) and *QA Specification G10 Control of Traffic* (Roads and Maritime, 2008). The TMP will include: • 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.	Contractor	Detailed design / Pre-construction	Core standard safeguard TT1 Section 4.8 of QA *G36 Environment Protection*
	Access to private property would be maintained during construction and operation.	Contractor	During construction and operation	Additional standard safeguard / additional safeguard
	All local residents would be notified of any potential delays regarding access and traffic flows during construction.	Contractor	During construction	Additional standard safeguard / additional safeguard

6.5 Noise and vibration

6.5.1 Methodology

A specialist noise and vibration assessment was completed for the proposal by Wilkinson Murray (refer to Appendix G). The noise and vibration impact assessment investigated potential noise and vibration impacts from construction and operation of the proposal.

The noise and vibration impact assessment was conducted in general accordance with the following NSW Government guidelines and policies:

- Noise Criteria Guideline (RMS, 2015)
- NSW Road Noise Policy (DECCW, 2011)
- Construction Noise and Vibration Guideline (RMS, 2016)
- Noise Criteria Guideline (RMS, 2015)
- Interim Construction Noise Guideline (DECC, 2009)
- Assessing Vibration: a technical guideline (DEC, 2006).

At the time of preparing the assessment, several options for the realignment were being considered. The options being considered were sufficiently similar to permit the assessment, based on indicative areas for construction and also the eventual road. The assessment was undertaken as a desktop study.

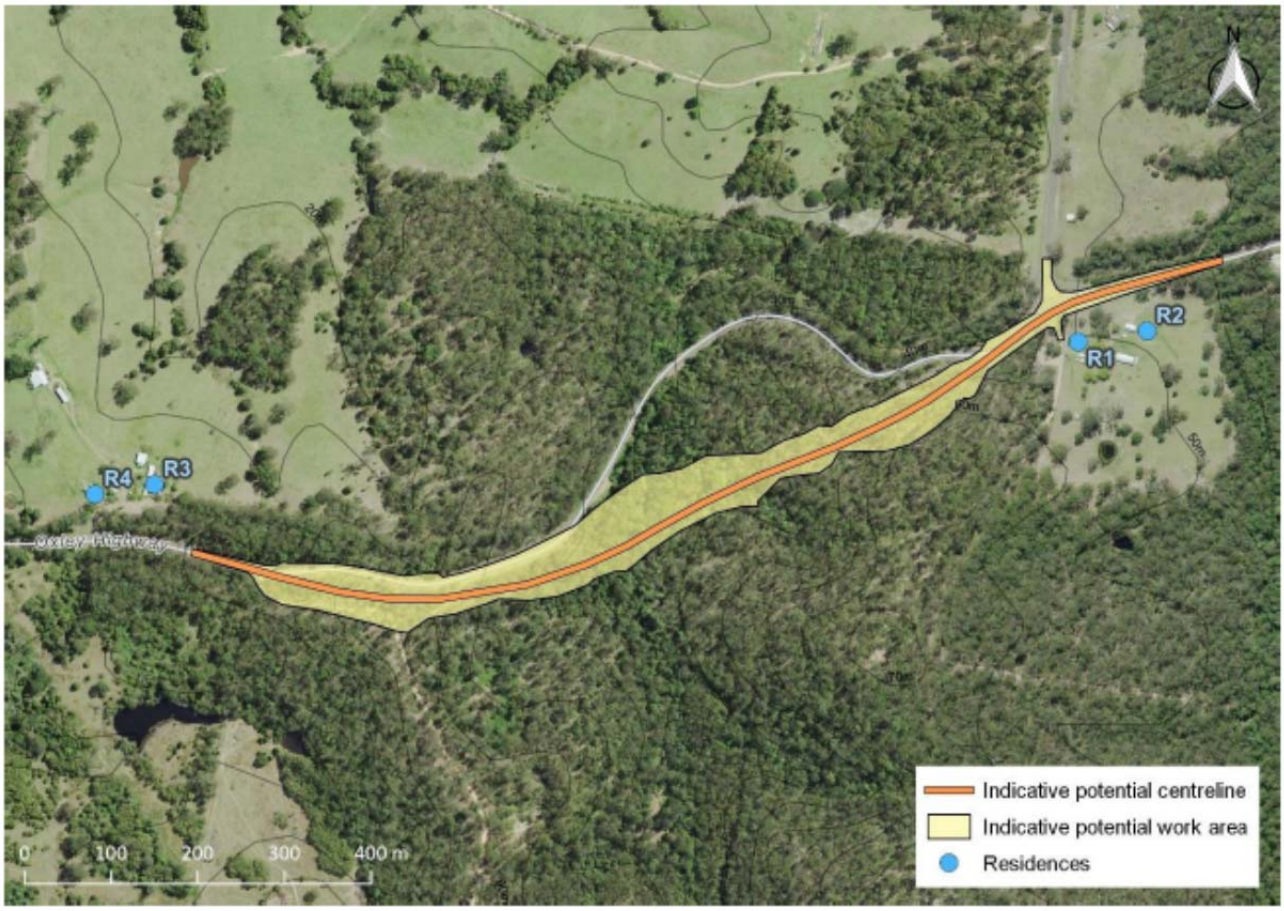
6.5.2 Existing environment

Indicative background noise levels for various environments are provided in Australian Standard AS 1055.2:1997 “Acoustics -Description and measurement of environmental noise”. Of the noise area categories included in AS 1055.2:1997, ‘R2’ best describes the environment surrounding the proposal – “*Areas with low density transportation*”. The estimated background noise levels for ‘R2’ category areas are:

- Day (7.00am-6.00pm Monday to Saturday and 9.00am-6.00pm Sunday) 45 dBA
- Evening (6.00pm-10.00pm Monday to Sunday) 40 dBA
- Night (10.00pm-7.00am Monday to Saturday and 10.00pm-9.00am Sunday) 35 dBA

For the purpose of deriving site specific construction noise criteria, these estimated background levels are considered appropriate. Residential receivers are indicated in Figure 6–2.

Figure 6–2: Location of residences assessed by the noise and vibration impact assessment (source: Wilkinson and Murray report at Appendix G)



6.5.3 Criteria

The Interim Construction Noise Guideline (ICNG) (DECC, 2009) recommends noise management levels (NML) to reduce the likelihood of noise impacts arising from construction activities. The ICNG NML for residential receivers are shown in Table 6–2.

Table 6–2: ICNG Noise Management Levels for residential receivers

Time of Day	Management Level $L_{Aeq,15min}$	How to Apply
Recommended Standard Hours: Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or Public Holidays	Noise affected RBL + 10 dBA	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured $L_{Aeq,15min}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dBA	The highly noise affected level represents the point above which there may be strong community reaction to noise. • Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting 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 works near schools, or mid-morning or mid-afternoon for works 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	Noise affected RBL + 5 dB	• A strong justification would typically be required for works 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 practices have been applied and noise is more than 5dB(A) above the noise affected level, the proponent should negotiate with the community.

The proposal specific construction NML for residential receivers are presented in Table 6–3.

Table 6–3: Construction NML – Residential Receivers

Acceptable $L_{Aeq,\ 15\ min}$ Noise Level				Highly Affected Level (Standard Hours)
Standard Construction Hours RBL + 10 (dBA)	Outside Standard Construction Hours RBL + 5 (dBA)			
	Day	Evening	Night	
55	50	45	40	75

Impacts from vibration can be considered both in terms of effects on building occupants (human comfort) and the effects on the building structure (building damage). Of these considerations, the human comfort limits are the most stringent. Therefore, for occupied buildings, if compliance with human comfort limits is achieved, it will follow that compliance with the building damage objectives will be achieved. The EPA's *Assessing Vibration: A Technical Guideline* (DEC, 2006) provides acceptable values for continuous and impulsive vibration in the range 1-80 Hz. The vibration criterion adopted for the assessment of human comfort is 0.4 mm/s PPV (component), and is applicable to assessment of potential impacts during the hours of 7:00am to 10:00pm. This criterion assumes that vibration would persist for a considerable portion of the day. As this is unlikely to be the case, the criterion is inherently conservative.

6.5.4 Potential impacts

Construction

Noise

The noise and vibration assessment (Appendix G) indicates the potential for construction noise levels to exceed the acceptable NMLs during all scenarios, whilst work is in the vicinity of receivers. During the loudest works, the LAeq noise level at the nearest residence is predicted to be up to 89 dBA, which would result if hydraulic hammers were used nearby to the residence (including a five dB penalty). The highly noise affected level (LAeq, 15 min 75 dBA) is expected to be exceeded whilst works are nearby receivers.

The bulk of the construction work will be more distant from receivers, in the areas requiring significant cut and fill. Receiver noise levels resulting from these activities are predicted to be approximately 60 dBA, excluding shielding that may be present from topography. On the basis of these predictions, moderate exceedances of the acceptable noise level would be expected, however the highly-affected noise level would not be exceeded by the majority of the construction work.

Noise levels from an ancillary compound have been predicted at a number of distances, neglecting shielding. While the location of ancillary facilities was not known at the time of the assessment, it was concluded that locating the compound near residences would require some noise management measures to be applied if the acceptable noise level is to be achieved (Appendix G).

Construction generated traffic would be limited to workers' vehicles and material transport. These movements would make negligible difference to existing traffic noise levels on the Oxley Highway.

As construction-related traffic is not anticipated to increase traffic noise by more than two dBA, no further assessment is required.

Vibration

Noting the distance to the nearest residences, it is unlikely that vibration criteria would be exceeded by the works. There is a potential for blasting to be employed during the construction phase. It is anticipated that if blasting were employed, it would be undertaken in the cuttings. If blasting is required, further detailed assessment would be required and a blast management plan prepared.

6.5.5 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
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 *Beyond the Pavement: urban design policy, process and principles* (Roads and Maritime, 2014) and the mitigation measures in the *Construction Noise and Vibration Guideline* (CNVG) (examples of which are reproduced in the proposal's Noise and Vibration Assessment at Appendix G) • 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 non-compliance with noise and vibration criteria.	Contractor	Detailed design / Pre-construction	Core standard safeguard NV1 Section 4.6 of *QA G36 Environment Protection*

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Noise and vibration	All sensitive receivers (eg local residents) likely to be affected will be notified at least seven days prior to commencement of any works associated with the activity that may have an adverse noise or vibration impact. The notification will provide details of: • The project • The construction period and construction hours • Contact information for project management staff • Complaint and incident reporting • How to obtain further information.	Contractor	Detailed design / Pre-construction	Core standard safeguard NV2

6.6 Aboriginal heritage

6.6.1 Existing environment

An Aboriginal Heritage Information Management System (AHIMS) search covering the proposed alignment was undertaken on 19 April 2017 (refer to Appendix H). A Stage 1 Procedure for Aboriginal Cultural Heritage Consultation and Investigation (PACHCI) was undertaken for the site by Barry Williams, Aboriginal Cultural Heritage Advisor for Roads and Maritime (Appendix E). Mr Williams has advised that there are no cultural heritage issues for the site and no further consultation is required.

6.6.2 History

The specific indigenous history of the study area is unknown to the author. The AHIMS search and PACHCI results indicate that no indigenous heritage items or places are known in or in proximity to the proposal footprint (refer to Appendix E and H).

6.6.3 Policy setting

Under Clause 228 of the *EP&A Regulation 2000*, any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations must be taken into account when assessing the impact of an activity for the purposes of Part 5 of the EP&A Act.

The primary piece of legislation that effects indigenous heritage management in NSW is the NPW Act. The protection and management of indigenous heritage is also supported by the EP&A Act.

These pieces of legislation aim to protect and preserve places and items of indigenous heritage significance, culture and heritage within NSW.

Clause 4.5 Competence, Training and Awareness and Clause 6.15 Aboriginal Heritage of *RTA QA Specification G35* provides guidelines for the management of indigenous heritage items.

6.6.4 Criteria

The most suitable performance criterion for this factor is that no indigenous heritage items would be impacted by the proposal. This criterion would be achieved by implementing relevant safeguards and management measures outlined below.

6.6.5 Potential impacts

Damage to aboriginal heritage could result from the proposed works uncovering unknown items at the site. However, this is considered to be a low risk (refer to Appendix E and H). Safeguards are provided to ensure any indigenous heritage items uncovered during the proposal are not significantly affected and appropriately dealt with.

6.6.6 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Aboriginal heritage	An Aboriginal Heritage Management Plan (AHMP) will be prepared in accordance with the *Procedure for Aboriginal cultural heritage consultation and investigation* (Roads and Maritime, 2012) and *Standard Management Procedure - Unexpected Heritage Items* (Roads and Maritime, 2015) and implemented as part of the CEMP. It will provide specific guidance on measures and controls to be implemented for managing impacts on Aboriginal heritage. The AHMP will be prepared in consultation with all relevant Aboriginal groups.	Contractor	Detailed design / Pre-construction	Core standard safeguard AH1 Section 4.9 of QA *G36 Environment Protection*
	The *Standard Management Procedure - Unexpected Heritage Items* (Roads and Maritime, 2015) will be followed in the event that an unknown or potential Aboriginal object/s, including skeletal remains, is found during construction. This applies where 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 / Pre-construction	Core standard safeguard AH2 Section 4.9 of QA *G36 Environment Protection*

6.7 Non-Aboriginal heritage

6.7.1 Methodology

Database searches were undertaken on 7 April 2017 including:

- RTA Section 170 Register
- NSW Heritage Database (Appendix I)
- Commonwealth EPBC heritage list (Appendix I)
- Australian Heritage Places Inventory (Appendix I)
- Port Macquarie-Hastings Council Local Environmental Plan 2011 – heritage items.

6.7.2 Existing environment

No items of known heritage significance are located within the study area. The above searches revealed the following heritage item in the vicinity of the proposal:

- Heritage item '*item 1040*' approximately 500 metres north-east of the proposal.

6.7.3 Policy setting

Under Clause 228 of the *EP&A Regulation 2000*, any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations must be taken into account when assessing the impact of an activity for the purposes of Part 5 of the EP&A Act.

Heritage management is enshrined within two acts in NSW: The *Heritage Act 1977* and the *EP&A Act 1979*. Together, they establish the legislative framework for heritage management in NSW and ensure that heritage forms an integral part of planning and development.

Clause 4.5 Competence, Training and Awareness and Clause 6.14 Non-Aboriginal heritage of *RTA QA Specification G35* provides guidelines for the management of non-indigenous heritage items on Roads and Maritime projects.

6.7.4 Criteria

The most suitable performance criterion for non-indigenous heritage is that potential impacts to associated heritage values are minimised. This criterion would be achieved by implementing relevant safeguards and management measures outlined below and throughout Section 6 of this REF.

6.7.5 Potential impacts

Damage to non-indigenous artefacts could result from the proposal if such items are undiscovered at proposed work sites. Given the location of the proposal, the likelihood of any items remaining within the site is considered low.

6.7.6 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Non-Aboriginal heritage	A Non-Aboriginal Heritage Management Plan (NAHMP) will be prepared and implemented as part of the CEMP. It will provide specific guidance on measures and controls to be implemented to avoid and mitigate impacts to Non-Aboriginal heritage.	Contractor	Detailed design / Pre-construction	Core standard safeguard H1 Section 4.10 of QA *G36 Environment Protection*
	The *Standard Management Procedure - Unexpected Heritage Items* (Roads and Maritime, 2015) 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	Detailed design / Pre-construction	Core standard safeguard H2 Section 4.10 of QA *G36 Environment Protection*

6.8 Landscape character and visual impacts

6.8.1 Existing environment

The proposed alignment for the most part traverses heavily forested areas. The area around the Oxley Highway – Rosewood Road intersection includes cleared rural landscape. The general locality of the proposed realignment is of moderate to high visual amenity while noting that past clearing practices and the existing highway diminish the visual amenity. It is noted that the proposed alignment is typically obscured by trees and other vegetation and is not visible from external viewpoints with the exception of the area near the Rosewood Road intersection, as discussed further below.

6.8.2 Policy setting

Under Clause 228 of the *EP&A Regulation 2000,* visual amenity and associated impacts must be taken into account when assessing the impact of an activity for the purposes of Part 5 of the EP&A Act.

Roads and Maritime QA Specification G35 and *RTA's Stockpile Management Guidelines* provides guidelines for the management of the visual amenity of a site on Roads and Maritime projects.

Roads and Maritime EIA guidelines practice note Landscape character and visual amenity (EIA-N04) sets out how proposals are to be assessed for impacts on visual amenity and landscape character.

6.8.3 Criteria

The most suitable performance criterion for visual amenity is the minimisation of changes to the visual amenity at the site. This criterion would be achieved by maintaining the site in a tidy state throughout construction, re-grassing exposed soils and appropriate decommissioning and rehabilitation of the site compound / stockpile sites after use.

6.8.4 Potential impacts

Construction

The construction phase would result in a minor visual impact. The majority of works would be within and surrounded by vegetation that would visually screen the works from outside viewpoints. Works at 'tie-ins' with the existing highway, including works adjacent to the residence at 2615 Oxley Highway, would be visible and would cause some visual impact; however, it is noted that this impact would not be out of keeping with the existing highway and would be temporary. Indicative locations of the site compound, stockpiles and borrow pit are provided in Figure 3–1. These indicative locations are surrounded by existing vegetation which provides a visual screen. While these locations are subject to chance, any visual impact from these facilities would be considered minor and temporary.

Operation

Whilst the proposal would result in considerable change to the visual landscape due to significant clearing and cut and fill earthworks, the alignment itself would not generally be visible from the existing highway or nearby residences with the exception of the residence at 2615 Oxley Highway. Residents at this property would experience a degree of visual impact, however it is noted that, given the residence is adjacent and has direct views of the existing highway, the proposed realignment would generally be in-keeping with the current views from the residence. The proposal would not result in the obstruction of any significant vistas from the property. Clearing of trees associated with the proposal would cause some visual impact to road users (and the aforementioned residents) however it is considered that this impact is not significant given that the area of clearing represents a very small portion of the total existing forest views.

6.8.5 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Landscape character and visual impact	• Roadside furniture (signs, guideposts, safety barrier) will be installed in accordance with guidelines. The appearance will be similar to that on the highway adjacent to the project. • *Shotcrete Design Guideline (RTA, 2005)*	Contractor	Detailed design / Pre-construction	Core standard safeguard UD1

6.9 Property

6.9.1 Existing environment

The proposed alignment intersects road reserve, private property (Lot 117, DP 1025207) and Travelling Stock Reserves. All areas are currently heavily vegetated and include significant numbers of trees.

6.9.2 Policy setting

Under Clause 94 of the State Environmental Planning Policy (Infrastructure) 2007, development for the purpose of a road or road infrastructure facilities may be carried out by or on behalf of a public authority without consent on any land.

The Land Acquisition (Just Terms Compensation) Act 1991 and the *Roads Act 1993* govern the *Roads and Maritime Land Acquisition Information Guide* which provides guidelines for the management of land acquisition related to Roads and Maritime projects.

6.9.3 Potential impacts

As discussed in Section 3.6, the proposal would require the acquisition of a portion of Lot 117, DP 1025207. This land is owned by the Bunyah Local Aboriginal Land Council (BLALC). Roads and Maritime have consulted with the BLALC and have reached agreement with regard to transfer of the required portion of land indicated in

Figure 3–2 and described in Table 3–1.

The proposal would also require the acquisition of a portion of the Travelling Stock Reserve which is managed by the NSW Local Land Services.

6.9.4 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
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 project manager	Pre-construction and construction	Core standard safeguard PL1

6.10 Socio-economic

6.10.1 Existing environment

The Oxley Highway is an important strategic highway which connects the coastal and hinterland areas of Port Macquarie and Wauchope on the Mid North Coast with the inland centres of Tamworth, Gunnedah, Coonabarabran, Gilgandra, Warren and Nevertire. The social and economic values of this road are overall rated as high.

6.10.2 Policy setting

Under Clause 228 of the *EP&A Regulation 2000*, social, economic and environmental impacts, including any environmental impact on a community, must be taken into account when assessing the impact of an activity for the purposes of Part 5 of the EP&A Act.

No specific legislation or guidelines are relevant to the assessment or management of this factor, however generally, the *EP&A Act* and EP&A *Regulation 2000* provide for the consideration of socio-economic impacts and the sustainability thereof in the planning system and development

6.10.3 Criteria

The most suitable criterion for this factor is that the socio-economic value of the site is maintained as a result of the proposal and socio-economic impacts during construction are minimised.

6.10.4 Potential impacts

The proposed works may impose a number of potential negative socio-economic impacts during construction including:

- Disruption to businesses (eg freight and transport companies) and the local community dependent on the local section of the Oxley Highway from traffic disruptions during construction (minor, short-term impact)
- Injury or mortality of construction personnel during construction, though standard Work Health and Safety requirements would ensure the risk of injury or mortality is minimised.

Post construction, the improved travel times associated with elimination of flood-related delays would have positive socio-economic impacts.

6.10.5 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Socio-economic	A Communication Plan (CP) will be prepared and implemented as part of the CEMP to help provide timely and accurate information to the community during construction. The CP 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.	Contractor	Detailed design / Pre-construction	Core standard safeguard SE1

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
	The CP will be prepared in accordance with the *Community Involvement and Communications Resource Manual* (RTA, 2008).			
	Any traffic closure and delays of Oxley Highway during construction would be mindful of the needs of the local community, freight businesses and commercial operators using the highway at the proposal site.	Contractor	Pre-construction and during construction	Additional safeguard
	In accordance with the Work Health and Safety Act 2011, workers would be provided with appropriate safety clothing and equipment. Supervisory staff and any visitors to the work area would also be required to wear protective clothing. Works personnel would be provided with or expected to have protective equipment and appropriate training.	Contractor	Pre-construction and during construction	Additional safeguard

6.11 Waste

6.11.1 Existing environment

The main types of waste currently associated with the site are mixed rubbish which has been left by road users within the road corridor of the Oxley Highway (minor occurrence only). The works will require some vegetation removal which will also generate waste and require disposal.

6.11.2 Policy setting

Under Clause 228 of the EP&A Regulation 2000, social, economic and environmental impacts (including the degradation and or pollution of the environment) must be taken into account when assessing the impact of an activity for the purposes of Part 5 of the EP&A Act.

The State's primary environment protection legislation, the *POEO Act 1997*, together with the *Waste Avoidance and Resource Recovery Act 2001* and the *Protection of the Environment Operations (Waste) Regulation 2005* contain the requirements for managing, storing, transporting, processing, recovering and disposing of waste.

The Roads and Maritime is committed to the principles embodied in the *Waste Avoidance and Resource Recovery Act 2001.* Roads and Maritime is also committed to ensuring responsible environmental management of waste that cannot be avoided and to providing opportunities for promoting the re-use of waste products. Clause 6.16 Waste Avoidance and Management of *RTA QA Specification G35* provide guidelines for the management and avoidance of waste on Roads and Maritime projects.

6.11.3 Criteria

The most suitable performance criterion for this factor is that waste material generated by the proposal is minimised and recycled to the maximum extent possible.

6.11.4 Potential impacts

Works activities and delivery of plant and equipment for the proposal would generate minimal waste at the site. Such waste would include:

- Tree and vegetation clearing: vegetation will be mulched and used on site during constriction (eg as erosion sediment controls) and/or disposed of at an approved facility
- Sediment spoils: clean sediment spoils would be used where possible within the works where required and appropriate. Unclean or excess spoil is to be disposed of at an approved facility
- Waste generated from construction staff ie food / drink and amenities waste
- Packaging materials.

Some of these waste sources have potential to disperse into the surrounding environment; impacting soils, water, biodiversity and agricultural practices associated with the land. The proposed works would be undertaken to ensure minimal impacts are generated from waste material produced on site by ensuring that all waste is collected and disposed of or recycled in accordance with Roads and Maritime waste disposal protocols and OEH guidelines. No significant waste management issues are anticipated.

6.11.5 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Waste	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 project • Classification of wastes and management options (re-use, recycle, stockpile, disposal) • Statutory approvals required for managing both on and off-site waste, or application of any relevant resource recovery exemptions • 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.	Contractor	Detailed design / Pre-construction	Core standard safeguard W1 Section 4.2 of QA *G36 Environment Protection*

6.12 Other impacts

6.12.1 Existing environment and potential impacts

Environmental factor	Existing environment	Potential impacts
Air quality	The site is surrounded by forest. Current emissions generated at the site, contributing to impact on air quality, include those generated by vehicles along the Oxley Highway.	Potential for minor air quality impacts from vehicle and plant emissions during construction.
Climate change	The site is surrounded by forest. Current emissions generated at the site, contributing to climate change, includes carbon dioxide generated by vehicles along the Oxley Highway.	The proposal would contribute to carbon emissions and climate change to a minor extent via the emissions of carbon dioxide by construction equipment and traffic as well as the consumption of materials requiring carbon emissions during extraction.
Hazard and risk management	The site is surrounded by forest. Current hazards are associated with vehicular traffic and transport on the Oxley Highway.	Risk associated with the storage use and handling of hazardous substances during construction.

6.12.2 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Air quality	An Air Quality Management Plan (AQMP) will be prepared and implemented as part of the CEMP. The AQMP will include, but not be limited to: • Potential sources of air pollution • Air quality management objectives consistent with any relevant published EPA and/or OEH guidelines • Mitigation and suppression measures to be implemented • Methods to manage work during strong winds or other adverse weather conditions • A progressive rehabilitation strategy for exposed surfaces.	Contractor	Detailed design / Pre-construction	Core standard safeguard AQ1 Section 4.4 of QA *G36 Environment Protection*

Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
Climate Change	Methods to avoid unnecessary carbon dioxide emissions would be adopted (eg switching off machinery and plant when not in use).	Contractor	During-construction	Additional safeguard
Hazards and risk management	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	Core standard safeguard HAZ1

6.13 Cumulative impacts

6.13.1 Study area

This cumulative impact assessment considers works (underway or proposed) to upgrade the Oxley Highway which stretches west from Port Macquarie on the NSW Mid North Coast to inland centres of Tamworth, Gunnedah, Coonabarabran, Gilgandra and Warren.

6.13.2 Broader program of work

The proposal is part of a broader program of works to upgrade the Oxley Highway to improve safety and reduce travel times along the Highway. This important work stems from the Oxley Highway Route Safety Review and the Oxley Highway Corridor Strategy (refer to Sections 2.1.4 and 2.1.5 for further detail). A number of road improvements along the Oxley Highway have been completed, are underway or are proposed. Works include realignments, bridge upgrades, intersection improvements and lane widening. Appendix J presents an RMS Community Update (November 2016) for the Oxley Highway works.

6.13.3 Cumulative impacts

The proposal is expected to add to a number of cumulative impacts including minor removal of native vegetation, resource consumption, disruption to traffic and generation of greenhouse gas emissions (eg through operation of vehicles and equipment). However, the mitigation measures outlined within Section 6 aim to minimise the extent to which the proposal contributes to cumulative adverse environmental impacts. Further, given the distance from the nearest Oxley Highway works that are underway or proposed (ie Spencers Cutting project, 10 kilometres to the east and drainage works at Gannons Creek, five kilometres to the west), the proposal is not expected to result in cumulative impacts from noise, air quality or other environmental aspects.

7 Environmental management

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

7.1 Environmental management plans (or system)

A number of safeguards and management measures have been identified in the REF in order to minimise adverse environmental impacts, including social impacts, which could potentially arise as a result of the proposal. Should the proposal proceed, these safeguards and management measures would be incorporated into the detailed design and applied during the construction and operation of the proposal.

A Construction Environmental Management Plan (CEMP) will be prepared to describe the safeguards and management measures identified. The CEMP will provide a framework for establishing how these measures will be implemented and who would be responsible for their implementation.

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

7.2 Summary of safeguards and management measures

Environmental safeguards and management measures outlined in this REF will be incorporated into the detailed design phase of the proposal and during construction and operation of the proposal, should it proceed. These safeguards and management measures will minimise any potential adverse impacts arising from the proposed works on the surrounding environment. The safeguards and management measures are summarised in **Error! Reference source not found.**.

Table 7–1: Summary of safeguards and management measures

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
1	General - minimise environmental impacts during construction	A CEMP will be prepared and submitted for review and endorsement of the Roads and Maritime Environment Manager prior to commencement of the activity. As a minimum, the CEMP will address the following: • Any requirements associated with statutory approvals • Details of how the project will implement the identified safeguards outlined in the REF • Issue-specific environmental management plans • Roles and responsibilities • Communication requirements • Induction and training requirements • Procedures for monitoring and evaluating environmental performance, and for corrective action • reporting requirements and record-keeping • Procedures for emergency and incident management • Procedures for audit and review. The endorsed CEMP will be implemented during the undertaking of the activity.	Contractor / Roads and Maritime project manager	Pre-construction / detailed design	Core standard safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
2	General - notification	All businesses, residential properties and other key stakeholders (eg schools, local councils) affected by the activity will be notified at least five days prior to commencement of the activity.	Contractor / Roads and Maritime project manager	Pre-construction	Core standard safeguard
3	General – environmental awareness	All personnel working on site will receive training to ensure awareness of environment protection requirements to be implemented during the project. This will include up-front site induction and regular "toolbox" style briefings. Site-specific training will be provided to personnel engaged in activities or areas of higher risk. These include: • No-go areas including environmentally sensitive areas and private property boundaries (including Bunyah Local Aboriginal Land Council property) • Threatened species habitat • Adjoining residential areas requiring particular noise management measures, notably the residence at 2615 Oxley Highway Bago.	Contractor / Roads and Maritime project manager	Pre-construction / detailed design	Core standard safeguard
4	Compound location	The location of the site compound would meet the following criteria: • Be located at least 40 metres away from the nearest waterway • Be of low ecological and heritage conservation significance • Be at least 100 metres away from residential dwellings and other land uses that may be sensitive to noise • Be of relatively level ground • Be outside the 1 in 10 year ARI floodplain.	Contractor	Detailed design / Pre-construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
5	Stockpile location	Location of stockpiles shall meet the following criteria: • Be located at least 15 metres clear of all areas of possible concentrated water flow • Be located at least 10 metres from a waterway (except mulch) • Mulch stockpiles are to be located more than 20 metres from a watercourse and outside the 1 in 10 year ARI floodplain (if in place for <1 month) • Mulch stockpiles are to be located more than 50 metres from a watercourse and outside the 1 in 10 year ARI floodplain (if in place for >1 month) • Be located on land with slopes less than 10 per cent • Be of low ecological and heritage conservation significance.	Contractor	Detailed design / Pre-construction	Additional safeguard
6	Borrow pit location	The location of the borrow pit (if required), shall meet the following criteria: • Be located at least five metres clear of all areas of possible concentrated water flow • Be located at least 30 metres from a waterway • Be located on land with slopes less than 10 per cent • Be of low ecological and heritage conservation significance.	Contractor	Detailed design / Pre-construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
7	Biodiversity	A flora and fauna management plan will be prepared in accordance with Roads and Maritime's *Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects* (RTA, 2011) 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 *Landscape Guideline* (RTA, 2008) • Pre-clearing survey requirements • procedures for unexpected threatened species finds and fauna handling • procedures addressing relevant matters specified in the *Policy and guidelines for fish habitat conservation and management* (DPI Fisheries, 2013) • Protocols to manage weeds and pathogens.	Contractor	Detailed design / Pre-construction	Core standard safeguard B1 Section 4.8 of QA *G36 Environment Protection*
8	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	Core standard safeguard B2

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
9	Biodiversity	A Nest Box strategy is to be developed in consultation with a qualified ecologist. This strategy should detail nest box design, placement and any monitoring requirements. Nest boxes would be installed to compensate for any hollow-bearing trees removed. Nest boxes would be installed at a ratio of four boxes per hollow removed (based on data collected during clearing works), hence ensuring no net loss of hollows. Nest boxes must be of types suited to fauna species likely to occur in the locality (eg parrots, microbats, small arboreal mammals) and placed in undisturbed forest areas at least 50 metres from the road edge. Nest boxes should be placed on the southern side of the new alignment where fauna can utilise areas of consolidated and unfragmented forest. Concurrence / agreement with adjacent property owners will be required if the acquired road reserve is insufficient to accommodate the required number of nest boxes.	Contractor	Detailed design / Pre-construction	Additional Safeguard
10	Removal of native vegetation	Pre-clearing surveys will be undertaken in accordance with *Guide 1: Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Contractor	During construction	Standard Safeguard
11	Removal of native vegetation	Native vegetation will be re-established in accordance with Guide 3: Re-establishment of native vegetation of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011).	Contractor	Post construction	Standard Safeguard
12	Removal of native vegetation	The unexpected species find procedure is to be followed under *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011) if threatened ecological communities, not assessed in the biodiversity assessment, are identified in the proposal site.	Contractor	During construction	Standard Safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
13	Removal of threatened species habitat and habitat features	Habitat removal will be minimised through detailed design.	Contractor	Detailed design	Standard Safeguard
14	Removal of threatened species habitat and habitat features	Habitat removal will be undertaken in accordance with *Guide 4: Clearing of vegetation and removal of bushrock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Contractor	During construction	Standard Safeguard
15	Removal of threatened species habitat and habitat features	Habitat will be replaced or re-instated in accordance with *Guide 5: Re-use of woody debris and bush rock and Guide 8: Nest boxes of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Contractor	During construction	Standard Safeguard
16	Removal of threatened species habitat and habitat features	The unexpected species find procedure is to be followed under *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011) if threatened fauna, not assessed in the biodiversity assessment, are identified in the proposal site.	Contractor	During construction	Standard Safeguard
17	Removal of threatened species habitat and habitat features	Vegetation clearing should be completed in a staged manner: • Stage 1 comprising clearing of non-hollow-bearing trees • Stage 2 comprising clearing of hollow-bearing trees. Stage 2 clearing must be undertaken at least the day after stage 1 clearing and preferably within one week of the stage 1 clearing around any hollow-bearing trees.	Contractor	During construction	Additional Safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
18	Removal of threatened species habitat and habitat features	An ecologist / wildlife carer must be present during stage 2 clearing and inspect all hollow-bearing trees for fauna, and capture and release fauna outside the construction footprint on the property as appropriate (eg at night for nocturnal fauna).	Contractor	During construction	Additional Safeguard
19	Removal of threatened species habitat and habitat features	Hollow-bearing trees must be removed carefully to reduce the potential for fauna mortality. Each tree should be 'bumped' with the excavator bucket several times and a minimum of two minutes provided prior to felling to allow any resident fauna to vacate. Should fauna be detected, additional safeguards may be identified by the project ecologist (eg additional bumps, or selective limb removal).	Contractor	During construction	Additional Safeguard
20	Removal of threatened plants	Pre-clearing surveys will be undertaken in accordance with *Guide 1: Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Contractor	During construction	Standard Safeguard
21	Removal of threatened plants	The unexpected species find procedure is to be followed under *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011) if threatened flora species, not assessed in the biodiversity assessment, are identified in the proposal site.	Contractor	During construction	Standard Safeguard
22	Aquatic impacts	Aquatic habitat will be protected in accordance with *Guide 10: Aquatic habitats and riparian zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011) and Section 3.3.2 *Standard precautions and mitigation measures of the Policy and guidelines for fish habitat conservation and management Update 2013* (DPI (Fisheries NSW) 2013). All project drainage designs must be cross referenced against these documents to ensure compliance pre works commencing.	Contractor	During detailed design / Pre-Construction / During construction	Standard Safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
23	Groundwater dependent ecosystems	Interruptions to water flows associated with groundwater dependent ecosystems will be minimised through detailed design.	Contractor / RMS	Detailed design	Standard Safeguard
24	Changes to hydrology	Changes to existing surface water flows will be minimised through detailed design.	Contractor / RMS	Detailed design	Standard Safeguard
25	Fragmentation of identified habitat corridors	Connectivity measures will be implemented in accordance with the *Wildlife Connectivity Guidelines for Road Projects* (RTA 2011).	Contractor	Detailed design, during construction and post construction	Standard Safeguard
26	Edge effects on adjacent native vegetation and habitat	Exclusion zones will be set up at the limit of clearing in accordance with *Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Contractor	During construction	Standard Safeguard
27	Injury and mortality of fauna	Fauna will be managed in accordance with *Guide 9: Fauna handling of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Contractor	During construction	Standard Safeguard
28	Invasion and spread of weeds	Weed species will be managed in accordance with *Guide 6: Weed management of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Contractor	During construction	Standard Safeguard
29	Invasion and spread of pests	Pest species will be managed within the proposal site.	Contractor	During construction	Standard Safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
30	Invasion and spread of pathogens and disease	Pathogens will be managed in accordance with *Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Contractor	During construction	Standard Safeguard
31	Noise, light and vibration	Shading and artificial light impacts will be minimised through detailed design.	Contractor	Detailed design	Standard Safeguard
32	Water quality, hydrology and flooding	A CEMP will be prepared in accordance with the specifications set out in the *QA Specification G36 - Environmental Protection (Management) System* to guide the implementation of environmental impact mitigation measures, identify key roles and responsibilities for environmental monitoring and methods of reporting incidents.	Contractor	Detailed design / Pre-construction	Additional safeguard
33	Water quality, hydrology and flooding	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. The SWMP will be reviewed by a soil conservationist on the Roads and Maritime list of Registered Contractors for Erosion, Sedimentation and Soil Conservation Consultancy Services. The SWMP will then be revised to address the outcomes of the review.	Contractor	Detailed design / Pre-construction	Core standard safeguard SW1 Section 2.1 of QA G38 *Soil and Water Management*
34	Water quality, hydrology and flooding	A site specific Erosion and Sediment Control Plan will be prepared and implemented as part of the SWMP. 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	Core standard safeguard SW2 Section 2.2 of QA G38 *Soil and Water Management*

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
35	Water quality, hydrology and flooding	Watercourse crossings shall be designed in consultation with the DPI (Fisheries NSW), EPA, DPI WATER and DoE, and where feasible and reasonable, be consistent with the *Guidelines for Controlled Activities Watercourse Crossings* (Department of Water and Energy, February 2008), *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (Fairfull and Witheridge, 2003), *Policy and Guidelines for Fish Friendly Waterway Crossings* (NSW Fisheries, February 2004), and *Policy and Guidelines for Fish Habitat Conservation and Management* (DPI Fisheries, 2013). All project drainage designs must be cross referenced against these documents to ensure compliance pre works commencing.	Contractor	Detailed design / Pre-construction	Additional safeguard
36	Water quality, hydrology and flooding	Work must cease and all sediment control measures checked and repaired or re-installed (if required) if heavy rainfall is forecast.	PEng	During work	Additional safeguard
37	Water quality, hydrology and flooding	Work must only commence once all erosion and sediment controls have been established. The controls would be maintained in place until the work is complete and all exposed erodible materials are stable.	PM	Pre-work	Additional safeguard
38	Water quality, hydrology and flooding	A spill containment kit must be available at all times. All personnel must be made aware of the location of the kit and trained in its effective deployment.	PEng	During work	Additional safeguard
39	Water quality, hydrology and flooding	If a spill occurs, the Roads and Maritime's Environmental Incident Classification and Management Procedure must be followed and the Roads and Maritime Project Manager notified as soon as practicable.	PM, PEng	Pre-work	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
40	Water quality, hydrology and flooding	Required fuels and other liquids must be stored in self-safe chemical storage containers.	PM	Pre-work, during work	Additional safeguard
41	Water quality, hydrology and flooding	Unnecessary storage of fuels, lubricants or other compounds on-site must be avoided.	PM, PEng	During work	Additional safeguard
42	Water quality, hydrology and flooding	Cleaning of tools and equipment must occur within a designated wash-down bay. The wash-down bay must be placed so that water filtered through the geofabric does not flow directly into drainage lines, but is captured and allowed to soak into the ground.	PM, PEng	Pre-work, during work	Additional safeguard
43	Water quality, hydrology and flooding	Water utilised for cleaning of tools must be minimised and obtained from a licensed location or town water supply.	PEng	During work	Additional safeguard
44	Water quality, hydrology and flooding	All equipment must be maintained in good working order and operated according to manufacturer's specifications.	PEng	Pre-work, during work	Additional safeguard
45	Soil and erosion	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. The SWMP will be reviewed by a soil conservationist on the Roads and Maritime list of Registered Contractors for Erosion, Sedimentation and Soil Conservation Consultancy Services. The SWMP will then be revised to address the outcomes of the review.	Contractor	Detailed design / Pre-construction	Core standard safeguard SW1 Section 2.1 of QA G38 *Soil and Water Management*

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
46	Soil and erosion	A site specific Erosion and Sediment Control Plan will be prepared and implemented as part of the SWMP. 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	Core standard safeguard SW2 Section 2.2 of QA G38 *Soil and Water Management*
47	Soil and erosion	No work would commence prior to installation of appropriate sediment control structures.	PM	During work	Additional safeguard
48	Soil and erosion	Erosion and sediment controls are to be checked and maintained on a regular basis (including clearing of sediment from behind barriers) and records kept and provided on request.	PM, PEng	During work	Additional safeguard
49	Soil and erosion	Erosion and sediment control measures are not to be removed until the works are complete or disturbed areas are stabilised.	PM, PEng	During work	Additional safeguard
50	Soil and erosion	Imported material for construction and for site compound / stockpile or access base materials would be sourced as clean-fill.	PM, PEng	During work	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
51	Contaminated land	A Contaminated Land Management Plan will be prepared in accordance with the *Guideline for the Management of Contamination* (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 • Further investigations required to determine the extent, concentration and type of contamination, as identified in the detailed site investigation (Phase 2) • Management of the remediation and subsequent validation of the contaminated land, including any certification required • Measures to ensure the safety of site personnel and local communities during construction.	Contractor	Detailed design / Pre-construction	Core standard safeguard C1 Section 4.2 of QA *G36 Environment Protection*
52	Contaminated land	If contaminated areas are encountered during construction, appropriate control measures will be implemented to manage the immediate risks of contamination. All other works 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.	Contractor	Detailed design / Pre-construction	Core standard safeguard C2 Section 4.2 of QA *G36 Environment Protection*
53	Accidental spill	A site specific emergency spill plan will be developed, and include spill management measures in accordance with the Roads and Maritime Code of Practice for Water Management (RTA, 1999) and relevant EPA guidelines. The plan will address measures to be implemented in the event of a spill, including initial response and containment, notification of emergency services and relevant authorities (including Roads and Maritime and EPA officers).	Contractor	Detailed design / Pre-construction	Core standard safeguard C3 Section 4.3 of QA *G36 Environment Protection*

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
54	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* (RTA, 2010) and *QA Specification G10 Control of Traffic* (Roads and Maritime, 2008). The TMP will include: • 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.	Contractor	Detailed design / Pre-construction	Core standard safeguard TT1 Section 4.8 of QA *G36 Environment Protection*
55	Traffic and transport	Access to private property would be maintained during construction and operation.	Contractor	During construction and operation	Additional standard safeguard / additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
56	Traffic and transport	All local residents would be notified of any potential delays regarding access and traffic flows during construction.	Contractor	During construction	Additional standard safeguard / additional safeguard
57	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 *Beyond the Pavement: urban design policy, process and principles* (Roads and Maritime, 2014) and the mitigation measures in the *Construction Noise and Vibration Guideline* (CNVG) (examples of which are reproduced in the proposal's Noise and Vibration Assessment at Appendix G) • 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 non-compliance with noise and vibration criteria.	Contractor	Detailed design / Pre-construction	Core standard safeguard NV1 Section 4.6 of *QA G36 Environment Protection*

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
58	Aboriginal heritage	All sensitive receivers (eg local residents) likely to be affected will be notified at least seven days prior to commencement of any works associated with the activity that may have an adverse noise or vibration impact. The notification will provide details of: • The project • The construction period and construction hours • Contact information for project management staff • Complaint and incident reporting • How to obtain further information.	Contractor	Detailed design / Pre-construction	Core standard safeguard NV2
59	Aboriginal heritage	An Aboriginal Heritage Management Plan (AHMP) will be prepared in accordance with the *Procedure for Aboriginal cultural heritage consultation and investigation* (Roads and Maritime, 2012) and *Standard Management Procedure - Unexpected Heritage Items* (Roads and Maritime, 2015) and implemented as part of the CEMP. It will provide specific guidance on measures and controls to be implemented for managing impacts on Aboriginal heritage. The AHMP will be prepared in consultation with all relevant Aboriginal groups.	Contractor	Detailed design / Pre-construction	Core standard safeguard AH1 Section 4.9 of QA *G36 Environment Protection*
60		The *Standard Management Procedure - Unexpected Heritage Items* (Roads and Maritime, 2015) will be followed in the event that an unknown or potential Aboriginal object/s, including skeletal remains, is found during construction. This applies where 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 / Pre-construction	Core standard safeguard AH2 Section 4.9 of QA *G36 Environment Protection*

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
61	Non-Aboriginal heritage	A Non-Aboriginal Heritage Management Plan (NAHMP) will be prepared and implemented as part of the CEMP. It will provide specific guidance on measures and controls to be implemented to avoid and mitigate impacts to Non-Aboriginal heritage.	Contractor	Detailed design / Pre-construction	Core standard safeguard H1 Section 4.10 of QA *G36 Environment Protection*
62	Non-Aboriginal heritage	The *Standard Management Procedure - Unexpected Heritage Items* (Roads and Maritime, 2015) 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	Detailed design / Pre-construction	Core standard safeguard H2 Section 4.10 of QA *G36 Environment Protection*
63	Landscape character and visual impact	• Roadside furniture (signs, guideposts, safety barrier) will be installed in accordance with guidelines. The appearance will be similar to that on the highway adjacent to the project. • *Shotcrete Design Guideline (RTS, 2005)*	Contractor	Detailed design / Pre-construction	Core standard safeguard UD1
64	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 project manager	Pre-construction and construction	Core standard safeguard PL1

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
65	Socio-economic	A Communication Plan (CP) will be prepared and implemented as part of the CEMP to help provide timely and accurate information to the community during construction. The CP 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 CP will be prepared in accordance with the *Community Involvement and Communications Resource Manual* (RTA, 2008).	Contractor	Detailed design / Pre-construction	Core standard safeguard SE1
66	Socio-economic	Any traffic closure and delays of Oxley Highway during construction would be mindful of the needs of the local community, freight businesses and commercial operators using the highway at the proposal site.	Contractor	Pre-construction and during construction	Additional safeguard
67	Socio-economic	In accordance with the Work Health and Safety Act 2011, workers would be provided with appropriate safety clothing and equipment. Supervisory staff and any visitors to the work area would also be required to wear protective clothing. Works personnel would be provided with or expected to have protective equipment and appropriate training.	Contractor	Pre-construction and during construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
68	Waste	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 project • Classification of wastes and management options (re-use, recycle, stockpile, disposal) • Statutory approvals required for managing both on and off-site waste, or application of any relevant resource recovery exemptions • 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.	Contractor	Detailed design / Pre-construction	Core standard safeguard W1 Section 4.2 of QA *G36 Environment Protection*
69	Air quality	An Air Quality Management Plan (AQMP) will be prepared and implemented as part of the CEMP. The AQMP will include, but not be limited to: • Potential sources of air pollution • Air quality management objectives consistent with any relevant published EPA and/or OEH guidelines • Mitigation and suppression measures to be implemented • Methods to manage work during strong winds or other adverse weather conditions • A progressive rehabilitation strategy for exposed surfaces.	Contractor	Detailed design / Pre-construction	Core standard safeguard AQ1 Section 4.4 of QA *G36 Environment Protection*
70	Climate change	Methods to avoid unnecessary carbon dioxide emissions would be adopted (eg switching off machinery and plant when not in use).	Contractor	During-construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Standard / additional safeguard
71	Hazards and risk management	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	Core standard safeguard HAZ1

7.3 Licensing and approvals

Table 7–2: Summary of licensing and approvals required

Instrument	Requirement	Timing
Protection of the Environment Operations Act 1997 (s43)	Environment protection licence (EPL) for scheduled activities from the EPA. • Extractive activities (land-based): if involves the extraction, processing or storage of more than 30,000 tonnes per year of extractive materials. • Crushing: The activity to which this clause applies is declared to be a scheduled activity if it has a capacity to process more than 150 tonnes of materials per day or 30,000 tonnes of materials per year.	Prior to start of the activity.
Protection of the Environment Operations Act 1997 (s43)	Environment protection licence (EPL) for non-scheduled activities for the purposes of regulating water pollution.	Prior to start of the activity.
Fisheries Management Act 1994 (s199)	Notification to the Minister for Primary Industries prior to any dredging or reclamation works. [Note exemption under s263A of the *Fisheries Management (General) Regulation 2010]*	A minimum of 28 days prior to the start of work.
Fisheries Management Act 1994 (s219)	Permit to obstruct the free passage of fish (temporary or permanent) from the Minister for Primary Industries.	Prior to start of the activity.
Threatened Species Conservation Act 1995 (s91) (repealed by BC Act; however transitional provisions apply as outlined below)	Ecologist / wildlife carer to have 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 (eg prior to stage 2 clearing when an ecologist / wildlife carer must be present for capture and release of any fauna).

8 Conclusion

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

8.1 Justification

The realignment of the Oxley Highway at Rosewood Road is required to meet the proposal objectives as well as the objectives of the NSW Road Safety Strategy 2012-2021 and the Oxley Highway Route Safety Review through:

- Improving road safety through this section of the Oxley Highway which is associated with a history of road accidents
- Eliminating flooding and thus improving travel times on the Highway.

With effective implementation of the safeguards and management measures of this REF, environmental impacts associated with undertaking the construction works would be minor. Unavoidable impacts required for the works (eg vegetation removal) are not substantial and would not significantly affect the local environment. Overall the social, economic and public interest factors would benefit from the proposal as road safety and travel times would be improved.

8.2 Objects of the EP&A Act

Object	Comment
5(a)(i) To encourage the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment.	The Roads and Maritime is committed to the principles embodied in the *Waste Avoidance and Resource Recovery Act 2001.* Roads and Maritime is also committed to ensuring responsible management of all resources. The proposal will not impact on the availability of resources in the locality.
5(a)(ii) To encourage the promotion and co-ordination of the orderly economic use and development of land.	The proposal will not have significant adverse impacts on the orderly economic use and development of land. Improved travel times between townships along the Oxley Highway increases the potential for development in the area.
5(a)(iii) To encourage the protection, provision and co-ordination of communication and utility services.	The proposal will not have significant adverse impacts on utility services in the area.
5(a)(iv) To encourage the provision of land for public purposes.	The proposal will improve the safety of a public road.
5(a)(v) To encourage the provision and co-ordination of community services and facilities.	Not relevant to the project.

Object	Comment
5(a)(vi) To encourage the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats.	The safeguards provided in this REF would be implemented to ensure any adverse biodiversity impacts associated with the proposal are minimised.
5(a)(vii) To encourage ecologically sustainable development.	Ecologically sustainable development is considered in Sections 8.2.1 to 8.2.4 below.
5(a)(viii) To encourage the provision and maintenance of affordable housing.	Not relevant to the project.
5(b) To promote the sharing of the responsibility for environmental planning between different levels of government in the State.	Not relevant to the project.
5(c) To provide increased opportunity for public involvement and participation in environmental planning and assessment.	The development application process for the proposal underwent community and stakeholder consultation in accordance with the provisions of the EP&A Act 1997.

8.2.1 The precautionary principle

Schedule 2 of the Environmental Planning and Assessment Regulation 2000 states that "the 'precautionary principle', namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by:

i. '*Careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment*
ii. *An assessment of the risk-weighted consequences of various options*'.

In the case of the proposal, the precautionary principle has been applied in the Environmental Assessment (Section 6) undertaken for the proposal. Potential environmental impacts of the proposal would generally be minor due to the nature of the works and the fact that the area to be cleared comprises a small portion of similar surrounding vegetation. The proposal is required to address the safety and flooding issues associated with this section of the Highway and would be undertaken in accordance with the safeguards outlined in Sections 6 of this REF.

8.2.2 Intergenerational equity

Schedule 2 of the Environmental Planning and Assessment Regulation 2000 defines intergenerational equity as "*the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations*". The proposal would not significantly affect the viability of local or threatened species, or any EECs. Therefore local biodiversity values would not be substantially adversely affected by the proposal and would be maintained for future generations. Without the works proceeding, traffic safety and efficiency would remain inadequate. Overall, the socio-economic, safety and environmental safety benefits of the proposal would occur only at limited minimal potential environmental expense.

8.2.3 Conservation of biological diversity and ecological integrity

Schedule 2 of the Environmental Planning and Assessment Regulation 2000 requires the "'*conservation of biological diversity and ecological integrity*", namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration.

The impacts to ecological integrity and conservation of biological diversity at the site have been thoroughly assessed as part of this REF. No threatened species, endangered populations or EECs are likely to be significantly affected by the proposal. No populations of native species are likely to be made locally rare or unviable as a result of the proposal. Consequently the ecological integrity and biological diversity would be maintained at the site.

8.2.4 Improved valuation, pricing and incentive mechanisms

The following principles of valuation, pricing and incentive as per Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* are acknowledged as part of this review:

i. Polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement.
ii. The users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste.
iii. Environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.

It is difficult, however, to assign a monetary value to the environment of a locality or to environmental resources not considered for commercial use. Roads and Maritime has taken an approach to manage the potential environmental impacts of the proposal by identifying appropriate safeguards (this REF) to mitigate adverse environmental effects with financial support for implementation.

8.3 Conclusion

The proposed realignment of the Oxley Highway at Rosewood Road is subject to assessment under Part 5 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 of wilderness areas, critical habitat, impacts on threatened species, populations and ecological communities and their habitats and other protected fauna and native plants. It has also considered potential impacts to matters of national environmental significance listed under the Federal EPBC Act.

A number of potential environmental impacts from the proposal have been avoided or reduced during the concept design development and options assessment. The proposal as described in the REF best meets the project objectives but would still result in some impacts on biodiversity, soil and water, traffic and noise and vibration. Safeguards and management measures as detailed in this REF would ameliorate or minimise these expected impacts. The proposal would also improve safety and driving conditions and reduce travel times. On balance the proposal is considered justified and the following conclusions are made.

Significance of impact under NSW legislation
The proposal would be unlikely to cause a significant impact on the environment. Therefore it is not necessary for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning under Part 5.1 of the EP&A Act. A Species Impact Statement is not required. The proposal is subject to assessment under Part 5 of the EP&A Act. Consent from Council is not required.

Significance of impact under Australian legislation
The proposal is not likely to have a significant impact on matters of national environmental significance or the environment of Commonwealth land within the meaning of the *Environment Protection and Biodiversity Conservation Act 1999*. A referral to the Australian Department of the Environment 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.

Jeremy Clifford
Environmental Advisor
GeoLINK
17/11/2017

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

Insert name
[Position title, eg Project Manager]
[Insert relevant Roads and Maritime Services region/program]
Date:

10 References

Transport for NSW 2015, *Oxley Highway Route Safety Review*, NSW.

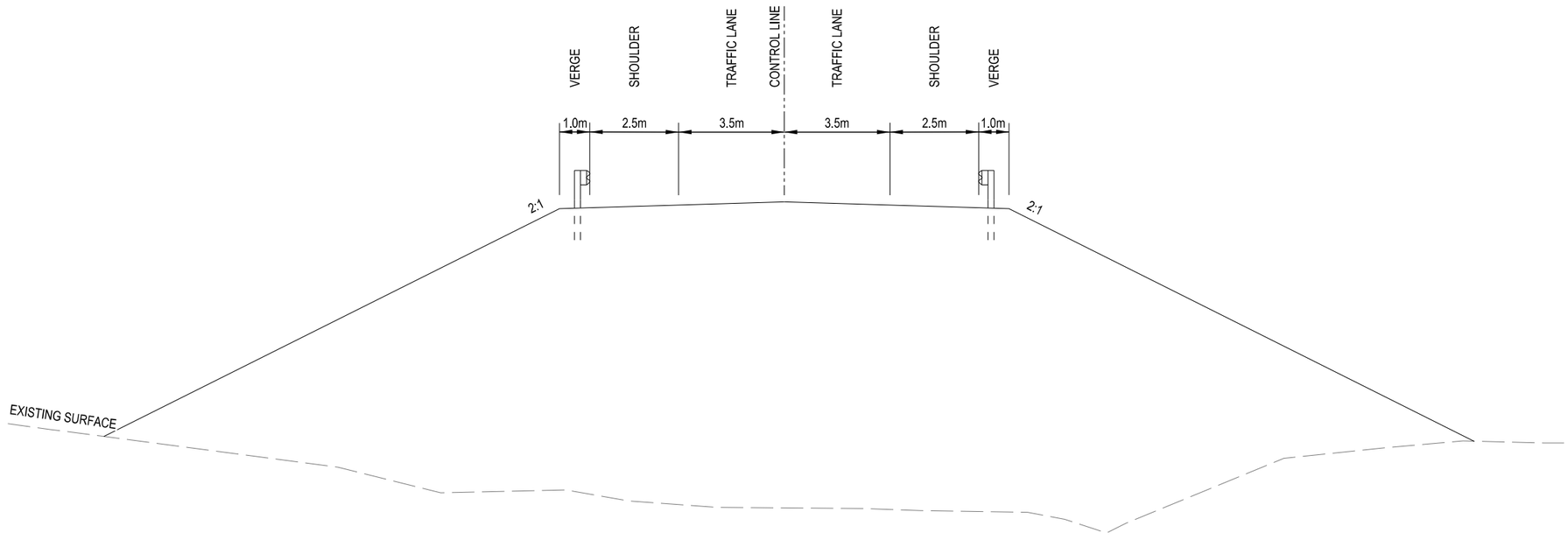
Transport for NSW 2016, *Oxley Highway Draft Corridor Strategy*, NSW

Terms and acronyms used in this REF

Term / Acronym	Description
CEMP	Construction environmental management plan
EIA	Environmental impact assessment
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW). Provides the legislative framework for land use planning and development assessment in NSW
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth). Provides for the protection of the environment, especially matters of national environmental significance, and provides a national assessment and approvals process.
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
FM Act	*Fisheries Management Act 1994* (NSW)
Heritage Act	*Heritage Act 1977* (NSW)
ISEPP	State Environmental Planning Policy (Infrastructure) 2007
LALC	Local Aboriginal Land Council
LEP	Local Environmental Plan. A type of planning instrument made under Part 3 of the EP&A Act.
NES	Matters of national environmental significance under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.
Noxious Weeds Act	*Noxious Weeds Act 1993* (NSW)
NPW Act	*National Parks and Wildlife Act 1974* (NSW)
Roads and Maritime	NSW Roads and Maritime Services
SEPP	State Environmental Planning Policy. A type of planning instrument made under Part 3 of the EP&A Act.
TSC Act	*Threatened Species Conservation Act 1995* (NSW)
QA Specifications	Specifications developed by Roads and Maritime Services for use with road work and bridge work contracts let by Roads and Maritime Services.

Appendix A

Typical cross section



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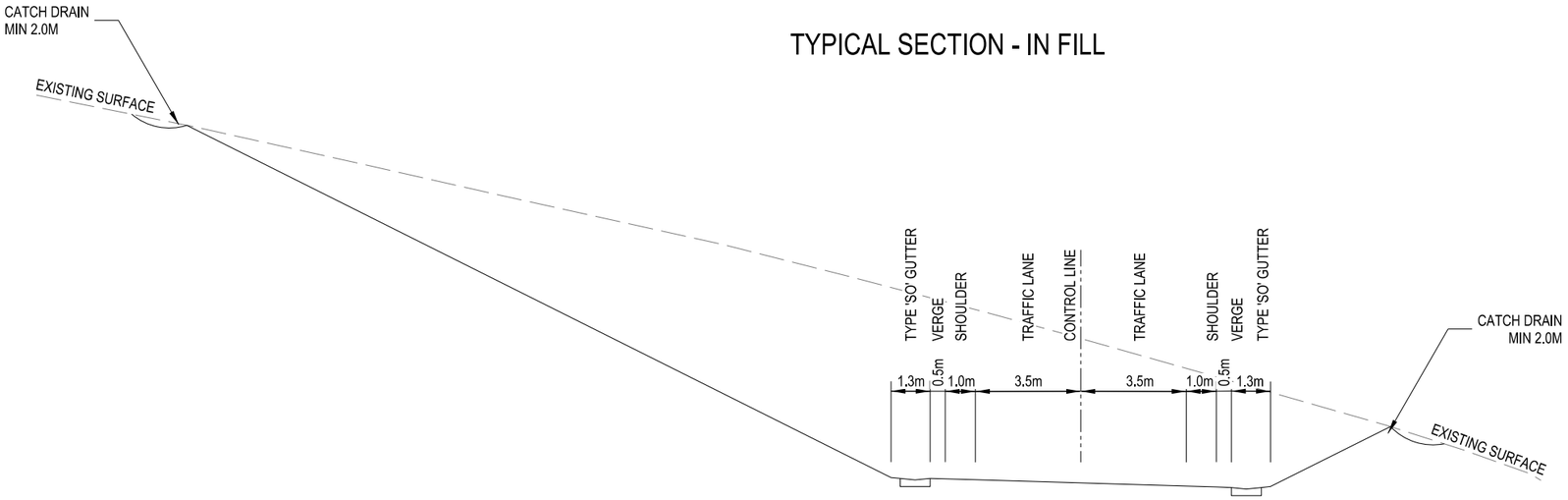

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EXTERNAL REFERENCE FILES	REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No.	APPROVAL	SCALES ON A3 SIZE DRAWING	DRAWINGS / DESIGN PREPARED BY	TITLE	NAME	NSW GOVERNMENT Transport Roads & Maritime Services		
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								PROJECT MNGR	A. STEWART			

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Appendix B

Consideration of clause 228(2) factors and matters of national environmental significance

Clause 228(2) checklist

In addition to the requirements of the *Is an EIS required?* guideline (DUAP 1995/1996) and the *Roads and Related Facilities EIS Guideline* (DUAP 1996) as detailed in the REF, the following factors, listed in clause 228(2) of the *Environmental Planning and Assessment Regulation 2000*, have also been considered to assess the likely impacts of the proposal on the natural and built environment.

Factor	Impact
a. Any environmental impact on a community? The community would not be affected through declines in the local environment as a result of the proposal. Extensive safeguards and management measures have been designed to reduce environmental impacts on the community to acceptable levels (refer to Section 6).	Minor short-term construction impacts; long-term high positive impact.
b. Any transformation of a locality? Temporary transformations comprise of: • Construction and operation of site compound / stockpile. • General construction works. After completion of the works, permanent transformations comprise of: • New road infrastructure.	Minor negative impacts. Positive long-term impacts with regards to the improving road safety and travel times.
c. Any environmental impact on the ecosystems of the locality? The proposal would not result in a significant impact on any EECs or threatened species, or the local ecosystems of the area. Effective implementation of the mitigation measures determined in Section 6 would ensure all environmental impacts associated with the proposal are not likely to be significant.	Minor negative impacts.
d. Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality? It is not likely that the scientific quality of the locality would be significantly affected by the proposal. The character of the general area would largely be the same post construction and no significant visual impact from external viewpoints is expected. No reduction in the quality of the environment associated with noise, water, soil and air quality or significant decreases in biodiversity are likely to occur due to the design of the works methodology and the mitigation measures provided in Section 6 of this REF. No significant changes to the locality are expected to occur.	Overall minor negative (predominantly short-term) impacts. Positive long-term impacts with regards to the improving road safety and travel times.
e. Any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations? The proposal is located adjacent the Oxley Highway within an area of forested land. The local area has aesthetic, heritage, social and scientific values, largely associated with the rural landscape environment. The works would not have a significant impact on any subject features of	Minor negative short-term. Positive long-term impacts with regards to the improving road safety.

Factor	Impact
special value for present or future generations of the area.	
f. Any impact on the habitat of protected fauna (within the meaning of the *National Parks and Wildlife Act* 1974)? Potential impacts on native fauna would be minor (eg minor loss / reduction of foraging sources). With effective implementation of the safeguards provided in Section 6 of this REF, the proposal is not considered likely to have a significant negative impact on the habitat of any protected fauna.	Minor negative short-term. Positive long-term impacts with regards to the improving road safety.
g. Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air? With effective implementation of the safeguards provided in Section 6, the proposal is not considered likely to impact any species of animal, plant or other form of life.	Minor negative short-term. Positive long-term impacts with regards to road safety.
h. Any long-term effects on the environment? No significant negative long-term environmental impacts are considered likely with effective implementation of the proposed mitigation measures in Section 6 of this REF.	Minor negative short-term. Positive long-term impacts with regards road safety.
i. Any degradation of the quality of the environment? No significant degradation of the quality of the environment is expected with effective implementation of the safeguards in Section 6 of this REF.	Minor negative short-term. Positive long-term impacts with regards road safety.
j. Any risk to the safety of the environment? The proposal is unlikely to pose any significant risk to the safety of the environmental attributes outlined in Section 6. Any possible impacts would be minimised with the implementation of the safeguards in Section 6 of this REF.	Minor negative short-term. Positive long-term impacts with regards road safety.
k. Any reduction in the range of beneficial uses of the environment? The proposal is not likely to result in any reduction in the range of beneficial uses of the environment.	Nil
l. Any pollution of the environment? Waste materials, fuel spills and sediment have the potential to cause pollution to the environment. However, given the proposed safeguards detailed in Section 6 of this REF and the nature and methodology proposed for the works, pollution to the environment is unlikely to occur.	Potential minor negative. Safeguards available to reduce the risk of pollution.

Factor	Impact
m. Any environmental problems associated with the disposal of waste? All waste generated by the proposal would be disposed of in a manner which would not damage or disturb any native flora or fauna or the physical environment. The disposal of waste would be in accordance with Roads and Maritime and OEH approved methods of waste disposal. Safeguards detailed in Section 6 of this REF would protect the environment from problems associated with all waste disposal.	Potential minor negative Mitigation measures available to address potential impacts
n. Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply? The proposal does not create any demand for resources that are in short supply nor is it likely to result in an increased demand on any natural resources that are likely to become in short supply. Roads and Maritime would attempt to draw supplies and resources from established suppliers having appropriate environmental approvals and standards.	Nil
o. Any cumulative environmental effect with other existing or likely future activities? The proposal would have minor cumulative impacts (eg resource consumption, vegetation clearing), but is unlikely to significantly contribute to any cumulative impacts.	Minor negative
p. Any impact on coastal processes and coastal hazards, including those under projected climate change conditions? The proposal would have minor cumulative impacts (eg carbon emissions, consumption of resources) contributing to climate change. The project is located away from the coastal fringe which would not be impacted by future coastal hazards.	Minor negative

Matters of national environmental significance

Under the environmental assessment provisions of the *Environment Protection and Biodiversity Conservation Act 1999*, the following matters of national environmental significance and impacts on Commonwealth land are required to be considered to assist in determining whether the proposal should be referred to the Australian Government Department of the Environment.

A referral is not required for proposed actions that may affect nationally listed threatened species, populations, endangered ecological communities and migratory species. Impacts on these matters are still assessed as part of the REF in accordance with Australian Government significant impact criteria and taking into account relevant guidelines and policies.

Factor	Impact
a. Any impact on a World Heritage property? The proposal footprint does not extend into World Heritage Property.	Nil
b. Any impact on a National Heritage place? The proposal does not impact on any registered items of National Heritage significance.	Nil
c. Any impact on a wetland of international importance? The proposal is not in proximity to any lands listed as Wetlands of International Significance (Ramsar Sites), and as accordingly no such wetland would be impacted by the proposal	Nil
d. Any impact on a listed threatened species or communities? No commonwealth listed threatened flora, fauna or ecological communities are likely to be significantly affected by the proposal (refer to **Section 6.1** and **Appendix D**).	Nil
e. Any impacts on listed migratory species? No commonwealth listed migratory species are likely to be significantly affected by the proposal (refer to **Section 6.1 and Appendix D**).	Nil
f. Does the proposal involve a nuclear action (including uranium mining)? The proposal does not involve a nuclear action.	Nil
g. Any impact on a Commonwealth marine area? The proposal would not impact upon any Commonwealth marine areas.	Nil
h. Additionally, any impact (direct or indirect) on Commonwealth land? The proposal is not located on Commonwealth Land.	Nil

Appendix C

Statutory consultation checklists

Infrastructure SEPP

Council related infrastructure or services

Issue	Potential impact	Yes / no	If 'yes' consult with	ISEPP clause
Stormwater	Are the works likely to have a *substantial* impact on the stormwater management services which are provided by council?	No		ISEPP cl.13(1)(a)
Traffic	Are the works likely to generate traffic to an extent that will *strain* the existing road system in a local government area?	No		ISEPP cl.13(1)(b)
Sewerage system	Will the works involve connection to a council owned sewerage system? If so, will this connection have a *substantial* impact on the capacity of any part of the system?	No		ISEPP cl.13(1)(c)
Water usage	Will the works involve connection to a council owned water supply system? If so, will this require the use of a *substantial* volume of water?	No		ISEPP cl.13(1)(d)
Temporary structures	Will the works involve the installation of a temporary structure on, or the enclosing of, a public place which is under local council management or control? If so, will this cause more than a *minor* or *inconsequential* disruption to pedestrian or vehicular flow?	No		ISEPP cl.13(1)(e)
Road & footpath excavation	Will the works involve more than *minor* or *inconsequential* excavation of a road or adjacent footpath for which council is the roads authority and responsible for maintenance?	No (it was thought the Paddock Road may be a Council asset, however Council confirmed during consultation that it is not (rather it is a Crown Road).		ISEPP cl.13(1)(f)

Local heritage items

Issue	Potential impact	Yes / no	If 'yes' consult with	ISEPP clause
Local heritage	Is there is a local heritage item (that is not also a State heritage item) or a heritage conservation area in the study area for the works? If yes, does a heritage assessment indicate that the potential impacts to the item / area are more than *minor* or *inconsequential*?	No		ISEPP cl.14

Flood liable land

Issue	Potential impact	Yes / no	If 'yes' consult with	ISEPP clause
Flood liable land	Are the works located on flood liable land? If so, will the works change flood patterns to more than a *minor* extent?	No		ISEPP cl.15

Public authorities other than councils

Issue	Potential impact	Yes / no	If 'yes' consult with	ISEPP clause
National parks and reserves	Are the works adjacent to a national park or nature reserve, or other area reserved under the *National Parks and Wildlife Act 1974*?	No	Office of Environment and Heritage	ISEPP cl.16(2)(a)
Marine parks	Are the works adjacent to a declared marine park under the *Marine Parks Act 1997*?	No	Department of Planning and Environment	ISEPP cl.16(2)(b)
Aquatic reserves	Are the works adjacent to a declared aquatic reserve under the *Fisheries Management Act 1994*?	No	Office of Environment and Heritage	ISEPP cl.16(2)(c)
Sydney Harbour foreshore	Are the works in the Sydney Harbour Foreshore Area as defined by the *Sydney Harbour Foreshore Authority Act 1998*?	No	Department of Planning and Environment	ISEPP cl.16(2)(d)
Bush fire prone land	Are the works for the purpose of residential development, an educational establishment, a health services facility, a correctional centre or group home in bush fire prone land?	No	Rural Fire Service	ISEPP cl.16(2)(f)

Appendix D

Biodiversity impact assessment

Oxley Highway – Rosewood Road Realignment

Biodiversity Assessment

September 2017

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Roads and Maritime Services

Oxley Highway - Rosewood Road Realignment

Biodiversity Assessment

September 2017

Prepared by: GeoLINK
Roads and Maritime Services Publication Number:
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Document ID	Document status	Date	Prepared by	Reviewed by
2849-1003	Version 1	24/08/2017	Ian Colvin	Veronica Silver
2849-1032	Version 2	22/09/2017	Ian Colvin	Veronica Silver

Executive summary

NSW Roads and Maritime Services (Roads and Maritime) propose to complete a realignment of part of the Oxley Highway approximately 6 kilometres west of Wauchope. The site contains the road formation and road reserve within the Oxley Highway as well as a portion of privately owned land (Lot 117 DP1025207). The work is within the Port Macquarie-Hastings Local Government Area (LGA).

Based on the site assessment and consideration of the work required, the following biodiversity matters apply to the proposal:

- The work would result in removal of an estimated 4.38 hectares of plant community type (PCT) 872, which is in good condition. This community is not a threatened ecological community listed in the *Threatened Species Conservation Act 1995* (TSC Act) or Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), and no threatened flora species were recorded
- Three threatened fauna species (Eastern Bentwing-bat, Glossy Black-cockatoo, Little Bentwing-bat) were recorded at the site, with potential that several other threatened fauna species may occur on an opportunistic or seasonal basis
- A number of mitigation measures have been recommended to manage potential impacts relating to biodiversity
- The proposal is unlikely to significantly affect any species, populations, communities or their habitats and therefore a species impact statement is not required, nor is the proposal subject to the EPBC Act Strategic Assessment.

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Glossary of terms

Definitions

Cumulative impact	The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. Refer to Clause 228(2) of the EP&A Regulation 2000 for cumulative impact assessment requirements.
Direct impact	Where a primary action is a substantial cause of a secondary event or circumstance which has an impact on a protected matter (ref http://www.environment.gov.au/system/files/resources/0b0cfb1e-6e28-4b23-9a97-fdadda0f111c/files/environment-assessment-manual.pdf).
Habitat	An area or areas occupied, or periodically or occasionally occupied, by a species, population or ecological community, including any biotic or abiotic component (OEH 2014).
Indirect impact	Where an event or circumstance is a direct consequence of the action (ref http://www.environment.gov.au/system/files/resources/0b0cfb1e-6e28-4b23-9a97-fdadda0f111c/files/environment-assessment-manual.pdf).
Locality	The local environment within 5 kilometres of the study area.
Matters of NES	A matter of national environmental significance (NES) protected by a provision of Part 3 of the EPBC Act
Mitchell landscape	Landscapes with relatively homogeneous geomorphology, soils and broad vegetation types, mapped at a scale of 1:250,000 (OEH 2014).
Mitigation	Action to reduce the severity of an impact (OEH 2014).
Mitigation measure	Any measure that facilitates the safe movement of wildlife and/or prevents wildlife mortality.
Population	All the individuals that interbreed within a given area.
Proposal area/ Proposal site	The area of land that is directly impacted on by a proposed Major Proposal that is under the EP&A Act, including access roads, and areas used to store construction materials (OEH 2014).
Study area	The area directly affected by the development and any additional areas likely to be affected by the development, either directly or indirectly (OEH 2014).
Target species	A species that is the focus of a study or intended beneficiary of a conservation action or connectivity measure.

Abbreviations

BVT	Biometric Vegetation Type
DP&E	Department of Planning and Environment
DPI	Department of Primary Industries
EEC	Endangered ecological community
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999* (Federal).
FM Act	*Fisheries Management Act 1994* (NSW)
GDE	Groundwater dependent ecosystems
IBRA	Interim Biogeographically Regionalisation of Australia
MNES	Matters of National Environmental Significance
OEH	Office of Environment and Heritage
PCT	Plant Community Type
REF	Review of Environmental Factors
SEPP	State Environmental Planning Policy
TECs	Threatened Ecological Communities
TSC Act	*Threatened Species Conservation Act 1995* (NSW).
TSPD	Threatened Species Profile Database
VIS	Vegetation information system

1 Introduction

1.1 Proposal background

NSW Roads and Maritime Services (Roads and Maritime) propose to complete a realignment of segments 0270 and 0280 of the Oxley Highway approximately 6 kilometres west of Wauchope (refer to Figure 1.1). The site contains the road formation and road reserve within the Oxley Highway as well as a portion of privately owned land (Lot 117 DP1025207).

The proposed work would be achieved by relocating the Oxley Highway to the south and smoothing the existing curves. A draft concept plan has been prepared and is provided at Figure 1.2). The work footprint is approximately 5.07 hectares, allowing for road construction, batters, drainage requirements, access tracks and ancillary sites (compound and stockpile sites).

1.2 The proposal

Key features of the proposal would include:

- Realignment of approximately 1.25 kilometres of road
- The footprint of the final road would be approximately 60,000 square metres
- Maximum vertical grades of 6 per cent
- Four new culverts, as follows:
    - A deeply incised drainage line would require a culvert under the road formation and a minor realignment up to a maximum of 20m upstream and downstream of the road; the culvert would likely comprise one box culvert constructed as a cast in-situ slab with precast culvert units. The headwall and wing-walls would be either cast in-situ or precast
    - The other three new culverts would be pipe culverts of minimum 600 millimetre diameter and probably made from precast reinforced concrete
- Three culvert extensions would be required; at chainages 4920, 5620 and 5800
- Two existing culverts would be required to be extended.
- One or more temporary sediment basins to manage site water quality during construction may be required. No sediment or water quality basin would be required once the project was finished
- Embankments with a 2:1 (or steeper) slope would likely be required for cut and fill batters. Batters would be stabilised by application of topsoil and re-vegetation wherever practical. Where re-vegetation is not deemed practical, alternative stabilisation methods such as rock revetment may be applied
- Longitudinal drainage including catch drains at top of batters, table drains (unlined and concrete lined), concrete kerb and guttering, subsoil lines, batter drains and ancillary items such as scour protection
- Tie-ins at each end of the proposed realignment of up to 300 metres. Tie-ins would be two lanes (with two-way traffic) upon completion. During construction of (and near to) the tie-ins, there would be potential for one lane, alternate flow under traffic control or traffic lights during construction (on a 24/7 basis)
- New rural boundary fencing along the proposed property acquisition boundary to the south of the realignment
- Safety barrier at the top of fills where the batter is steeper than 4:1
- One permanent and two temporary compounds, plant parking areas and stockpile sites (within the assessed footprint)
- Access tracks these would be kept within construction footprint where possible. An existing track off the existing highway would also be utilised. Benches may be required to be placed on batters to facilitate future maintenance needs

- A borrow pit may be required to supplement fill requirements. Import of fill may be required from another RMS project at Spencers Cutting project located approximately 6 kilometres east of Wauchope
- Storage of the old road pavement in situ for potential future use as quality fill or select material.

1.3 Legislative context

A Review of Environmental Factors (REF) is prepared to satisfy Roads and Maritime Services duties under s.111 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) to ñexamine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of that activityò and s.112 in making decisions on the likely significance of any environmental impacts. This biodiversity impact assessment forms part of the REF being prepared for the Oxley Highway - Rosewood Road realignment, and assesses the biodiversity impacts of the proposal to meet the requirements of the EP&A Act.

Under s.111 of the EP&A Act, Roads and Maritime Services must consider the effect of an activity on:

- any conservation agreement entered into under the *National Parks and Wildlife Act 1974* (NP&W Act)
- any plan of management adopted under the NP&W Act for the conservation area to which the agreement relates
- any joint management agreement entered into under the *Threatened Species Conservation Act 1995* (TSC Act)
- any BioBanking agreement entered into under Part 7A of the TSC Act
- any wilderness area (within the meaning of the *Wilderness Act 1987*) in the locality
- critical habitat
- threatened species, populations and ecological communities, and their habitats and whether there is likely to be a significant effect
- any other protected fauna or protected native plants within the meaning of the NP&W Act.

Sections 5A and 5C of the EP&A Act require that the significance of the impact on threatened species, populations and endangered ecological communities listed under the TSC Act or FM Act is assessed using a seven-part test. Where a significant impact is likely to occur, a species impact statement (SIS) must be prepared in accordance with the Director-Generalôs requirements.

Note: The *Biodiversity Conservation Act 2016* (BC Act) and its supporting regulations commenced on 25 August 2017. The BC Act repeals the *Threatened Species Conservation Act 1995* along with other natural resource management legislation. The BC Act sets out the assessment framework for threatened species and ecological communities. However transitional arrangements are in place, including those for pending Part 5 Assessments under the EP&A Act. Pursuant to Section 29 of the Biodiversity Conservation (Savings and Transitional) Regulation 2017, as this Part 5 assessment began before the commencement of the BC Act (on 25 August 2017), the transitional arrangements and therefore former planning provisions apply, subject to the Proponent commencing to carry out the activity within 18 months after the commencement of the new BC Act (being 25 February 2019).

As a result, Roads and Maritime proposals assessed via an REF:

- must address and consider potential impacts on nationally listed threatened species, populations, ecological communities and migratory species, including application of the ñavoid, minimise, mitigate and offsetò hierarchy
- do not require referral to the Federal Department of the Environment and Energy for these matters, even if the activity is likely to have a significant impact.

Roads and Maritime must consider impacts to nationally listed threatened species, ecological communities and migratory species as part of the approval process under the strategic assessment. To assist with this, assessments are required in accordance with the *Matters of National Environmental Significance: Significant impact guidelines 1.1. Environment Protection and Biodiversity Conservation Act 1999* (DoE 2013).

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Proposal Context

HW11 Oxley Highway - Rosewood Road Realignment - Biodiversity Assessment
2849-1043 Rev B

Figure 1-1

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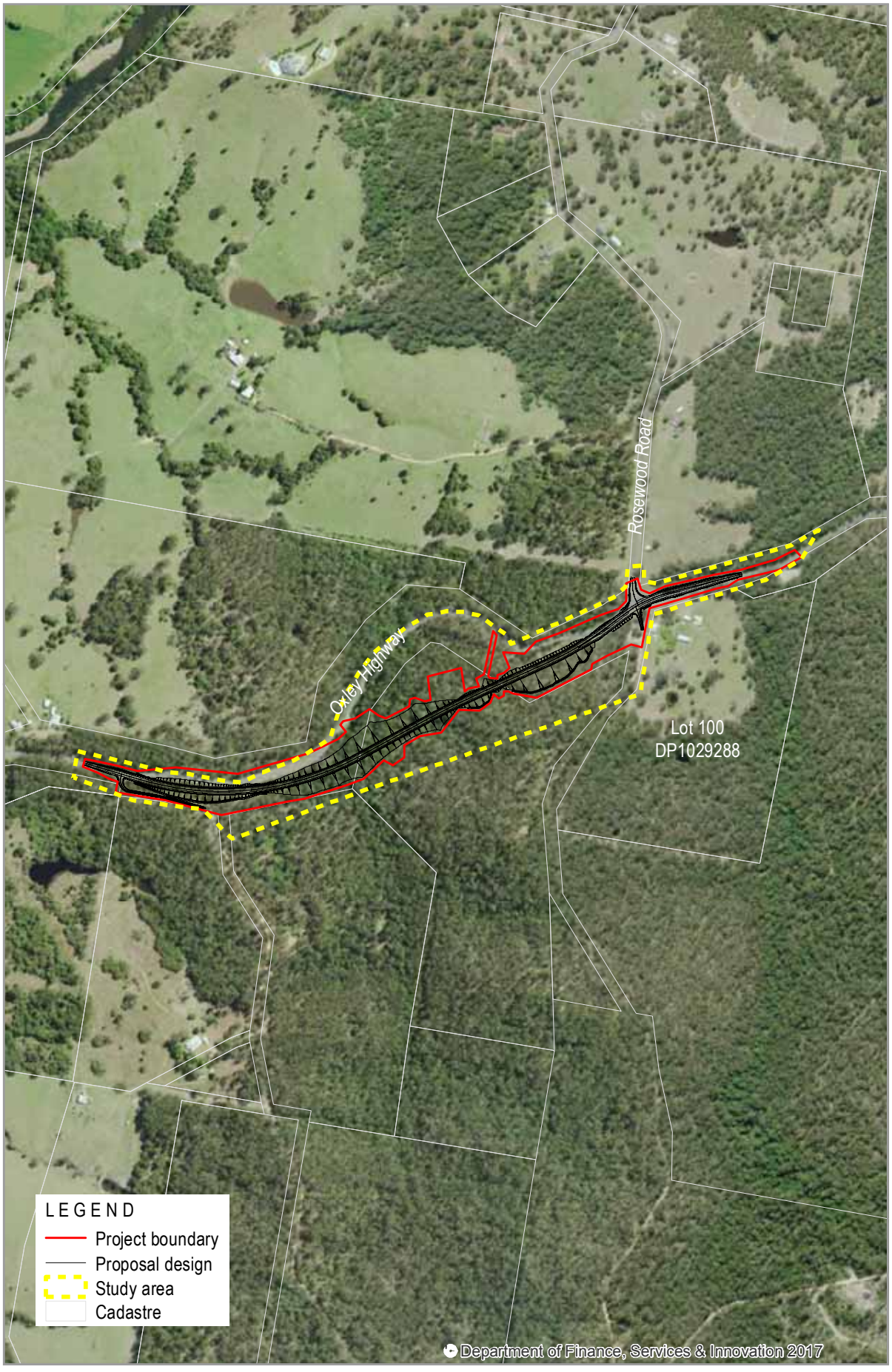

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The Proposal

2 Methods

2.1 Personnel

Qualifications and experience of personnel involved in the assessment is provided in Table 2.1.

Table 2.1: Qualifications and experience

Name	Qualification	Years of experience	Role
Ian Colvin	Bachelor of Applied Science (Environmental Resource Management)	12	Field surveys and Biodiversity Assessment content.
Veronica Silver	Bachelor of Environmental Science (Environmental Management) Graduate Diploma of Urban and Regional Planning	13	Review of Biodiversity Assessment.

2.2 Background research

2.2.1 Database searches

Prior to undertaking field surveys, searches of the databases listed in Table 2.2 were completed. Database search results are provided at Appendix A.

Table 2.2: Database searches

Source	Database name	Accessed	Search area	Date conducted
OEH	BioNet	http://www.bionet.nsw.gov.au/	20 km x 20 km grid centred on the site	2 March 2017
	Critical habitat register	http://www.environment.nsw.gov.au/criticalhabitat/CriticalHabitatProtectionByDoctype.htm	NSW	2 March 2017
	Vegetation Types Database	http://www.environment.nsw.gov.au/projects/BiometricTool.htm	Northern Rivers CMA Area	2 March 2017
NSW Department of Primary Industries (DPI) Fisheries	Threatened Species Viewer	http://www.dpi.nsw.gov.au/fishing/species-protection/threatened-species-distributions-in-nsw	Port Macquarie-Hastings LGA	11 April 2017
	NSW WeedWise	http://weeds.dpi.nsw.gov.au/WeedDeclarations?RegionId=93	Port Macquarie-Hastings LGA	2 March 2017
	Key Fish Habitat mapping	http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0004/634315/Hastings.pdf	Port Macquarie-Hastings LGA	11 April 2017
	Register of critical habitat	http://www.dpi.nsw.gov.au/fisheries/species-protection/conservation/what/register	NSW	11 April 2017

Source	Database name	Accessed	Search area	Date conducted
Australian Government Department of Environment	Protected Matters Search Tool (PMST) for Matters of National Environmental Significance (MNES)	http://environment.gov.au/erin/ert/epbc/index.html	10 km radius of the site	2 March 2017
	Directory of important wetlands	http://www.environment.gov.au/cgi-bin/wetlands/search.pl?smode=DOIW	Wauchope	2 March 2017
	Critical habitat register	http://www.environment.gov.au/cgi-bin/sprat/public/publicregisterofcriticalhabitat.pl	Australia	2 March 2017
Australian Government Bureau of Meteorology	Atlas of Groundwater Dependent Ecosystems (GDE)	http://www.bom.gov.au/water/groundwater/gde/map.shtml	Wauchope	11 April 2017

2.2.2 Literature review

Prior to the site assessment, the following desktop review was completed:

- Review of Koala habitat mapping and data in the *Port Macquarie Hastings Koala Habitat and Population Assessment* (Biolink 2013)
- Review of Council vegetation mapping (Phillips *et al.* 2013).

2.3 Habitat assessment

Based on the background research completed, a habitat assessment table has been prepared to assess the likelihood of threatened species, populations or communities (threatened biodiversity) identified with the potential to occur in the study area (refer to Appendix B).

2.4 Field survey

The site was assessed over three days (March 20-22 2017) by Ian Colvin (GeoLINK Senior Ecologist) as follows:

- March 20: preliminary inspection and nocturnal survey
- March 21: vegetation survey, habitat tree assessment, Koala scat survey and nocturnal survey
- March 22: Anabat collection and dawn bird survey.

The site assessment utilised the following methodology over approximately 13 hours in the field (not including passive Anabat survey while not present at the site):

- Random meander of vegetation communities within and adjacent to the alignment and compilation of a flora inventory using a modified Braun-Blanquet index
- Targeted survey for any threatened flora and/ or Endangered Ecological Communities (EECs)
- Survey by visual inspection using binoculars, and marking of hollow-bearing trees with spray-paint and red and white flagging tape using hand held global positioning system. Each hollow-bearing tree within the realignment footprint was painted with an identification number for future reference by project surveyors

- Recording the occurrence and extent of any biosecurity risk weeds listed in the *Biosecurity Act 2015*
- Opportunistic survey of all fauna based on visual or aural observations
- Targeted Koala survey using the Spot Assessment Technique (SAT; Phillips & Callaghan 2011)
- Two nights nocturnal survey utilising the following techniques: spotlighting, Anabat detection, call playback for threatened frogs and owls.

A summary of fauna survey effort is provided in Figure 2.1.

Weather conditions during the survey were as follows:
- March 21: (am) overcast and dry, mild temperatures; (pm) mild temperatures, no wind, overcast with light showers throughout nocturnal survey. Moon waxing gibbous (52% full)
- March 22: (am) overcast and dry, mild temperatures; (pm) mild temperatures, no wind, overcast. Moon in last quarter (50% full)
- March 23: (am) overcast and dry, mild temperatures.

The site assessment followed several previous days of heavy rainfall, with some local flooding. All watercourses are active and standing water persisted in some depressions and disturbed areas.

2.4.1 Vegetation surveys

All vegetation within the study area was thoroughly traversed as part of the general vegetation survey, habitat tree assessment, Koala assessment and nocturnal survey. A detailed floristic inventory was compiled. Due to the typical homogeneity of native vegetation at the site, no plot-based survey was completed.

Targeted flora surveys were completed in particular locations including along gully lines (target species: *Marsdenia longiloba, Melaleuca groveana*) and examination of Prickly Paperbark (*Melaleuca styphelioides*) for Spider Orchids (*Dendrobium melaleucaphilum*). The entire forest area comprises potential habitat for *Hakea archaeoides, Pomaderris queenslandica* and *Thesium australe*, so investigations allocated attention to identification of these species. All threatened flora identified from BioNet searches are readily identified in the field, with the exception of *Thesium australe*, which can be difficult to detect when in flower (spring-summer). The survey corresponded with the late stages of the flowering period for this species.

2.4.2 Targeted fauna surveys

As the site comprises well-connected sclerophyll forest containing hollow-bearing trees and watercourses, potential habitat for a range of threatened fauna occurs. The following targeted fauna surveys were completed:
- Koala survey using the SAT (Phillips & Callaghan 2011); with two sites surveyed
- Two nights nocturnal survey utilising the following techniques: spotlighting, Anabat detection, call playback for threatened frogs (Giant Barred Frog, Green-thighed Frog, Stuttering Frog) and threatened owls (Barking Owl, Masked Owl, Powerful Owl) and the Yellow-bellied Glider as follows:
  - Owl call playback was completed at one central location, with frog call playback completed at several locations along gully lines and areas of ponding water. Calls were broadcast for three minutes, followed by a five minute listening period
  - Spotlighting was completed for a total of approximately 4.3 hours
  - Anabat survey for microchiropteran bats (completed while undertaking the spotlight survey and including all night survey on 21 March 2017; total of approximately 12.5 hours). Anabat files were analysed by recognised expert Greg Ford (Balance! Environmental).

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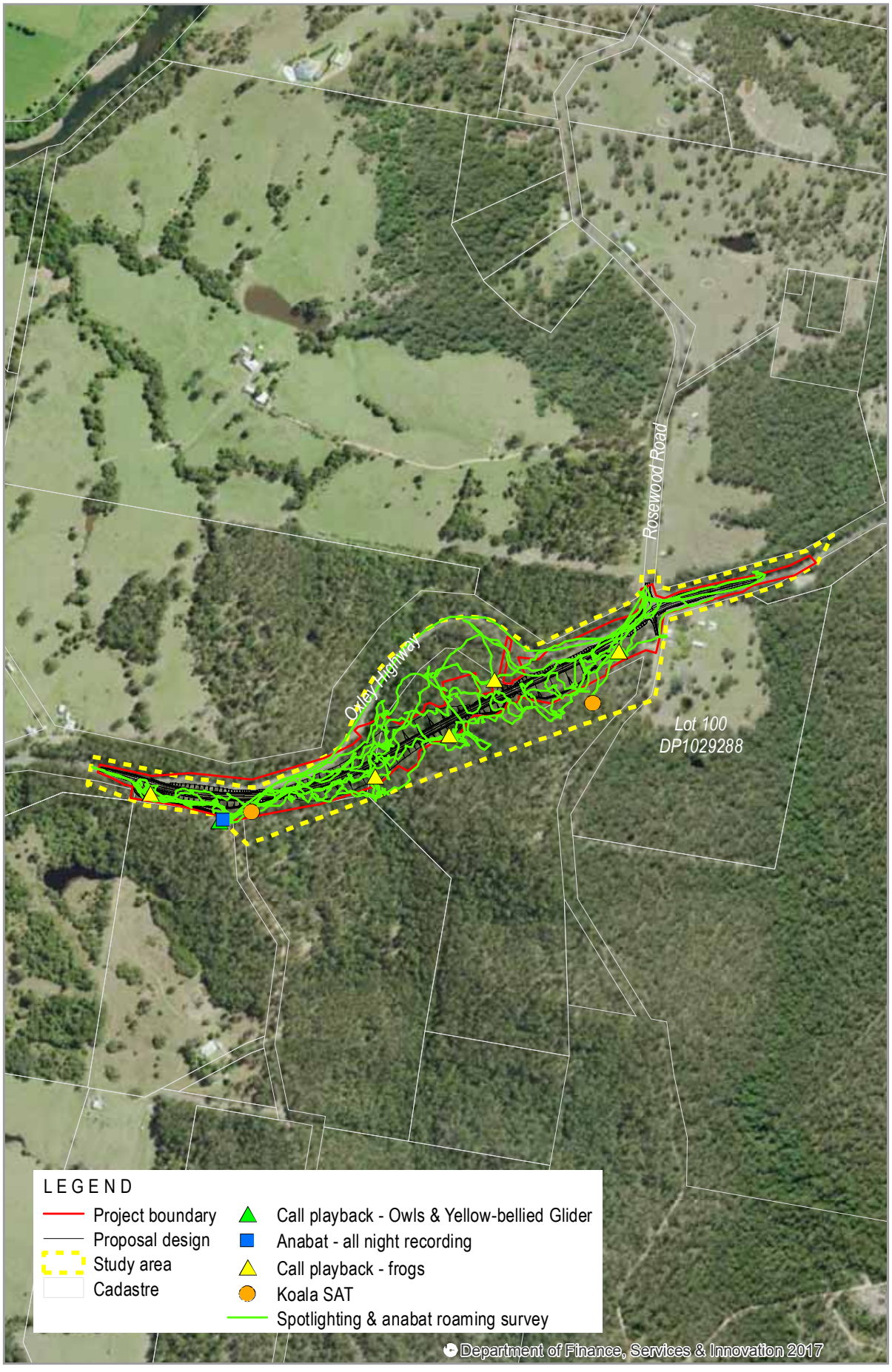
Source of base data:SixMap



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Threatened Species Survey Locations

Summary of survey effort

The effort for each survey technique employed is summarised in Table 2.3. Survey techniques are compared with relevant guidelines and comments noted. The survey effort was generally in accordance with the (working) draft *Threatened Biodiversity Survey and Assessment Guidelines* (DEC 2004), however call playback was less than the recommended number of nights for threatened owls.

Table 2.3: Targeted species survey details

Species	Minimum survey requirements (DEC 2004)	Survey completed
Barking Owl	5 nights call playback	2 nights call playback
Brush-tailed Phascogale	2 nights spotlighting, arboreal trapping/ hair tubes	2 nights spotlighting
Giant Barred Frog	2 nights spotlighting, 2 nights call playback, watercourse traverses	2 nights spotlighting, 2 nights call playback, watercourse traverses
Glossy Black-cockatoo	Searches for chewed cones	Searches for chewed cones
Greater Glider	2 nights spotlighting	2 nights spotlighting
Green-thighed Frog	2 nights spotlighting, 2 nights call playback, watercourse traverses	2 nights spotlighting, 2 nights call playback, watercourse traverses
Koala	2 nights spotlighting, call playback, scat surveys	2 nights spotlighting, 2 SAT sites surveyed
Masked Owl	8 nights call playback	2 nights call playback
Microbats	2 nights Anabat survey, including one all night survey	2 nights Anabat survey, including one all night survey
Powerful Owl	5 nights call playback	2 nights call playback
Stuttering Frog	2 nights spotlighting, 2 nights call playback, watercourse traverses	2 nights spotlighting, 2 nights call playback, watercourse traverses
Yellow-bellied Glider	2 nights spotlighting, call playback	2 nights spotlighting

2.5 Limitations

No major tree species were in flower/fruit during the assessment, therefore providing relatively scant fauna resources. Previous days of heavy rain provided excellent conditions for frogs, with all watercourses containing water and standing water present at several locations. Rain also fell during the first nights nocturnal survey while completing frog call playback surveys. While weather conditions were excellent for frog detection, rainfall on the first nights survey may have influenced spotlighting detection and bat activity.

While the survey only provides a ósnapshotôof fauna usage during the early autumn period, the techniques utilised provide suitable sampling for a range of fauna with an emphasis on targeting threatened species. Based on local fauna records and vegetation/habitat mapping, predictions of fauna usage can be made with a high level of confidence.

3 Existing environment

The study area comprises a well forested landscape which has been partially cleared and disturbed for agriculture and road construction. The site occurs within the NSW North Coast bioregion, subregion NNC07 (Macleay Hastings) as per Interim Biogeographic Regionalisation for Australia (IBRA, version 7) and lies within the Wauchope Coastal Foothills (Wcf) Mitchell Landscape (DECC 2002). Wauchope Coastal Foothills comprise hills and ranges of the coastal fall with dendritic drainage on faulted Carboniferous lithic sandstone, siltstone, tuff and some limestone. General elevation is 50 to 460 metres, local relief is 200 metres. Red and yellow texture-contrast soils occur throughout. Dry hardwood forests of Blackbutt (*Eucalyptus pilularis*), White Mahogany (*Eucalyptus acmenoides*), Spotted Gum (*Corymbia variegata*), Forest Red Gum (*Eucalyptus tereticornis*), Grey Gum (*Eucalyptus punctata*) and Red Bloodwood (*Corymbia gummifera*) occur.

The site comprises dry sclerophyll forest on low undulating hills, with a permanent watercourse and several ephemeral watercourses. The closest conservation reserve is Bago Bluff National Park, an area of 4023 hectares which occurs approximately 1 kilometre west of the site. Broken Bago State Forest occurs immediately south and east of the site and connects to Bago Bluff National Park.

A summary of the desktop assessment is shown at Table 3.1.

Table 3.1: Summary of desktop assessment

Source	Database name	Search area	Result
OEH	BioNet	20 km x 20 km grid centred on the site	21 records of eight threatened flora species and 494 records of 35 threatened fauna species; nine EECs known from within 10 km of the site (refer to Appendix A).
	Critical habitat register	NSW	No areas of critical habitat occur in the locality.
	Vegetation Types Database (BioMetric)	Northern Rivers CMA Area	BioMetric identifies a range of vegetation communities in the Port Macquarie-Hastings (PMH) LGA.
NSW Department of Primary Industries (DPI) Fisheries	Fish Records Viewer	PMH LGA	No threatened freshwater fish species are known to occur within the PMH LGA.
	NSW WeedWise	PMH LGA	A number of biosecurity risk weed species are listed in the PMH LGA; two species occur at the site (Lantana, Fireweed).
	Key Fish Habitat mapping	Hastings	On advice from DPI Fisheries, the water features that intersect the subject section of the Oxley Highway are not Key Fish Habitat. Works however are within close proximity to Yippin Creek which is located on the eastern edge of the project boundary and is Key Fish Habitat.
	Register of critical habitat	NSW	No areas of critical habitat listed under the TSC Act occur within PMH LGA.
Australian Government Department of Environment	Protected Matters Search Tool (PMST) for Matters of National Environmental Significance (MNES)	10 km radius centred on the site	Habitat for one threatened ecological community, 56 threatened species (14 flora and 42 fauna species) and 27 migratory species occurs within 10 km of the site (refer to Appendix A).
	Directory of important wetlands	Wauchope	No important wetlands occur within the locality.

Source	Database name	Search area	Result
	Critical habitat register	Australia	No federally listed areas of critical habitat occur within the locality.
Australian Government Bureau of Meteorology	Atlas of Groundwater Dependent Ecosystems (GDE)	Wauchope	No groundwater dependent ecosystems occur within the locality (refer to Section 3.4).

3.1 Plant community types

Vegetation at the site comprises open forest dominated by Grey Ironbark (*Eucalyptus siderophloia*) and Small-fruited Grey Gum (*E. propinqua*). This community is broadly analogous with vegetation unit PCT 872 in the NSW vegetation information system (VIS). PCT 872 is described as *Grey Ironbark - Grey Gum open forest of the northern escarpment ranges of the NSW North Coast Bioregion.* This community is in good condition with low levels of weed infestation (occasional Lantana).

Disturbed grassland along the road verge is dominated by a range of introduced grasses and herbs such as Pigeon Grass (*Setaria sphacelata*), Rhodes Grass (*Chloris gayana*), Vasey Grass (*Paspalum urvillei*), Purpletop (*Verbena bonariensis*) and Ragweed (*Ambrosia artemisiifolia*). There is no equivalent PCT for this community, as non-native vegetation is not recognised in VIS.

No aquatic vegetation occurs within the main watercourse or other ephemeral watercourses at the site.

A flora inventory for the site is provided at Appendix B. Details of native vegetation communities are summarised at Table 3.2 and overleaf. Vegetation communities are depicted at Figure 3.1.

Table 3.2: Plant community types

Plant community type (PCT)	Condition class	Threatened ecological community?	Area (hectares) in proposal area*	Area (hectares) in study area*
Grey Ironbark - Grey Gum open forest of the northern escarpment ranges of the NSW North Coast Bioregion (872)	Good	No	4.38	14
Total			**4.38**	**14**

***** refer to Figure 3.1

Grey Ironbark - Grey Gum open forest of the northern escarpment ranges of the NSW North Coast Bioregion

Vegetation formation: KF_CH5A Dry Sclerophyll Forests (Shrub/grass sub-formation)
Vegetation class: Northern Gorge Dry Sclerophyll Forests
PCT: 872
BVT: NR176
Conservation status: Nil
Estimate of percent cleared: 15% within Northern Rivers Catchment Management Authority (CMA) Area
Condition: Good
Extent in the study area: 14 hectares (refer to Figure 3.1)

Table 3.3: Plant community type description

Structure	Height range (centimetres)	Cover range	Typical species
Trees	25 ï 30 m	50 ï 70%	*Eucalyptus siderophloia, E. propinqua, E. acmenoides, Corymbia intermedia, E. microcorys*
Small trees	6 ï 10 m	10 ï 20%	*Allocasuarina torulosa, Jacksonia scoparia, Melaleuca styphelioides*
Shrubs	0.5 ï 2 m	<10%	*Breynia oblongifolia, Leucopogon juniperinum*
Ground covers	0.2 - 0.4 m	80 ï 90%	*Themeda australis, Lomandra longifolia, Imperata cylindrica*
Vines & climbers	< 2 m	< 10%	*Lantana camara*, Desmodium rhytidophyllum, Glycine clandestina, Morinda jasminoides*

*Introduced species

Description: vegetation at the site comprises open forest dominated by Grey Ironbark (*Eucalyptus siderophloia*) and Small-fruited Grey Gum (*E. propinqua*) with occasional White Mahogany (*E. acmenoides*), Pink Bloodwood (*Corymbia intermedia*) and infrequent Tallowwood (*E. microcorys*); refer to Plate 3.1. The midstorey is typically sparse with occasional Forest Oak (*Allocasuarina torulosa*), Dogwood (*Jacksonia scoparia*) and Coffee Bush (*Breynia oblongifolia*). Around gully lines and the main watercourse, Prickly Paperbark (*Melaleuca styphelioides*) is common in the midstorey. The ground layer is dominated by Kangaroo Grass (*Themeda australis*), Spiny-headed Mat-rush (*Lomandra longifolia*) and Blady Grass (*Imperata cylindrica*).

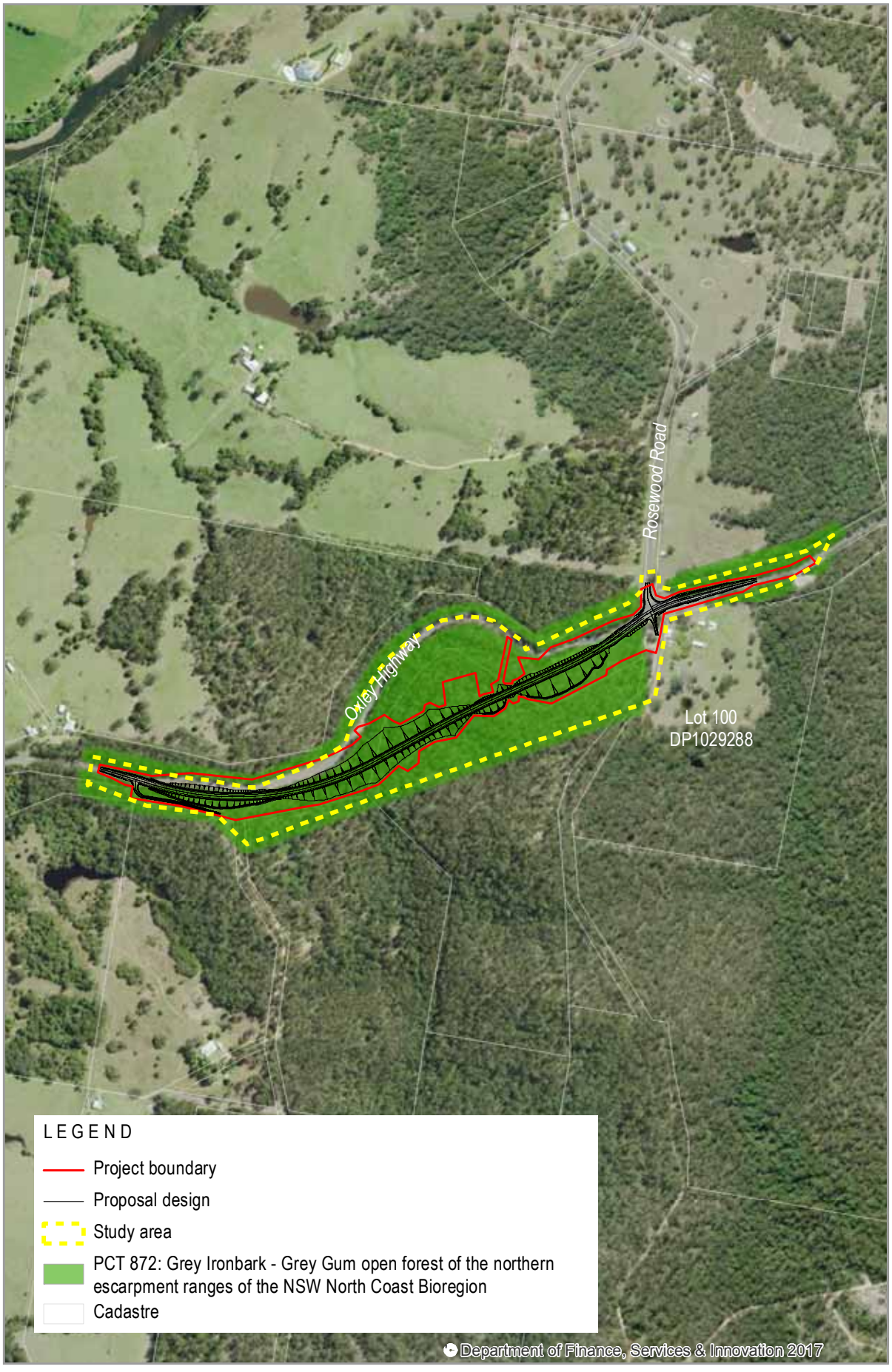
Flanking the main watercourse, occasional emergent Turpentine (*Syncarpia glomulifera*) and infrequent Brush Box (*Lophostemon confertus*) occur; refer to Plate 3.2. A secondary tree layer comprising Prickly Paperbark and other species such as Water Gum (*Tristaniopsis laurina*) and Cheese Tree (*Glochidion ferdinandi*) is present, along with midstorey species such as Black Plum (*Diospyros australis*), Tree Heath (*Trochocarpa laurina*), Orange Thorn (*Pittosporum multiflorum*), Narrow-leaved Palm Lily (*Cordyline stricta*) and Cleistanthus (*Cleistanthus cunninghamii*). The ground layer comprises Saw-sedge (*Gahnia melanocarpa*), Settlers Twine (*Gymnostachys anceps*) and Rasp Fern (*Doodia aspera*), with Stream Mat-rush (*Lomandra hystrix*) lining the watercourse.

Plate 3.1: Grey Ironbark - Grey Gum open forest (PCT872) at the site

Plate 3.2: Riparian forest along main watercourse within Grey Ironbark - Grey Gum open forest

Information shown is for illustrative purposes only

Drawn by: AB Checked by: RE Reviewed by: ILC Date: 20/11/2017
Source of base data:SixMap



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Plant Community Types

3.2 Threatened ecological communities

Vegetation present at the site is not characteristic of any Threatened Ecological Communities (TECs) listed under the TSC Act or EPBC Act.

3.3 Groundwater dependent ecosystems

Given the sites location (foothills country elevated from the coastal floodplain) and that dry sclerophyll forests are not typically associated with groundwater dependent ecosystems (GDEs), no GDEs are considered to occur at the site. This reflects the lack of any mapped GDEs in the locality.

3.4 Threatened species and populations

No threatened flora species listed under the TSC Act or EPBC Act were recorded at the site.

Three threatened fauna species listed under the TSC Act were confirmed (refer to Table 3.4). While Anabat results confirmed two threatened microbat species at the site, a further three threatened species may occur (*Nyctophilus bifax, Mormopterus norfolkensis, Scoteanax rueppellii*) but were unable to be positively identified (refer to Anabat results at Appendix C). An inventory of all fauna recorded at the site is provided at Appendix B.

Table 3.4: Habitat assessment and survey results

Scientific name	Common name	Status		Potential occurrence (Low, Moderate, High, Recorded)
		TSC Act	EPBC Act	
Calyptorhynchus lathami	Glossy Black-cockatoo	V	-	Recorded
Miniopterus australis	Little Bentwing-bat	V	-	Recorded
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	-	Recorded

Details of threatened fauna species recorded are as follows (refer to Figure 3.2):

- Glossy Black-cockatoo: recorded from several chewed cones under Forest Oak (*Allocasuarina torulosa*). No birds were directly observed. Suitable nest sites occur in hollow-bearing trees within the site
- Eastern and Little Bentwing-bat: both species recorded by Anabat during both roaming and all night survey. Both species are likely to forage freely over the site. No suitable roost habitat occurs. Existing culverts under the Oxley Highway are flood prone and accessible to predators and hence unsuitable for roosting
- All of the potential threatened microbat species (*Nyctophilus bifax, Mormopterus norfolkensis, Scoteanax rueppellii*) roost in tree-hollows, hence both foraging and roosting habitat occurs at the site.

3.4.1 Aquatic results

Only the main watercourse at the site is likely to hold water all year round, with gully watercourses functioning as ephemeral watercourses. The main watercourse passes under the Oxley Highway and eventually enters the Hastings River, approximately 1.2 kilometres to the north. DPI mapping for the Hastings region indicates the Hastings River and many connecting watercourses are mapped as Key Fish Habitat. However on advice from DPI Fisheries, the water features that intersect the subject section of the Oxley Highway are not Key Fish Habitat. It is noted that the works are within close proximity to Yippin Creek which is located on the eastern edge of the project boundary and is Key Fish Habitat. The locality does

not include any mapped habitat for threatened freshwater fish species listed under the *Fisheries Management Act 1994* (FM Act).

No habitat for threatened species, populations or communities listed under the FM Act is likely to occur at the site based on habitat mapping and the characteristics of the main watercourse (ie. shallow and intermittent). The proposal is therefore considered unlikely to have significant adverse impact on any FM Act listed threatened species, populations or communities.

3.5 Critical habitat

No areas of critical habitat are listed under the TSC Act occurring within Port Macquarie-Hastings LGA.

3.6 Wildlife connectivity corridors

The site does not occur within a mapped wildlife corridor as per Scotts (2003), although the Pappinbarra-Brok regional corridor occurs immediately to the east, connecting to Broken Bago State Forest. Key habitat is mapped over much of the site and surrounds. While the site occurs within a small window of disturbed and partially cleared agricultural land, the proposed alignment passes through a large well connected stand of eucalypt forest which adjoins Broken Bago State Forest to the east. Bago Bluff National Park (4023 hectares) occurs west of the site and connects with Broken Bago State Forest, forming an extensive well-connected forested landscape allowing excellent dispersal connectivity for forest fauna.

3.7 SEPPs

3.7.1 SEPP 14 Coastal Wetlands

State Environmental Planning Policy (SEPP) 14 aims to ensure that coastal wetlands are preserved and protected in the environmental and economic interests of the state. No SEPP 14 Coastal Wetlands are located within 10 kilometres of the site. The proposal would not impact on any areas of SEPP 14 Coastal Wetlands.

3.7.2 SEPP 26 Littoral Rainforest

SEPP 26 aims to provide a mechanism for the consideration of applications for development that is likely to damage or destroy littoral rainforest areas with a view to the preservation of those areas in their natural state. No SEPP 26 Littoral Rainforest occurs within 10 kilometres of the site. The proposal would not impact on any areas of SEPP 26 Littoral Rainforest.

3.7.3 SEPP 44 Koala Habitat

SEPP 44 aims to encourage the conservation and management of natural vegetation areas that provide habitat for Koalas, to ensure permanent free-living populations would be maintained over their present range. Clause 6 of SEPP 44 states that the SEPP applies only to land ón relation to which a development application has been madeô Clause 94 of ISEPP precludes the proposal from requiring consent therefore Part 2 of SEPP 44 does not apply to the proposal. It is Roads and Maritime policy, however, to consider environmental issues relating to their work to the fullest extent possible, including impacts on Koalas.

The proposal requires removal of habitat which contains the Schedule 2 Koala feed tree Tallowwood, with very low numbers of Tallowwood likely to require removal (less than ten). The site is unlikely to represent potential Koala habitat (as per the definitions in SEPP 44) as Tallowwood occur very infrequently and do not comprise >15% of the forest canopy. No Koalas were recorded at the site and no Koala activity cells are mapped at or in close proximity to the site (refer to *Port Macquarie-Hastings Koala Habitat and Population Assessment*, Biolink 2013). On this basis, impacts to occupied Koala habitat are likely to be relatively low.

3.8 Matters of National Environmental Significance

The EPBC Act protects/regulates MNES, including:

- World heritage properties
- National heritage places
- Wetlands of international importance
- Nationally threatened species and ecological communities
- Migratory species
- Commonwealth marine areas
- The Great Barrier Reef Marine Park
- Nuclear actions (including uranium mining)
- A water resource, in relation to coal seam gas development and large coal mining development.

Based on the search results and site assessment (refer to summary at Table 3.5), no significant impacts to any MNES are likely to result from the proposal, nor is the proposal subject to the EPBC Act Strategic Assessment.

Table 3.5: Assessment of MNES

Factor	Impact
Any impact on a World Heritage property?	
No World Heritage properties occur within 10 km of the site.	Nil
Any impact on a National Heritage place?	
No National Heritage places occur within 10 km of the site.	Nil
Any impact on a wetland of international importance?	
No wetlands of international importance occur within 10 km of the site.	Nil
Any impact on nationally listed threatened biodiversity?	
Habitat for one threatened ecological community, 56 threatened species (14 flora and 42 fauna species), 40 marine species and 27 migratory species is identified within 10 km of the site. The vegetation present does not conform to the definition of any federally listed threatened ecological communities. No nationally listed threatened or migratory species were recorded; however it is likely that several listed species (eg Grey-headed Flying-fox, Koala, Rufous Fantail, Satin Flycatcher) may utilise the site on an opportunistic or seasonal basis. Mitigation measures have been provided (refer to **Section 5.2**) to minimise any potential impacts to any listed species. No listed threatened species or communities are likely to be significantly affected by the proposal.	Negligible
Any impact on a Commonwealth marine area?	
No Commonwealth marine areas occur within 10 km of the site.	Nil
Any impact on critical habitats?	
No critical habitat occurs within 10 km of the site.	Nil
Does the proposal involve a nuclear action (including uranium mining)?	
The proposal does not involve a nuclear action.	Nil
Additionally, any impact (direct or indirect) on Commonwealth land?	
Four areas of Commonwealth Land occur within the locality. The proposal would not impact upon these areas.	Nil

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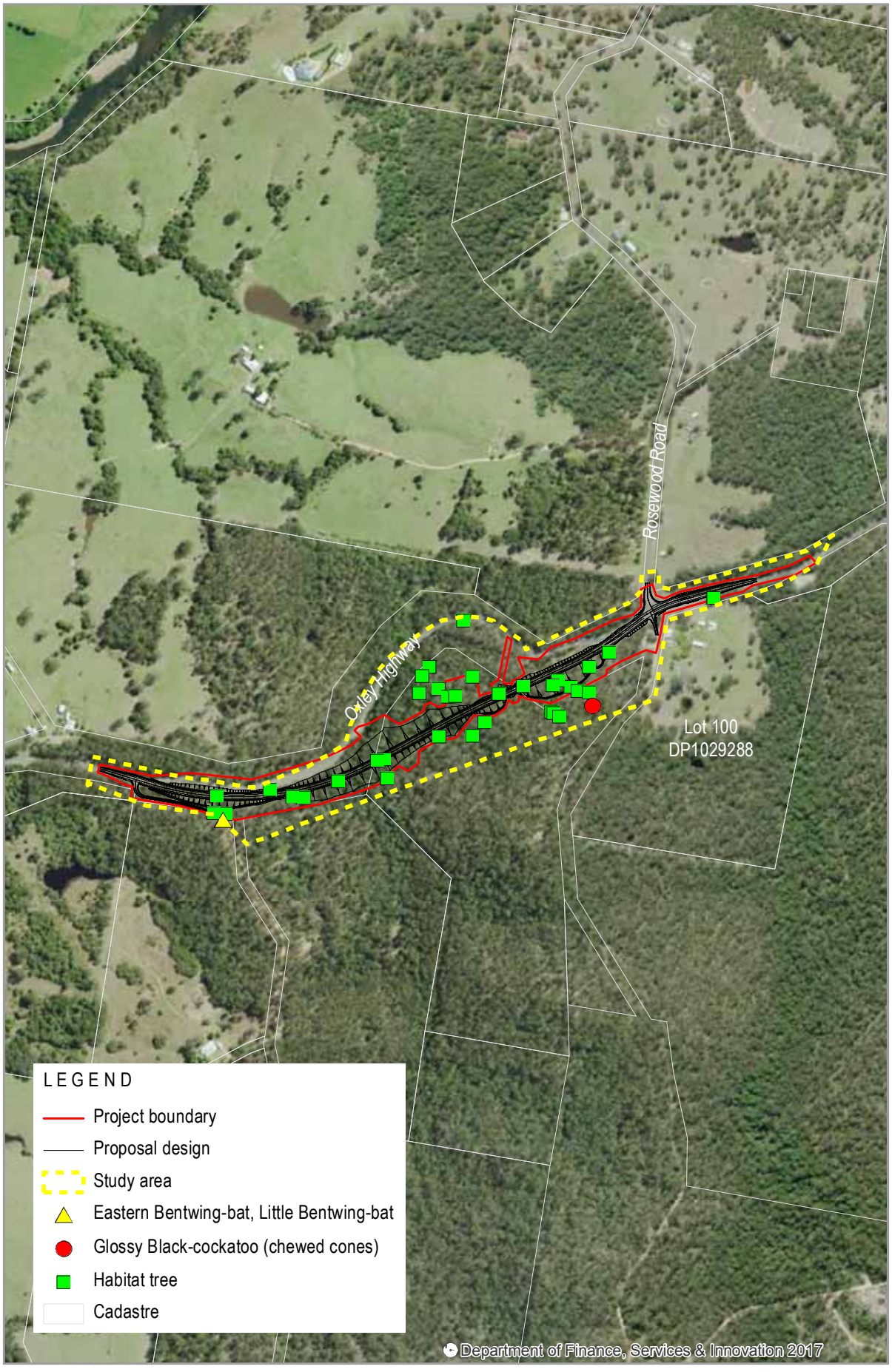
Drawn by: AB Checked by: RE Reviewed by: ILC Date: 20/11/2017
Source of base data:SixMap



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Recorded Threatened Fauna Species and Habitat Features

4 Impact assessment

The proposal would result in a number of ecological impacts related to the removal of vegetation and habitat (including habitat for threatened species) during the construction phase. Potential impacts of the work are discussed in the following sections and relate to both the construction and operational stages of the proposal.

4.1 Construction impacts

4.1.1 Removal of native vegetation

The proposal requires the removal of native vegetation within the north of Lot 117 and the road reserve. An estimated 4.38 hectares of dry sclerophyll forest (PCT 872) would be removed (refer to Table 4.1). Removal of native vegetation is recognised as a Key Threatening Process (KTP) in the TSC Act.

Table 4.1: Impacts on vegetation

Plant community type (PCT)	Status		Proposal area (hectares)	Percent cleared in CMA area
	TSC Act	EPBC Act		
872	-	-	**4.38**	15%
Total			**4.38**	

4.1.2 Removal of threatened fauna habitat

The proposal would remove an estimated 4.38 hectares of dry sclerophyll forest which provides known habitat for at least three threatened fauna species (Eastern Bentwing-bat, Glossy Black-cockatoo, Little Bentwing-bat), and potential habitat for a number of other threatened species identified from confirmed OEH database records (refer to Appendix D and Table 4.2). It is likely that eight (8) hollow-bearing trees would be removed for the work.

The main watercourse in the west of the site provides potential habitat for the Giant Barred Frog and Stuttering Frog and would also be disturbed for the installation of culverts and associated drainage.

The work is characteristic of the following KTPs with regard to threatened fauna:

- Clearing of native vegetation
- Loss of hollow-bearing trees
- Removal of dead wood and dead trees.

Table 4.2: Impacts on threatened fauna and fauna habitat

Species	Potential occurrence (moderate, high, recorded)	Impacted by proposal?	Impact
Barking Owl	High	Yes	
Black-necked Stork	Nil	No	Nil
Brolga	Nil	No	Nil
Brown Treecreeper	Moderate	Yes	4.38 ha habitat removed
Brush-tailed Phascogale	High	Yes	4.38 ha habitat removed
Comb-crested Jacana	Nil	No	Nil
Eastern Bentwing-bat	Recorded	Yes	4.38 ha habitat removed
Eastern Cave Bat	Nil	No	Nil
Eastern Freetail-bat	Moderate	Yes	4.38 ha habitat removed
Eastern Osprey	Nil	No	Nil
Giant Barred Frog	Moderate	Yes	Approx. 155 mļ of habitat disturbed along watercourse
Glossy Black-cockatoo	Recorded	Yes	4.38 ha habitat removed
Golden-tipped Bat	Nil	No	Nil
Greater Broad-nosed Bat	High	Yes	4.38 ha habitat removed
Green-thighed Frog	Moderate	Yes	Approx. 155 mļ of habitat disturbed along watercourse
Grey-headed Flying-fox	Moderate	Yes	4.38 ha habitat removed
Koala	Moderate	Yes	4.38 ha habitat removed
Little Bentwing-bat	Recorded	Yes	4.38 ha habitat removed
Little Lorikeet	Moderate	Yes	4.38 ha habitat removed
Masked Owl	Moderate	Yes	4.38 ha habitat removed
Olive Whistler	Moderate	Yes	4.38 ha habitat removed
Powerful Owl	Moderate	Yes	4.38 ha habitat removed
Scarlet Robin	Moderate	Yes	4.38 ha habitat removed
Sooty Owl	Nil	No	Nil
Southern Myotis	Nil	No	Nil
Spotted Harrier	Nil	No	Nil
Spotted-tailed Quoll	Moderate	Yes	4.38 ha habitat removed
Square-tailed Kite	Moderate	Yes	4.38 ha habitat removed
Stephens' Banded Snake	Moderate	Yes	4.38 ha habitat removed
Stuttering Frog	Moderate	Yes	Approx. 155 mļ of habitat disturbed along watercourse
Swift Parrot	Moderate	Yes	4.38 ha habitat removed
Varied Sittella	Moderate	Yes	4.38 ha habitat removed
White-bellied Sea-Eagle	Nil	No	Nil
Wompoo Fruit-Dove	Nil	No	Nil
Yellow-bellied Glider	Moderate	Yes	4.38 ha habitat removed

4.1.3 Removal of threatened flora

No threatened flora would be removed as a result of the proposal.

4.1.4 Aquatic impacts

Significant impacts to waterways and aquatic habitats are not expected to result from the proposal, as the only area of impact would be where the western watercourse is bridged by culverts and associated drainage work. This area is flanked by rainforest species and no instream aquatic vegetation occurs. The culverts and related infrastructure occur along approximately 31 metres of the watercourse and would result in the removal of riparian vegetation over an estimated area of 155 mĮ. As no specific culvert design has been provided, it is not known whether ground layer vegetation (Stream Mat-rush) would be removed (eg for a concrete culvert base).

Ephemeral watercourses comprise bare grassy gullies and provide poor habitat for aquatic fauna, with standing water providing habitat for frogs and invertebrates only.

Impacts to waterways and aquatic habitats would include:

- Temporary displacement of fauna (frogs and invertebrates)
- Loss of 155 mĮ of riparian and aquatic habitat, including removal of small amounts of woody debris
- Localised turbidity and sedimentation during construction
- Temporary obstruction to fish passage during construction
- Modification of the watercourse if concrete lining/scour protection is implemented in the construction design.

The western watercourse is unlikely to provide habitat for any freshwater aquatic species listed in the FM Act. Mitigation measures specific to biodiversity are provided within Section 5.2 and mitigation measures specific to waterways are provided within the REF.

4.1.5 Injury and mortality

Injury and mortality of fauna may occur during construction activities when habitat (particularly hollow-bearing trees) is removed. Mitigation measures specific to reduce the potential for fauna mortality or injury are provided within Section 5.2.

4.2 Indirect/operational impacts

4.2.1 Wildlife connectivity and habitat fragmentation

The proposal would result in significant fragmentation of an existing forest landscape. While this is unlikely to affect some fauna groups (birds, microbats), it may result in barriers to movement for less mobile fauna such as frogs, reptiles and ground-dwelling mammals, or gliding mammals which are unable to cross large distances (eg Feathertail Glider). As the site occurs within a well-connected landscape, it is unlikely that the proposal would limit any fauna movements within a local sense as dispersal routes to the east, west and south would remain unaffected.

Following construction it would be expected that fauna mortality would initially occur as animals attempt to disperse across the newly aligned road. Fauna groups/ species most susceptible to roadkill are likely to include macropods (Red-necked Wallaby, Eastern Grey Kangaroo), ground-dwelling mammals (Northern Brown Bandicoot, Long-eared Bandicoot), arboreal mammals (Common Brushtail Possum, Koala), birds (Tawny Frogmouth, Australian Magpie, Rainbow Lorikeet) and reptiles (Carpet Python, Eastern Water Dragon, Bearded Dragon); based on studies by Queensland Department of Main Roads (2002).

Dispersal opportunities for aquatic fauna are unlikely to be affected as the culverts on the main watercourse would allow free movement. The culvert design ensures that fish passage would not be affected.

4.2.2 Edge effects on adjacent native vegetation and habitat

The proposal would result in duplication of edge effects to the new alignment similar to that which already occur. This includes colonisation of batters and waste ground by introduced grasses and weeds (eg Pigeon Grass, Rhodes Grass, Ragweed, Cobblers Pegs), and potential for further invasion and establishment of woody weeds and climbers along vegetation edges (eg Lantana, Winter Senna, Privet, Passionfruit Vines).

4.2.3 Invasion and spread of weeds

Impacts of potential weed invasion are noted in Section 4.2.2.

4.2.4 Invasion and spread of pests

While a variety of pest species may occur in the locality (eg Common Myna, Rabbit, Feral Cat, Red Fox), the proposal would not result in any potential to increase conditions such that pest species would become more prevalent. The Red Fox is known to utilise newly created tracks and roads, however the open nature of the existing forest and existing tracks and clearings poses few limitations to the species.

4.2.5 Invasion and spread of pathogens and disease

No signs of myrtle rust were observed at the site. With the adoption of standard hygiene measures there is little likelihood of the introduction of pathogens or disease to the site.

4.2.6 Changes to hydrology

Drainage work (including pipes and culverts) would ensure that hydrology is unchanged.

4.2.7 Noise, light and vibration

Once operational, the proposal would bring noise impacts from the existing highway closer to less disturbed areas of habitat. It would be expected that fauna species in close proximity to the existing road alignment are habituated to noise and no significant impacts to breeding or behaviour would occur during operation of the new alignment. While no street lighting is proposed, the new road would make adjacent habitat areas subject to headlight shine from passing vehicles. Adjacent habitat areas would ensure substantial areas for retreat or relocation for sensitive fauna species.

No significant increase in vibration during road operation is expected.

4.2.8 Groundwater dependent ecosystems

As noted, groundwater dependent ecosystems do not occur at the site and surrounds; changes to groundwater flows are unlikely to occur as a result of the continued operation of the new road alignment.

4.3 Cumulative impacts

The proposal would have a minor cumulative negative effect due to the required habitat loss/ modification and generation of greenhouse gas emissions during work. However the impacts of the proposal are not substantial in a local context and would not impose a significant effect locally. Additionally the mitigation measures detailed in Section 5.2 would ensure such impacts are minimised.

The loss of vegetation/habitat in the locality from other projects is not known, and hence an assessment of the contribution to potential cumulative impacts of habitat loss cannot be made.

4.4 Assessments of significance

The TSC Act requires an assessment of significance (seven-part test) when assessing whether an action, development or activity is likely to significantly affect threatened species, populations or ecological communities, or their habitats.

Based on the potential for several fauna species to occur (refer to Appendix D[1]), assessments of significance have been completed (refer to Appendix E). The assessment concluded that the proposal would be unlikely to significantly increase the risk of extinction for any fauna species (refer to Table 4.3), and hence a SIS is not required.

Table 4.3: Summary of significance assessments

TSC Act significance assessments								
Threatened species, or communities	**Significance assessment question[1]**							**Likely significant impact?**
	a	**b**	**c**	**d**	**e**	**f**	**g**	
Barking Owl	N	X	X	N	X	X	Y	No
Brown Treecreeper	N	X	X	N	X	X	Y	No
Brush-tailed Phascogale	N	X	X	N	X	X	Y	No
Eastern Bentwing-bat	N	X	X	N	X	X	Y	No
Eastern Freetail-bat	N	X	X	N	X	X	Y	No
Giant Barred Frog	N	X	X	N	X	X	Y	No
Glossy Black-cockatoo	N	X	X	N	X	X	Y	No
Greater Broad-nosed Bat	N	X	X	N	X	X	Y	No
Green-thighed Frog	N	X	X	N	X	X	Y	No
Grey-headed Flying-fox	N	X	X	N	X	X	Y	No
Koala	N	X	X	N	X	X	Y	No
Little Bentwing-bat	N	X	X	N	X	X	Y	No
Little Lorikeet	N	X	X	N	X	X	Y	No
Masked Owl	N	X	X	N	X	X	Y	No
Olive Whistler	N	X	X	N	X	X	Y	No
Powerful Owl	N	X	X	N	X	X	Y	No
Scarlet Robin	N	X	X	N	X	X	Y	No
Spotted-tailed Quoll	N	X	X	N	X	X	Y	No
Square-tailed Kite	N	X	X	N	X	X	Y	No
Stephens' Banded Snake	N	X	X	N	X	X	Y	No
Stuttering Frog	N	X	X	N	X	X	Y	No
Swift Parrot	N	X	X	N	X	X	Y	No
Varied Sittella	N	X	X	N	X	X	Y	No
Yellow-bellied Glider	N	X	X	N	X	X	Y	No

EPBC Act assessments		
Threatened species, or communities	**Important population[2]**	**Likely significant impact?**
Nil	n/a	n/a

Notes: Y= Yes (negative impact), N= No (no or positive impact), X= not applicable, ?= unknown impact.

[1] Pelagic species (albatrosses, prions etc) and marine reptiles for which no habitat occurs at the site have not been assessed.

1. Significance Assessment Questions as set out in the *Threatened Species Conservation Act 1995/ Environmental Planning and Assessment Act 1979.*
   a in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,
   b in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,
   c in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
      (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
      (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,
   d in relation to the habitat of a threatened species, population or ecological community:
      (i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
      (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
      (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,
   e whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),
   f whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,
   g whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

2. A ópopulation of a speciesô as determined by the *Environment Protection and Biodiversity Conservation Act 1999* is an occurrence of the species in a particular area. In relation to critically endangered, endangered or vulnerable threatened species, occurrences include but are not limited to:
   a. a geographically distinct regional population, or collection of local populations, or
   a population, or collection of local populations, that occurs within a particular bioregion.

   Important Population as determined by the *Environment Protection and Biodiversity Conservation Act 1999*, is one that for a vulnerable species:
   a is likely to be key source populations either for breeding or dispersal
   b is likely to be necessary for maintaining genetic diversity
   c is at or near the limit of the species range.

4.5 Impact summary

Table 4.4 provides the standard impacts to be considered in the assessment, but also provides a summary of the impact assessment.

Table 4.4: Summary of impacts

Impact	Biodiversity values	Nature of impact (direct, indirect, cumulative)	Extent of impact (site based, Local, Regional, State, National)	Duration (short term long term)	Does the proposal constitute or exacerbate a key threatening process?	Confidence in assessment (known, unknown, unpredictable or irreversible)
Removal of native vegetation	Native vegetation	Direct	Site based	Long term	• Clearing of native vegetation	Irreversible
	TECs	Nil	Nil	Nil	n/a	Known
Removal of threatened fauna habitat	Eastern Bentwing-bat, Glossy Black-cockatoo, Little Bentwing-bat	Direct			• Clearing of native vegetation • Bush rock removal • Loss of hollow-bearing trees • Removal of dead wood and dead trees	Irreversible
Removal of threatened flora	Nil					
Aquatic impacts	Watercourse habitat and riparian vegetation	Direct	Site based	Long term	• Clearing of native vegetation	Irreversible
Injury and mortality of fauna	Local fauna	Direct	Site based	Short term	n/a	unpredictable
Fragmentation of identified biodiversity links and habitat corridors	Nil					
Edge effects on adjacent native vegetation and habitat	Habitat degradation from weed invasion	cumulative	Site based	Long term	n/a	unpredictable
Invasion and spread of weeds	Native vegetation	Indirect	Site based	Long term	• Invasion and establishment of exotic vines and scramblers • Invasion of native plant communities by African Olive (*Olea europaea* L. subsp. □*uspidate)* • Invasion, establishment and spread of *Lantana camara* • Invasion of native plant communities by exotic perennial grasses	unpredictable

Impact	Biodiversity values	Nature of impact (direct, indirect, cumulative)	Extent of impact (site based, Local, Regional, State, National)	Duration (short term long term)	Does the proposal constitute or exacerbate a key threatening process?	Confidence in assessment (known, unknown, unpredictable or irreversible)
					• Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants	
Invasion and spread of pests	Native fauna	Indirect	Site based	Short term	• Competition and grazing by the feral European rabbit (*Oryctolagus cuniculus*) • Competition and habitat degradation by feral goats (*Capra hircus*) • Herbivory and environmental degradation caused by feral deer • Invasion and establishment of the cane toad (*Bufo marinus*) • Predation and hybridisation of feral dogs (*Canis lupus familiaris*) • Predation by the European red fox (*Vulpes vulpes*) • Predation by the feral cat (*Felis catus*) • Predation by Plague Minnow or Mosquito Fish *(Gambusia holbrooki*) • Predation, habitat degradation, competition and disease transmission by feral pigs (*Sus scrofa*)	unpredictable
Invasion and spread of pathogens and disease	Native vegetation and fauna	Indirect	Site based	Short term	• Infection of native plants by *Phytophthora cinnamomi* • Introduction and Establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae • Infection by psittacine circoviral (beak and feather) disease affecting endangered psittacine species and populations	unpredictable

Impact	Biodiversity values	Nature of impact (direct, indirect, cumulative)	Extent of impact (site based, Local, Regional, State, National)	Duration (short term long term)	Does the proposal constitute or exacerbate a key threatening process?	Confidence in assessment (known, unknown, unpredictable or irreversible)
					• Infection of frogs by amphibian chytrid causing the disease chytridiomycosis	
Groundwater dependent ecosystems	Nil					
Changes to hydrology	Aquatic habitat	Direct/ indirect	Site based	Long term	• Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands	unpredictable
Noise, light and vibration	Native fauna	Direct/ indirect	Site based	Long term	n/a	unpredictable

5 Avoid, minimise and mitigate impacts

Based on the hierarchy of ‘avoid, minimise and mitigate’, the road design has been modified to avoid habitat trees recorded during the site investigations. Avoidance of other ecological impacts has not been possible based on the preferred alignment to achieve project objectives.

5.1 Avoidance and minimisation

All efforts have been made to avoid in the first instance and then minimise impacts through consideration of the road alignment to avoid hollow-bearing trees.

5.2 Mitigation measures

Mitigation measures outlined in this document aim to minimise any potential adverse impacts arising from the proposal with regard to biodiversity. The safeguards and management measures are listed below and summarised in Table 5.1.

1. Appropriate exclusion zones defining the work limits must be established around areas of adjacent native vegetation prior to commencement of work in accordance with the Roads and Maritime *Biodiversity Guidelines 2011*.
2. Sediment fencing and erosion controls must be installed prior to any works and maintained for the duration of the project.
3. Declared biosecurity risk weeds must be managed according to requirements under the *Biosecurity Act 2015.*
4. Weeds must be disposed of appropriately as per Council requirements and OEH protocols.
5. Removal of native riparian vegetation must be limited to the amount required to undertake the work.
6. Trees must be felled in a way that minimises disturbance or damage to adjacent retained native vegetation.
7. Vegetation to be removed that does not include millable or usable timber should be placed within cleared areas to serve as fauna habitat or chipped and retained at the site or utilised in erosion control. No burning of vegetation wastes shall occur.
8. Tree trimming (if required) must be undertaken by a qualified arborist in accordance with the *Australian Standard 4373-2007 Pruning of amenity trees.* Pruning of mature trees must be undertaken by a qualified arborist.
9. Vegetation clearing should be completed in a staged manner:
   - Stage 1 comprising clearing of non-hollow-bearing trees
   - Stage 2 comprising clearing of hollow-bearing trees. Stage 2 clearing must be undertaken at least the day after stage 1 clearing and preferably within 1 week of the stage 1 clearing around any hollow-bearing trees.
10. An ecologist/ wildlife carer must be present during Stage 2 clearing and inspect all hollow-bearing trees for fauna, and capture and release fauna outside the construction footprint on the property as appropriate (eg at night for nocturnal fauna).
11. Hollow-bearing trees must be removed carefully to reduce the potential for fauna mortality. Each tree should be ‘bumped’ with the excavator bucket several times and a minimum of two minutes provided prior to felling to allow any resident fauna to vacate. Should fauna be detected, additional safeguards may be identified by the project ecologist (eg additional bumps, or selective limb removal).
12. Habitat tree clearing requirements must be clearly communicated to clearing personnel during ‘tool-box’ meetings prior to commencing of clearing activities.
13. Should injured fauna be located on the site during the work, local wildlife care groups and/ or local veterinarians must be contacted immediately and arrangements made for the immediate welfare of the animal. The phone number of the local WIRES group must be known to the project foremen (WIRES 1300 094 737). Fauna handling must be carried out in accordance

with the requirements the *Roads and Maritime Services Biodiversity Guidelines – Guide 9 (Fauna Handling).*

14. Environmental safeguards must be communicated to all construction personnel as part of an environmental site induction, and repeated where appropriate at toolbox sessions prior to commencement of relevant work components.
15. Disturbances beyond the limit of work (particularly within the drip line of adjacent retained trees) must be avoided.
16. Weed and pathogen management guidelines as detailed in *Guide 6: Weed Management* and *Guide 7. Pathogen Managemen*t of the Roads and Maritime *Biodiversity Guidelines 2011* must be implemented. This would include:
    - Ensuring all plant, equipment and personnel are free of soil and potential weed propagules prior to being brought to the site.
    - Washing down and disinfecting vehicles used off-road, or plant, equipment (including hand tools) and boots that have the potential to transport weeds and pathogens before being used on other sites.
17. If unexpected threatened fauna or flora species are discovered, work must stop immediately and follow the Roads and Maritime *Unexpected Threatened Species Find Procedure* in the Roads and Maritime *Biodiversity Guidelines 2011 – Guide 1 (Pre-clearing process)*ô
18. If security lighting is installed at compound areas, it should be sited to reduce light spill into areas of adjacent vegetation/habitat.
19. Prior to opening of the new alignment, new wildlife signage will be installed in proximity to either end of the new alignment warning of the risk of fauna roadkill.
20. Nest boxes would be installed to compensate for any hollow-bearing trees removed and will be installed in the month prior to vegetation clearing (providing landowner approval and siting considerations have been resolved). Nest boxes would be installed at a ratio of one box per hollow removed (based on data collected prior to clearing works), hence ensuring no net loss of hollows. Nest boxes must be of types suited to fauna species likely to occur in the locality (eg parrots, microbats, small arboreal mammals) and placed in undisturbed forest areas at least 50 metres from the road edge. Nest boxes should be placed on the southern side of the new alignment where fauna can utilise areas of consolidated and unfragmented forest. Concurrence/agreement with adjacent property owners will be required if the acquired road reserve is insufficient to accommodate the required number of nest boxes.

Table 5.1: Mitigation measures

Impact	Mitigation measures	Timing and duration	Likely efficacy of mitigation	Residual impacts anticipated
Removal of native vegetation	Native vegetation removal will be minimised through detailed design.	Detailed design	Effective	No residual impacts from loss of native vegetation
	Pre-clearing surveys will be undertaken in accordance with *Guide 1: Pre-clearing process* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Prior to construction	Effective	
	Vegetation removal will be undertaken in accordance with *Guide 4: Clearing of vegetation and removal of bush rock* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Effective	
	Native vegetation will be re-established in accordance with *Guide 3: Re-establishment of native vegetation* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Post construction	Effective	
	The unexpected species find procedure is to be followed under *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011) if threatened ecological communities, not assessed in the biodiversity assessment, are identified in the proposal site.	During construction	Proven	
Removal of threatened species habitat and habitat features	Habitat removal will be minimised through detailed design.	Detailed design	Effective	No residual impacts from loss of threatened fauna habitat
	Habitat removal will be undertaken in accordance with *Guide 4: Clearing of vegetation and removal of bushrock* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Effective	
	Habitat will be replaced or re-instated in accordance with *Guide 5: Re-use of woody debris and bush rock* and *Guide 8: Nest boxes* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Proven	
	The unexpected species find procedure is to be followed under *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011) if threatened fauna, not assessed in the biodiversity assessment, are identified in the proposal site.	During construction	Proven	
Removal of threatened plants	Pre-clearing surveys will be undertaken in accordance with *Guide 1: Pre-clearing process* of the *Biodiversity Guidelines: Protecting and managing*	During construction	Proven	No residual impacts from loss of

Impact	Mitigation measures	Timing and duration	Likely efficacy of mitigation	Residual impacts anticipated
	biodiversity on RTA projects (RTA 2011).			threatened plants
	The unexpected species find procedure is to be followed under *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011) if threatened flora species, not assessed in the biodiversity assessment, are identified in the proposal site.	During construction	Proven	
Aquatic impacts	Aquatic habitat will be protected in accordance with *Guide 10: Aquatic habitats and riparian zones* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011) and Section 3.3.2 *Standard precautions and mitigation measures* of the *Policy and guidelines for fish habitat conservation and management Update 2013* (DPI (Fisheries NSW) 2013).	During construction	Effective	No residual impacts on aquatic habitat
Groundwater dependent ecosystems	Interruptions to water flows associated with groundwater dependent ecosystems will be minimised through detailed design.	Detailed design	Effective	No residual impacts on Groundwater dependent ecosystems
Changes to hydrology	Changes to existing surface water flows will be minimised through detailed design.	Detailed design	Effective	No residual impacts to hydrology
Fragmentation of identified habitat corridors	Connectivity measures will be implemented in accordance with the *Wildlife Connectivity Guidelines for Road Projects* (RTA 2011).	Detailed design, during construction and post construction	Effective	n/a
Edge effects on adjacent native vegetation and habitat	Exclusion zones will be set up at the limit of clearing in accordance with *Guide 2: Exclusion zones* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Effective	No residual impacts from loss of habitat in edge areas
Injury and mortality of fauna	Fauna will be managed in accordance with *Guide 9: Fauna handling* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Effective	None
Invasion and spread of weeds	Weed species will be managed in accordance with *Guide 6: Weed management* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Effective	None

Impact	Mitigation measures	Timing and duration	Likely efficacy of mitigation	Residual impacts anticipated
Invasion and spread of pests	Pest species will be managed within the proposal site.	During construction	Effective	None
Invasion and spread of pathogens and disease	Pathogens will be managed in accordance with *Guide 2: Exclusion zones* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Effective	None
Noise, light and vibration	Shading and artificial light impacts will be minimised through detailed design.	Detailed design	Effective	No residual impacts from loss of habitat in edge areas

6 Offset strategy

6.1 Quantification of impacts

In accordance with the Roads and Maritime *Guideline for Biodiversity Offsets* (Roads and Maritime 2011), biodiversity offsets are not considered necessary for the proposal as no native vegetation that is core habitat for any threatened species, population or community in the locality would be removed or modified.

Roads and Maritime only provide biodiversity offsets for impacts that exceed the following thresholds (refer to Table 6.1) ï the project clearly does not exceed any of these thresholds.

Table 6.1: Roads and Maritime offset justification

Description of activity or impact	Consider offsets or supplementary measures
Activities in accordance with Roads and Maritime Services Environmental assessment procedure: Routine and Minor Works (RTA 2011)	No
Works on cleared land, plantations, exotic vegetation where there are no threatened species or habitat present	No
Works involving clearing of vegetation planted as part of a road corridor landscaping program (this includes where threatened species or species comprising listed ecological communities have been used for landscaping purposes)	No
Works involving clearing of national or NSW listed critically endangered ecological communities (CEEC)	Where there is any clearing of an CEEC in moderate to good condition
Works involving clearing of nationally listed threatened ecological community (TEC) or nationally listed threatened species habitat	Where clearing >1 ha of a TEC or habitat in moderate to good condition
Works involving clearing of NSW endangered or vulnerable ecological community	Where clearing > 5 ha or where the ecological community is subject to an SIS
Works involving clearing of NSW listed threatened species habitat where the species is a species credit species as defined in the OEH Threatened Species Profile Database (TSPD)	Where clearing > 1 ha or where the species is the subject of an SIS
Works involving clearing of NSW listed threatened species habitat and the species is an ecosystem credit species as defined in OEHõs Threatened Species Profile Database (TSPD)	Where clearing > 5 ha or where the species is the subject of an SIS
Type 1 or Type 2 key fish habitats (as defined by NSW Fisheries)	Where there is any net loss of habitat

7 Conclusion

Based on the site assessment and consideration of the work required, the following biodiversity matters apply to the proposal:

- The work would result in removal of an estimated 4.38 hectares of plant community type (PCT) 872, which is in good condition. This community is not a threatened ecological community listed in the TSC Act or EPBC Act, and no threatened flora species were recorded
- Three threatened species (Eastern Bentwing-bat, Glossy Black-cockatoo, Little Bentwing-bat) were recorded at the site, with potential that several other threatened species may occur on an opportunistic or seasonal basis.
- A number of mitigation measures have been recommended to manage potential impacts relating to biodiversity.
- The proposal is unlikely to significantly affect any species, populations, communities or their habitats and therefore a species impact statement is not required, nor is the proposal subject to the EPBC Act Strategic Assessment.
- A biodiversity offset strategy is not required.

8 References

Biolink 2013, *Port Macquarie-Hastings Koala Habitat and Population Assessment. Final Report to Port Macquarie-Hastings Council.* Biolink Ecological Consultants, Uki.

Department of Environment and Climate Change (DECC) 2002, *Descriptions for NSW (Mitchell) Landscapes Version 2 (2002)*. DECC, Hurstville NSW.

Department of Environment and Conservation (DEC) 2004, *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities. Working Draft.* Department of Environment and Conservation (NSW), Sydney.

Phillips, S. and Callaghan, J. 2011, The Spot Assessment Technique: a tool for determining localised levels of habitat use by koalas *Phascolarctos cinereus*. *Australian Zoologist* **35**, 774ï 780.

Phillips, S., Chang, M. & Kordas, G. 2013, *Vegetation of the Port Macquarie-Hastings Koala Local Government Area. Version 1.08.* Report to Port Macquarie Hastings Council. Biolink Ecological Consultants, Uki. NSW.

Queensland Department of Main Roads 2002, *Fauna Sensitive Road Design. Volume 1 – Past and Existing Practices.* Queensland Department of Main Roads

Scotts, D. 2003, *Key Habitats and Corridors for Forest Fauna. Occasional Paper 32.* NSW NPWS.

Department of the Environment (DoE) 2013, *Matters of National Environmental Significance: Significant impact guidelines 1.1. Environment Protection and Biodiversity Conservation Act 1999.*

Appendix A – Search results

Data from the BioNet Atlas of NSW Wildlife website, which holds records from a number of custodians. The data are only indicative and cannot be considered comprehensive inventory, and may contain errors and omissions. Species listed under the Sensitive Species Data Policy may have their locations denatured (^ rounded to 0.1Â°; ^^ rounded to 0.01Â°). Copyright the State of NSW through the Office of Environment and Heritage. Search criteria : Public Report of all Val Records of Threatened (listed on TSC Act 1995) Plants in selected area [North: -31.38 West: 152.59 East: 152.78 South: -31.58] returned a total of 21 records c species.

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Kingdom	Class	Family	Species Code	Scientific Name	Exotic	Common Name	NSW status	Comm. status	Records
Plantae	Flora	Apocynaceae	1233	*Marsdenia longiloba*		Slender Marsdenia	E1,P	V	1
Plantae	Flora	Fabaceae (Caesalpinioideae)	8772	*Senna acclinis*		Rainforest Cassia	E1,P		3
Plantae	Flora	Myrtaceae	4252	*Melaleuca groveana*		Grove's Paperbark	V,P		6
Plantae	Flora	Orchidaceae	6630	*^Dendrobium melaleucaphilum*		Spider orchid	E1,P,2		2
Plantae	Flora	Orchidaceae	4480	*^Phaius australis*		Southern Swamp Orchid	E1,P,2	E	1
Plantae	Flora	Proteaceae	10801	*^^Hakea archaeoides*		Big Nellie Hakea	V,P,3	V	5
Plantae	Flora	Rhamnaceae	5592	*Pomaderris queenslandica*		Scant Pomaderris	E1,P		1
Plantae	Flora	Santalaceae	5871	*Thesium australe*		Austral Toadflax	V,P	V	2

Data from the BioNet Atlas of NSW Wildlife website, which holds records from a number of custodians. The data are only indicative and cannot be considered comprehensive inventory, and may contain errors and omissions. Species listed under the Sensitive Species Data Policy may have their locations denatured (^ rounded to 0.1Â°; ^^ rounded to 0.01Â°). Copyright the State of NSW through the Office of Environment and Heritage. Search criteria : Public Report of all Val Records of Threatened (listed on TSC Act 1995) Communities in selected area [North: -31.38 West: 152.59 East: 152.78 South: -31.58] returned 0 records for 9 entities.

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Kingdom	Class	Family	Species Code	Scientific Name	Exotic	Common Name	NSW status	Comm. status	Records
Community				*Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*		Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	V	K
Community				*Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*		Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3		K
Community				*Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*		Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	CE	K
Community				*Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions*		Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions	E3	CE	K

Community	*Lowland Rainforest on Floodplain in the New South Wales North Coast Bioregion*	Lowland Rainforest on Floodplain in the New South Wales North Coast Bioregion	E3	CE	K
Community	*Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion*	Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion	E3		K
Community	*Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3		K
Community	*Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*	Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3		K
Community	*Themeda grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner Bioregions*	Themeda grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner Bioregions	E3		K

Data from the BioNet Atlas of NSW Wildlife website, which holds records from a number of custodians. The data are only indicative and cannot be considered comprehensive inventory, and may contain errors and omissions. Species listed under the Sensitive Species Data Policy may have their locations denatured (^ rounded to 0.1Â°; ^^ rounded to 0.01Â°). Copyright the State of NSW through the Office of Environment and Heritage. Search criteria : Public Report of all Val Records of Threatened (listed on TSC Act 1995) Animals in selected area [North: -31.38 West: 152.59 East: 152.78 South: -31.58] returned a total of 494 recor 35 species.

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Kingdom	Class	Family	Species Code	Scientific Name	Exotic	Common Name	NSW status	Comm. status	Records
Animalia	Amphibia	Myobatrachidae	3073	*^Mixophyes balbus*		Stuttering Frog	E1,P,2	V	6
Animalia	Amphibia	Myobatrachidae	3075	*^Mixophyes iteratus*		Giant Barred Frog	E1,P,2	E	4
Animalia	Amphibia	Hylidae	3169	*Litoria brevipalmata*		Green-thighed Frog	V,P		4
Animalia	Reptilia	Elapidae	2677	*Hoplocephalus stephensii*		Stephens' Banded Snake	V,P		1
Animalia	Aves	Columbidae	0025	*Ptilinopus magnificus*		Wompoo Fruit-Dove	V,P		6
Animalia	Aves	Ciconiidae	0183	*Ephippiorhynchus asiaticus*		Black-necked Stork	E1,P		4
Animalia	Aves	Accipitridae	0218	*Circus assimilis*		Spotted Harrier	V,P		2
Animalia	Aves	Accipitridae	0226	*Haliaeetus leucogaster*		White-bellied Sea-Eagle	V,P	C	1
Animalia	Aves	Accipitridae	0230	*^^Lophoictinia isura*		Square-tailed Kite	V,P,3		10
Animalia	Aves	Accipitridae	8739	*^^Pandion cristatus*		Eastern Osprey	V,P,3		2
Animalia	Aves	Gruidae	0177	*Grus rubicunda*		Brolga	V,P		1
Animalia	Aves	Jacanidae	0171	*Irediparra gallinacea*		Comb-crested Jacana	V,P		2
Animalia	Aves	Cacatuidae	0265	*^Calyptorhynchus lathami*		Glossy Black-Cockatoo	V,P,2		111
Animalia	Aves	Psittacidae	0260	*Glossopsitta pusilla*		Little Lorikeet	V,P		21
Animalia	Aves	Psittacidae	0309	*^^Lathamus discolor*		Swift Parrot	E1,P,3	CE	1
Animalia	Aves	Strigidae	0246	*^^Ninox connivens*		Barking Owl	V,P,3		2
Animalia	Aves	Strigidae	0248	*^^Ninox strenua*		Powerful Owl	V,P,3		8

Animalia	Aves	Tytonidae	0250	^^*Tyto novaehollandiae*	Masked Owl	V,P,3		17
Animalia	Aves	Tytonidae	9924	^^*Tyto tenebricosa*	Sooty Owl	V,P,3		15
Animalia	Aves	Climacteridae	8127	*Climacteris picumnus victoriae*	Brown Treecreeper (eastern subspecies)	V,P		2
Animalia	Aves	Neosittidae	0549	*Daphoenositta chrysoptera*	Varied Sittella	V,P		7
Animalia	Aves	Pachycephalidae	0405	*Pachycephala olivacea*	Olive Whistler	V,P		1
Animalia	Aves	Petroicidae	0380	*Petroica boodang*	Scarlet Robin	V,P		1
Animalia	Mammalia	Dasyuridae	1008	*Dasyurus maculatus*	Spotted-tailed Quoll	V,P	E	20
Animalia	Mammalia	Dasyuridae	1017	*Phascogale tapoatafa*	Brush-tailed Phascogale	V,P		5
Animalia	Mammalia	Phascolarctidae	1162	*Phascolarctos cinereus*	Koala	V,P	V	82
Animalia	Mammalia	Petauridae	1136	*Petaurus australis*	Yellow-bellied Glider	V,P		28
Animalia	Mammalia	Pteropodidae	1280	*Pteropus poliocephalus*	Grey-headed Flying-fox	V,P	V	34
Animalia	Mammalia	Molossidae	1329	*Mormopterus norfolkensis*	Eastern Freetail-bat	V,P		4
Animalia	Mammalia	Vespertilionidae	1369	*Kerivoula papuensis*	Golden-tipped Bat	V,P		10
Animalia	Mammalia	Vespertilionidae	1346	*Miniopterus australis*	Little Bentwing-bat	V,P		43
Animalia	Mammalia	Vespertilionidae	1834	*Miniopterus schreibersii oceanensis*	Eastern Bentwing-bat	V,P		19
Animalia	Mammalia	Vespertilionidae	1357	*Myotis macropus*	Southern Myotis	V,P		11
Animalia	Mammalia	Vespertilionidae	1361	*Scoteanax rueppellii*	Greater Broad-nosed Bat	V,P		5
Animalia	Mammalia	Vespertilionidae	1025	*Vespadelus troughtoni*	Eastern Cave Bat	V,P		4

Australian Government
Department of the Environment and Energy

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

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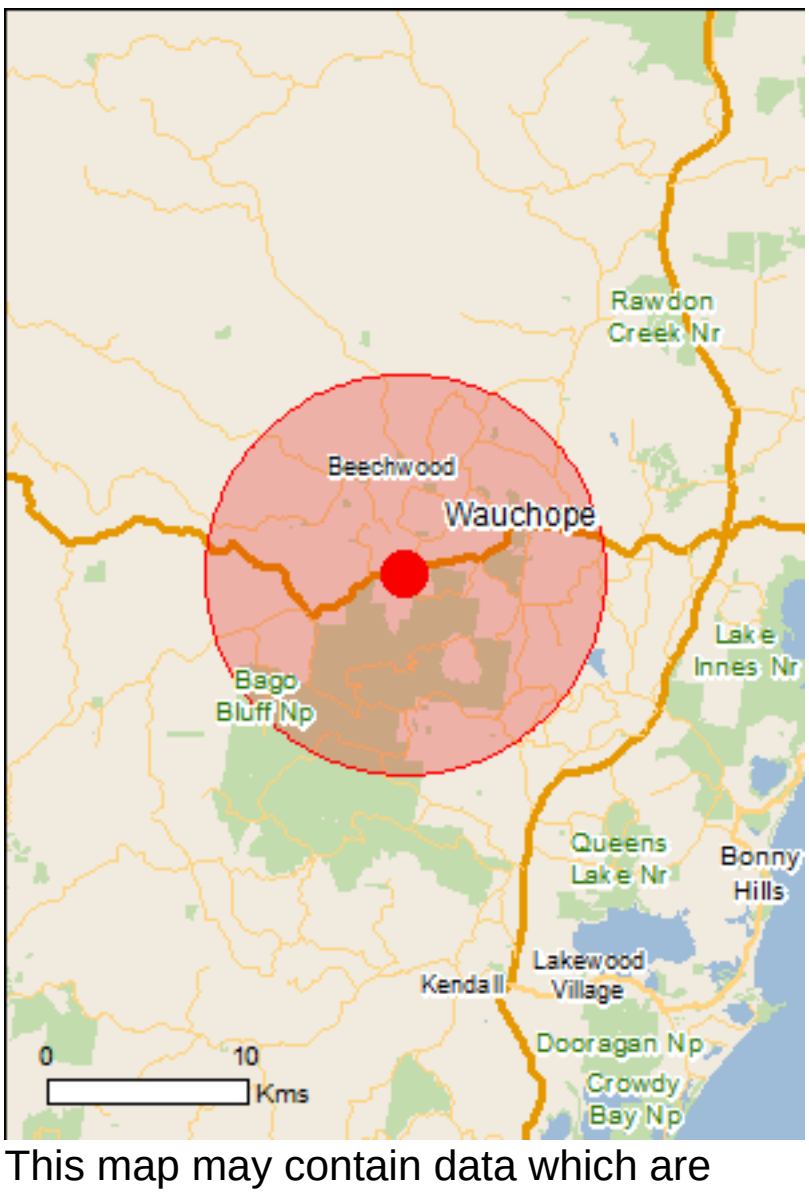
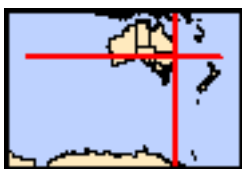
Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

Caveat
Acknowledgements



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates
Buffer: 10.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	1
Listed Threatened Species:	56
Listed Migratory Species:	27

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	4
Commonwealth Heritage Places:	None
Listed Marine Species:	40
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	3
Regional Forest Agreements:	1
Invasive Species:	37
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Lowland Rainforest of Subtropical Australia	Critically Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Species or species habitat known to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Dasyornis brachypterus Eastern Bristlebird [533]	Endangered	Species or species habitat likely to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Species or species habitat likely to occur within area
Diomedea antipodensis gibsoni Gibson's Albatross [82270]	Vulnerable	Species or species habitat likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Species or species habitat likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Species or species habitat likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Species or species habitat likely to occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat likely to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur

Name	Status	Type of Presence within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat may occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche bulleri platei Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta cauta Shy Albatross, Tasmanian Shy Albatross [82345]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta steadi White-capped Albatross [82344]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Species or species habitat likely to occur within area
Fish		
Epinephelus daemelii Black Rockcod, Black Cod, Saddled Rockcod [68449]	Vulnerable	Species or species habitat likely to occur within area
Frogs		
Litoria aurea Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat likely to occur within area
Mixophyes balbus Stuttering Frog, Southern Barred Frog (in Victoria)	Vulnerable	Species or species

Name	Status	Type of Presence
[1942]		habitat likely to occur within area
Mixophyes iteratus		
Giant Barred Frog, Southern Barred Frog [1944]	Endangered	Species or species habitat known to occur within area
Mammals		
Chalinolobus dwyeri		
Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat likely to occur within area
Dasyurus maculatus maculatus (SE mainland population)		
Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area
Petauroides volans		
Greater Glider [254]	Vulnerable	Species or species habitat known to occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)		
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Potorous tridactylus tridactylus		
Long-nosed Potoroo (SE mainland) [66645]	Vulnerable	Species or species habitat likely to occur within area
Pseudomys novaehollandiae		
New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat likely to occur within area
Pteropus poliocephalus		
Grey-headed Flying-fox [186]	Vulnerable	Roosting known to occur within area
Plants		
Allocasuarina defungens		
Dwarf Heath Casuarina [21924]	Endangered	Species or species habitat likely to occur within area
Arthraxon hispidus		
Hairy-joint Grass [9338]	Vulnerable	Species or species habitat may occur within area
Callistemon pungens		
[55581]	Vulnerable	Species or species habitat may occur within area
Cryptostylis hunteriana		
Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat likely to occur within area
Cynanchum elegans		
White-flowered Wax Plant [12533]	Endangered	Species or species habitat likely to occur within area
Euphrasia arguta		
[4325]	Critically Endangered	Species or species habitat may occur within area
Hakea archaeoides		
[66702]	Vulnerable	Species or species habitat likely to occur within area
Haloragis exalata subsp. velutina		
Tall Velvet Sea-berry [16839]	Vulnerable	Species or species habitat may occur within area
Macadamia integrifolia		
Macadamia Nut, Queensland Nut Tree, Smooth-shelled Macadamia, Bush Nut, Nut Oak [7326]	Vulnerable	Species or species habitat may occur within area
Marsdenia longiloba		
Clear Milkvine [2794]	Vulnerable	Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Melaleuca biconvexa Biconvex Paperbark [5583]	Vulnerable	Species or species habitat may occur within area
Parsonsia dorrigoensis Milky Silkpod [64684]	Endangered	Species or species habitat likely to occur within area
Phaius australis Lesser Swamp-orchid [5872]	Endangered	Species or species habitat may occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat likely to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Species or species habitat likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta Tasmanian Shy Albatross [89224]	Vulnerable*	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Migratory Marine Species		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat may occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat may occur within area
Migratory Terrestrial Species		
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species

Name	Threatened	Type of Presence
		habitat likely to occur within area
Pandion haliaetus		
Osprey [952]		Breeding known to occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land - Australian Postal Commission
Commonwealth Land - Australian Telecommunications Commission
Commonwealth Land - Defence Service Homes Corporation
Commonwealth Land - Telstra Corporation Limited

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Cuculus saturatus		
Oriental Cuckoo, Himalayan Cuckoo [710]		Species or species habitat may occur within area
Diomedea antipodensis		
Antipodean Albatross [64458]	Vulnerable	Species or species habitat likely to occur within area
Diomedea epomophora		
Southern Royal Albatross [89221]	Vulnerable	Species or species habitat likely to occur within area
Diomedea exulans		
Wandering Albatross [89223]	Vulnerable	Species or species habitat likely to occur

Name	Threatened	Type of Presence within area
Diomedea gibsoni Gibson's Albatross [64466]	Vulnerable*	Species or species habitat likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Species or species habitat likely to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta Tasmanian Shy Albatross [89224]	Vulnerable*	Species or species habitat may occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche sp. nov. Pacific Albatross [66511]	Vulnerable*	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Species or species habitat likely to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat may occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat may occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Bago Bluff	NSW
FMAs in KENDALL	NSW
LNE Special Management Zone No1	NSW

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
North East NSW RFA	New South Wales

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Pycnonotus jocosus Red-whiskered Bulbul [631]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Alternanthera philoxeroides Alligator Weed [11620]		Species or species habitat likely to occur within area
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera subsp. rotundata Bitou Bush [16332]		Species or species habitat likely to occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Sage, Wild Sage [10892]		
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Protasparagus densiflorus Asparagus Fern, Plume Asparagus [5015]		Species or species habitat likely to occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-31.47719 152.6776

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Appendix B – Species recorded

Recorded flora

Family	Scientific name	Common name	Status	
			TSC Act	EPBC Act
Adiantaceae	*Adiantum aethiopicum*	Common Maidenhair	-	-
Adiantaceae	*Cheilanthes sieberi*	Mulga Fern	-	-
Acanthaceae	*Pseuderanthemum variabile*	Pastel Flower	-	-
Anacardiaceae	*Euroschinus falcatus*	Ribbonwood	-	-
Apiaceae	*Centella asiatica*	Pennywort	-	-
Apocynaceae	*Parsonsia straminea*	Common Silkpod	-	-
Apocynaceae	*Gomphocarpus physocarpus**	Balloon Cotton Bush	-	-
Araceae	*Gymnostachys anceps*	Settler's Flax	-	-
Araliaceae	*Polyscias sambucifolia*	Elderberry Panax	-	-
Arecaceae	*Phoenix canariensis**	Date Palm	-	-
Asparagaceae	*Asparagus plumosus**	Climbing Asparagus Fern	-	-
Asteliaceae	*Cordyline stricta*	Narrow-leaved Palm Lily	-	-
Asteraceae	*Ambrosia artemisiifolia**	Annual Ragweed	-	-
Asteraceae	*Bidens pilosa**	Cobbler's Pegs	-	-
Asteraceae	*Cirsium vulgare**	Spear Thistle	-	-
Asteraceae	*Conyza bonariensis**	Flaxleaf Fleabane	-	-
Asteraceae	*Emilia sonchifolia*	Purple Sow Thistle	-	-
Asteraceae	*Hypochaeris radicata**	Catsear	-	-
Asteraceae	*Ozothamnus diosmifolius*	White Dogwood	-	-
Bignoniaceae	*Jacaranda mimosifolia**	Jacaranda	-	-
Bignoniaceae	*Pandorea pandorana*	Wonga Wonga Vine	-	-
Blechnaceae	*Doodia aspera*	Rasp Fern	-	-
Casuarinaceae	*Allocasuarina torulosa*	Forest Oak	-	-
Celastraceae	*Denhamia silvestris*	Narrow-leaved Orangebark	-	-
Celastraceae	*Elaeodendron australe*	Red Olive Plum	-	-
Commelinaceae	*Commelina cyanea*	Scurvy Weed	-	-
Convolvulaceae	*Dichondra repens*	Kidney Weed	-	-
Convolvulaceae	*Polymeria calycina*	Polymeria	-	-
Cyperaceae	*Carex appressa*	Tall Sedge	-	-
Cyperaceae	*Cyperus gracilis*		-	-
Cyperaceae	*Gahnia aspera*	Rough Saw-sedge	-	-
Cyperaceae	*Gahnia melanocarpa*	Black Fruit Saw-sedge	-	-
Cyperaceae	*Lepidosperma laterale*	Sword-sedge	-	-
Dennstaedtiaceae	*Hypolepis muelleri*	Harsh Ground Fern	-	-
Dilleniaceae	*Hibbertia aspera*	Rough Guinea Flower	-	-
Dilleniaceae	*Hibbertia scandens*	Climbing Guinea Flower	-	-
Dioscoreaceae	*Dioscorea transversa*	Native Yam	-	-
Ebenaceae	*Diospyros australis*	Black Plum	-	-
Elaeocarpaceae	*Elaeocarpus obovatus*	Hard Quandong	-	-
Ericaceae	*Leucopogon juniperinus*	Prickly Beard-heath	-	-
Ericaceae	*Trochocarpa laurina*	Tree Heath	-	-
Euphorbiaceae	*Breynia oblongifolia*	Coffee Bush	-	-
Euphorbiaceae	*Croton verreauxii*	Native Cascarilla	-	-
Euphorbiaceae	*Euphorbia prostrata**	Caustic Weed	-	-
Euphorbiaceae	*Glochidion ferdinandi var. ferdinandi*	Cheese Tree	-	-
Euphorbiaceae	*Mallotus philippensis*	Red Kamala	-	-
Eupomatiaceae	*Eupomatia laurina*	Bolwarra	-	-
Fabaceae (Caesalpinioideae)	*Senna septemtrionalis**	Smooth Senna	-	-

Family	Scientific name	Common name	Status	
			TSC Act	EPBC Act
Fabaceae (Faboideae)	*Daviesia ulicifolia*	Gorse Bitter Pea	-	-
Fabaceae (Faboideae)	*Derris involuta*	Native Derris	-	-
Fabaceae (Faboideae)	*Desmodium rhytidophyllum*	Rusty Tick-trefoil	-	-
Fabaceae (Faboideae)	*Glycine tabacina*	Slender Glycine	-	-
Fabaceae (Faboideae)	*Hardenbergia violacea*	False Sarsaparilla	-	-
Fabaceae (Faboideae)	*Jacksonia scoparia*	Dogwood	-	-
Fabaceae (Faboideae)	*Macroptilium lathyroides**	Phasey Bean	-	-
Fabaceae (Faboideae)	*Wisteria sp.**	Wisteria	-	-
Fabaceae (Mimosoideae)	*Acacia falcata*	Hickory Wattle	-	-
Fabaceae (Mimosoideae)	*Acacia fimbriata*	Fringed Wattle	-	-
Fabaceae (Mimosoideae)	*Acacia irrorata subsp. irrorata*	Green Wattle	-	-
Fabaceae (Mimosoideae)	*Acacia longissima*	Long-leaf Wattle	-	-
Fabaceae (Mimosoideae)	*Acacia maidenii*	Maiden's Wattle	-	-
Fabaceae (Mimosoideae)	*Acacia melanoxylon*	Blackwood	-	-
Flacourtiaceae	*Scolopia braunii*	Flintwood	-	-
Iridaceae	*Patersonia glabrata*	Leafy Purple-flag	-	-
Lamiaceae	*Clerodendrum tomentosum*	Hairy Clerodendrum	-	-
Lauraceae	*Cinnamomum camphora**	Camphor Laurel	-	-
Lomandraceae	*Lomandra confertifolia*	Mat-rush	-	-
Lomandraceae	*Lomandra hystrix*	Stream Mat-rush	-	-
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush	-	-
Luzuriagaceae	*Eustrephus latifolius*	Wombat Berry	-	-
Luzuriagaceae	*Geitonoplesium cymosum*	Scrambling Lily	-	-
Malvaceae	*Hibiscus heterophyllus*	Native Rosella	-	-
Malvaceae	*Sida rhombifolia**	Paddy's Lucerne	-	-
Menispermaceae	*Sarcopetalum harveyanum*	Pearl Vine	-	-
Monimiaceae	*Wilkiea huegeliana*	Veiny Wilkiea	-	-
Moraceae	*Ficus coronata*	Creek Sandpaper Fig	-	-
Moraceae	*Maclura cochinchinensis*	Cockspur Thorn	-	-
Myrsinaceae	*Myrsine howittiana*	Brush Muttonwood	-	-
Myrsinaceae	*Myrsine variabilis*	Muttonwood	-	-
Myrtaceae	*Acmena smithii*	Common Lilly Pilly	-	-
Myrtaceae	*Backhousia myrtifolia*	Grey Myrtle	-	-
Myrtaceae	*Callistemon salignus*	Willow Bottlebrush	-	-
Myrtaceae	*Corymbia gummifera*	Red Bloodwood	-	-
Myrtaceae	*Eucalyptus acmenoides*	White Mahogany	-	-
Myrtaceae	*Eucalyptus carnea*	Broad-leaved White Mahogany	-	-
Myrtaceae	*Eucalyptus microcorys*	Tallowwood	-	-
Myrtaceae	*Eucalyptus propinqua*	Small-fruited Grey Gum	-	-
Myrtaceae	*Eucalyptus siderophloia*	Northern Grey Ironbark	-	-
Myrtaceae	*Lophostemon confertus*	Brush Box	-	-
Myrtaceae	*Melaleuca styphelioides*	Prickly Paperbark	-	-
Myrtaceae	*Rhodamnia rubescens*	Scrub Turpentine	-	-
Myrtaceae	*Syncarpia glomulifera*	Turpentine	-	-
Myrtaceae	*Syzygium luehmannii*	Riberry	-	-
Myrtaceae	*Syzygium oleosum*	Blue Lilly Pilly	-	-
Myrtaceae	*Tristaniopsis laurina*	Water Gum	-	-
Oleaceae	*Jasminum volubile*	Stiff Jasmine	-	-
Oleaceae	*Ligustrum lucidum**	Large-leaved Privet	-	-
Oleaceae	*Notelaea longifolia*	Large Mock-olive	-	-

Family	Scientific name	Common name	Status	
			TSC Act	EPBC Act
Oxalidaceae	*Oxalis chnoodes*		-	-
Passifloraceae	*Passiflora subpeltata**	White Passionflower	-	-
Phormiaceae	*Dianella caerulea*	Blue Flax lily	-	-
Phyllanthaceae	*Cleistanthus cunninghamii*	Cleistanthus	-	-
Pinaceae	*Pinus elliottii**	Slash Pine	-	-
Pittosporaceae	*Pittosporum multiflorum*	Orange Thorn	-	-
Poaceae	*Capillipedium spicigerum*	Scented-top Grass	-	-
Poaceae	*Cenchrus clandestinus**	Kikuyu	-	-
Poaceae	*Chloris gayana**	Rhodes Grass	-	-
Poaceae	*Cymbopogon refractus*	Barbed Wire Grass	-	-
Poaceae	*Digitaria ciliaris**	Summer Grass	-	-
Poaceae	*Eleusine indica **	Crowsfoot Grass	-	-
Poaceae	*Entolasia marginata*	Bordered Panic	-	-
Poaceae	*Entolasia stricta*	Wiry Panic	-	-
Poaceae	*Eragrostis sp.*	Lovegrass	-	-
Poaceae	*Imperata cylindrica*	Blady Grass	-	-
Poaceae	*Oplismenus aemulus*	Basket Grass	-	-
Poaceae	*Paspalum mandiocanum**	Broad-leaved Paspalum	-	-
Poaceae	*Paspalum urvillei**	Vasey Grass	-	-
Poaceae	*Setaria gracilis**	Slender Pigeon Grass	-	-
Poaceae	*Setaria sphacelata**	Pigeon Grass	-	-
Poaceae	*Sporobolus africanus**	Parramatta Grass	-	-
Poaceae	*Themeda australis*	Kangaroo Grass	-	-
Polypodiaceae	*Grammitis billardierei*	Finger Fern	-	-
Proteaceae	*Persoonia linearis*	Narrow-leaved Geebung	-	-
Ranunculaceae	*Clematis glycinoides*	Forest Clematis	-	-
Rhamnaceae	*Pomaderris lanigera*	Woolly Pomaderris	-	-
Rubiaceae	*Cyclophyllum longipetalum*	Coast Canthium	-	-
Rubiaceae	*Morinda jasminoides*	Sweet Morinda	-	-
Rubiaceae	*Pomax umbellata*	Pomax	-	-
Rutaceae	*Acronychia oblongifolia*	Common Acronychia	-	-
Rutaceae	*Melicope micrococca*	White Euodia	-	-
Rutaceae	*Zieria furfuracea*	Zieria	-	-
Santalaceae	*Exocarpos cupressiformis*	Native Cherry	-	-
Sapindaceae	*Dodonaea triquetra*	Hop-bush	-	-
Sapindaceae	*Guioa semiglauca*	Guioa	-	-
Sapindaceae	*Jagera pseudorhus var. pseudorhus*	Foambark Tree	-	-
Smilacaceae	*Smilax australis*	Lawyer Vine	-	-
Solanaceae	*Solanum densevestitum*			
Solanaceae	*Solanum mauritianum**	Wild Tobacco Bush	-	-
Solanaceae	*Solanum nigrum**	Blackberry Nightshade	-	-
Solanaceae	*Solanum prinophyllum*	Forest Nightshade	-	-
Sterculiaceae	*Commersonia rugosa*	Kurrajong	-	-
Ulmaceae	*Aphananthe philippinensis*	Rough-leaved Elm	-	-
Verbenaceae	*Lantana camara**	Lantana	-	-
Verbenaceae	*Verbena bonariensis**	Purpletop	-	-
Violaceae	*Hybanthus stellarioides*	Spade Flower	-	-
Viscaceae	*Notothixos cornifolius*	Kurrajong Mistletoe	-	-
Viscaceae	*Notothixos subaureus*	Golden Mistletoe	-	-
Vitaceae	*Cayratia clematidea*	Slender Grape	-	-
Vitaceae	*Cissus antarctica*	Water Vine	-	-

*Introduced species

Recorded fauna

Taxa/Fauna group	Scientific Name	Common name	Status	
			TSC Act	EPBC Act
Amphibia	*Adelotus brevis*	Tusked Frog	-	-
	Litoria tyleri	Tyler's Tree Frog	-	-
	Mixophyes fasciolatus	Great Barred Frog	-	-
	Pseudophyrne coriacea	Red-backed Toadlet	-	-
Reptilia	*Itellagama lesueurii*	Eastern Water Dragon		
	Lampropholis delicata	Grass Skink	-	-
Aves	*Acanthiza nana*	Yellow Thornbill	-	-
	Acanthiza pusilla	Brown Thornbill	-	-
	Alisterus scapularis	Australian King Parrot	-	-
	Cacomantis flabelliformis	Fan-tailed Cuckoo	-	-
	Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-
	Colluricincla harmonica	Grey Shrike-thrush	-	-
	Columba leucomela	White-headed Pigeon	-	-
	Coracina novaehollandiae	Black-faced Cuckoo-shrike	-	-
	Cormobates leucophaea	White-throated Treecreeper	-	-
	Corvus coronoides	Australian Raven	-	-
	Cracticus torquatus	Grey Butcherbird	-	-
	Dacelo novaehollandiae	Laughing Kookaburra	-	-
	Dicaeum hirundinaceum	Mistletoebird	-	-
	Eolophus roseicapilla	Galah	-	-
	Eopsaltria australis	Eastern Yellow Robin	-	-
	Geopelia humeralis	Bar-shouldered Dove	-	-
	Grallina cyanoleuca	Magpie-lark	-	-
	Macropygia phasianella	Brown Cuckoo-dove	-	-
	Malurus lamberti	Variegated Fairy Wren	-	-
	Meliphaga lewinii	Lewin's Honeyeater	-	-
	Myzomela sanguinolenta	Scarlet Honeyeater	-	-
	Ninox novaeseelandiae	Southern Boobook	-	-
	Pachycephala pectoralis	Golden Whistler	-	-
	Platycercus elegans	Crimson Rosella	-	-
	Podargus strigoides	Tawny Frogmouth	-	-
	Psophodes olivaceus	Eastern Whipbird	-	-
	Rhipidura fuliginosa	Grey Fantail	-	-
	Sericornis frontalis	White-browed Scrubwren	-	-
	Strepera graculina	Pied Currawong	-	-
	Trichoglossus haematodus	Rainbow Lorikeet	-	-
Mammalia	*Acrobates pygmaeus*	Feathertail Glider	-	-
	Austronomus australis	White-striped Freetail Bat	-	-
	Chalinolobus gouldii	Gould's Wattled Bat	-	-
	Macropus giganteus	Eastern Grey Kangaroo	-	-
	Miniopterus australis	Little Bentwing-bat	V	-
	Miniopterus orianae (schreibersii) oceanensis	Eastern Bentwing-bat	V	-
	*Mormopterus sp.**	Freetail Bat	-	-
	Petaurus breviceps	Sugar Glider	-	-
	Vespadelus pumilus	Little Forest Bat	-	-

*Unable to be identified to species level; may be either *Mormopterus norfolkeneis* or *M. ridei* (refer to Anabat results at **Appendix C**). *M. norfolkensis* is scheduled Vulnerable under the *TSC Act.*

Appendix C – Anabat results

Microbat Call Identification Report

Prepared for ("Client"):	Geolink
Survey location/project name:	Wauchope
Survey dates:	20th & 21st March 2017
Client project reference:	2849
Job no.:	GEO-1702
Report date:	4 April 2017

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Methods

Data received

The data set received for analysis included 400 bat-call sequence files (zero-crossing analysis format), which were recorded over two nights using an Anabat detector (Titley Scientific, Brisbane).

Call identification

All sequence files were viewed using *AnalookW* (Corben 2015), with species identification achieved manually by comparing the call spectrograms with those of reference calls from eastern New South Wales and/or with published call descriptions (e.g. Reinhold *et al.* 2001; Pennay *et al*. 2004).

Species determination was also guided by considering probability of occurrence based on published distribution maps (e.g. Churchill 2008; van Dyck *et al.* 2013) and online databases (e.g. *Atlas of Living Australia* http://www.ala.org.au).

Reporting standard

The format and content of this report follows Australasian Bat Society standards for the interpretation and reporting of bat call data (Reardon 2003), available on-line at http://www.ausbats.org.au/.

Species nomenclature follows Reardon *et al.* (2015).

Results & Discussion

Over one-third (38%) of the sequence files contained only background noise; and many of the recorded calls were brief and/or fragmented, which made identification difficult. Of the 250 calls identified from this data set, almost half (116 calls) could not be reliably allocated to a single species.

Five species were positively identified, while another three call types each potentially representing two species (see Table 1). These unresolved calls were grouped as follows:

- *Nyctophilus* species or *Myotis macropus*
    - 2 very brief and weak calls recorded on the night of 21st March
    - Impossible to differentiate between *Nyctophilus* and *M. macropus* in such short calls
    - More likely *Nyctophilus* if recorded away from water, since *M. macropus* preferentially forages over water-bodies
    - Two of the possible candidates – *N. bifax* and *M. macropus* – are Vulnerable under the *TSC Act*
- *Mormopterus norfolkeneis* or *M. ridei*
    - 39 calls recorded – 3 on 20th March and 36th on 21st March
    - Considered most likely to have been *M. norfolkensis* because most of the calls contain flat and/or inverted-U-shaped pulses with characteristic frequency (Fc) around 29-30 kHz and some evidence of inter-pulse frequency alternation
    - Some calls lacked the above features and may have been from either species
    - *M. norfolkensis* is scheduled Vulnerable under the *TSC Act*

- *Scotorepens orion* or *Scoteanax rueppellii*
    - 2 calls with curvilinear pulses at Fc~34-35 kHz, recorded on night of 21st March
    - Calls of insufficient duration or quality to obtain reliable metric for differentiation between the two species
    - *S. rueppellii* is scheduled Vulnerable under the *TSC Act*

Table 1 Microbat species recorded at Wauchope, 20-21 March 2017.

Date	20/03/2017	21/03/2017
Total ZC files	141	259
Total calls identified	29	221
Species positively identified		
Chalinolobus gouldii	✔	✔
Vespadelus pumilus	✔	✔
Miniopterus australis	✔	✔
Miniopterus orianae oceanensis	✔	✔
Austronomus australis	✔	
Species NOT positively identified		
Myotis macropus or *Nyctophilus* sp.		✔
Mormopterus norfolkensis or *M. ridei*	✔	✔
Scotorepens orion or *Scoteanax rueppellii*		✔

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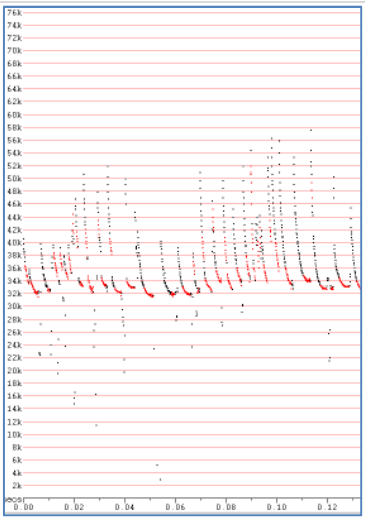
Glossary

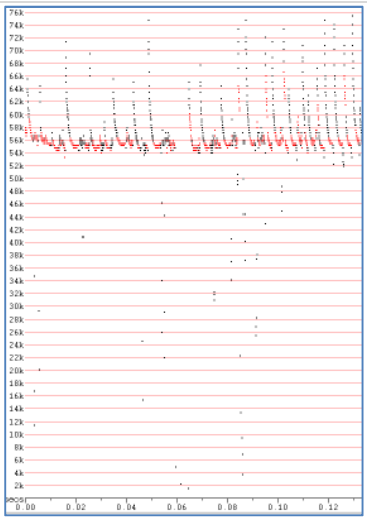
Technical terms used in this report are described in the following table.

Approach phase	The part of a bat *call* emitted as the bat starts to home in on a detected prey item; a transitional series of *pulses* between the *search phase* and *feeding buzz*, that become progressively steeper and shorter in duration.
Call	Refers to a single bat call, made up of a series of individual sound *pulses* in one or more *phases* (*search, approach, feeding buzz*).
CF (=Constant Frequency)	A type of *pulse* in which the dominant component consists of a more-or-less 'pure tone' of sound at a Constant Frequency; with *shape* appearing flat on the sonogram. Often also contains a brief *FM* component at the beginning and/or end of the CF component (*viz.* FM-CF-FM).
Characteristic frequency (Fc)	The frequency of the flattest part of a *pulse*; usually the lowest frequency reached in the *qCF* component of a pulse. This is often the primary diagnostic feature for species identification.
Duration	The time period from the beginning of a *pulse* to the end of the pulse.
Feeding buzz	The terminal part of a *call*, following the *approach phase*, emitted as the bat catches a prey item; a distinctive, rapid series of very steep, very short-duration pulses.
FM (=Frequency Modulated)	A type of *pulse* in which there is substantial change in frequency from beginning to end; *shape* ranges from almost vertical and linear through varying degrees of curvature.
FC range	Refers to the range of frequencies occupied by the *characteristic frequency* section of *pulses* within a call or set of calls.
Frequency sweep or "band-width"	The range of frequencies through which a *pulse* sweeps from beginning to end; Maximum frequency (Fmax) – minimum frequency (Fmin).
Knee	The transitional part of a *pulse* between the initial (usually steeper) frequency sweep and the *characteristic frequency* section (usually flatter); time to knee (Tk) and frequency of knee (Fk) can be diagnostic for some species.
Pulse	An individual pulse of sound within a bat *call*; the *shape*, *duration* and *characteristic frequency* of a pulse are the key diagnostic features used to differentiate species.
Pulse body	The part of the *pulse* between the *knee* and *tail* and containing the *characteristic frequency* section.
Pulse shape	The general appearance of a *pulse* on the sonogram, described using relative terms related to features such as slope and degree of curvature. See also *CF, qCF* and *FM*.
qCF (=quasi Constant Frequency)	A type of *pulse* in which there is very little change in frequency from beginning to end; *shape* appears to be almost flat. Some pulses also contain an *FM* component at the beginning and/or end of the qCF component (*viz.* FM-qCF).
Search phase	The part of a bat *call* generally required for reliable species diagnosis. A consistent series of *pulses* emitted by a bat that is searching for prey or and/or navigating through its habitat. Search phase pulses generally have longer duration, flatter slope and more consistent shape than *approach phase* and *feeding buzz* pulses.
Sequence	A sequence of *pulses* that may be from one or more bats; but generally refers to a *call* or part (e.g. *phase*) of a call.
Tail	The final component of a *pulse*, following the *characteristic frequency* section; may consist of a short or long sweep of frequencies either upward or downward from the Fc; or may be absent.

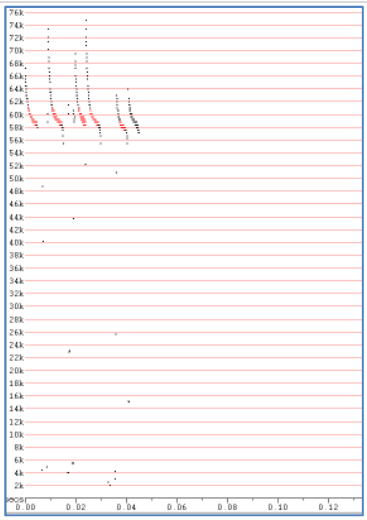
Appendix 1 Representative call sequences recorded at Wauchope, 20-21 March 2017.
y=Log frequency (kHz); x=time (sec); time between pulses removed



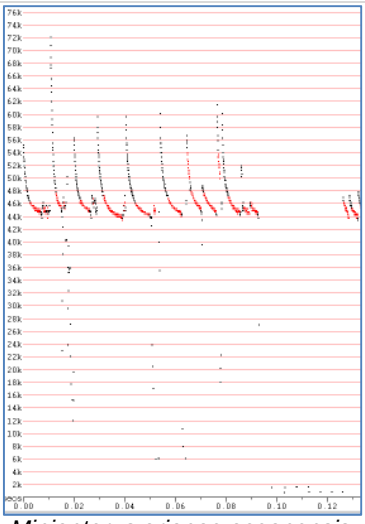
Chalinolobus gouldii



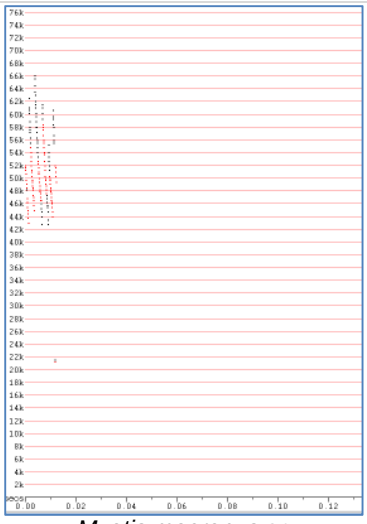
Vespadelus pumilus



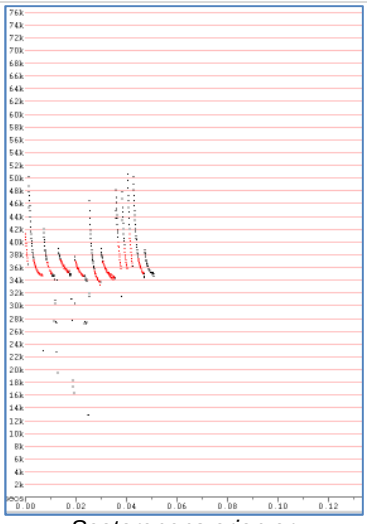
Miniopterus australis



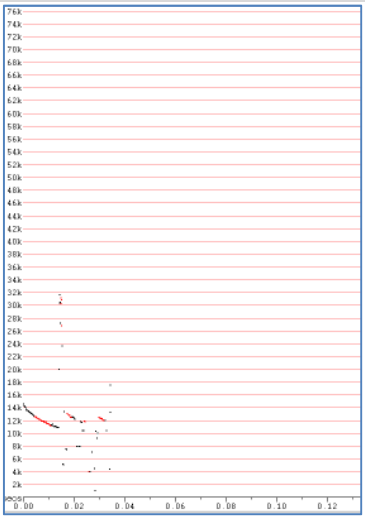
Miniopterus orianae oceanensis



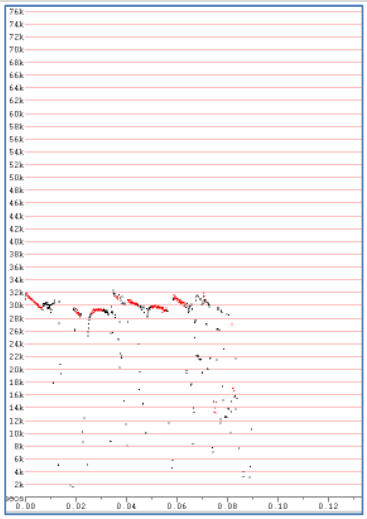
Myotis macropus or *Nyctophilus* sp.



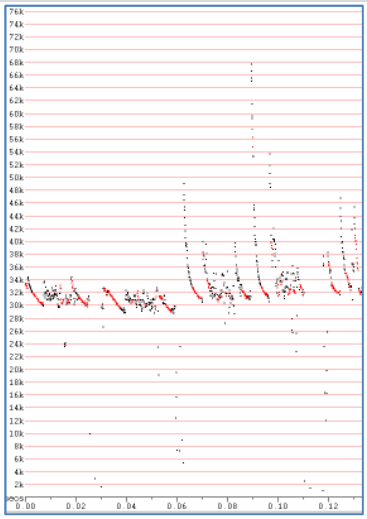
Scotorepens orion or Scoteanax rueppellii



Austronomus australis



Probably *Mormopt. norfolkensis*



Possibly *Mormopterus ridei*

Appendix D – Habitat assessment table

Likelihood of occurrence criteria

Likelihood	Criteria
Recorded	The species was observed in the study area during the current survey
High	It is highly likely that a species inhabits the study area and is dependant on identified suitable habitat (ie for breeding or important life cycle periods such as winter flowering resources), has been recorded recently in the locality (10 km) and is known or likely to maintain resident populations in the study area. Also includes species known or likely to visit the study area during regular seasonal movements or migration.
Moderate	Potential habitat is present in the study area. Species unlikely to maintain sedentary populations however may seasonally use resources within the study area opportunistically or during migration. The species is unlikely to be dependent (ie. for breeding or important life cycle periods such as winter flowering resources) on habitat within the study area, or habitat is in a modified or degraded state. Includes cryptic flowering flora species that were not seasonally targeted by surveys and that have not been recorded.
Low	It is unlikely that the species inhabits the study area and has not been recorded recently in the locality (10km). It may be an occasional visitor, but habitat similar to the study area is widely distributed in the local area, meaning that the species is not dependent (ie. for breeding or important life cycle periods such as winter flowering resources) on available habitat. Specific habitat is not present in the study area or the species are a non-cryptic perennial flora species that were specifically targeted by surveys and not recorded.
None	Suitable habitat is absent from the study area.

Habitat assessment table – threatened flora

Common Name *(Scientific Name)*	TSC Act	EPBC Act	Habitat requirements	Number of records (source: BioNet)	Likelihood of occurrence
Austral Toadflax (*Thesium australe*)	V	V	Grassland or grassy eucalypt woodland where Themeda australis is predominant, on grassy headlands.	2	Low
Biconvex Paperbark (*Melaleuca biconvexa*)	V	V	Damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects.	Nil	Low
Big Nellie Hakea (*Hakea archaeoides*)	V	V	Found on steep, rocky, sheltered slopes and in deep gullies in open eucalypt forest.	5	Low
Callistemon pungens	-	V	In or near rocky watercourses, usually in sandy creek beds on granite or sometimes on basalt.	Nil	None
Clear Milkvine (*Marsdenia longiloba*)	V	V	Subtropical and warm temperate rainforest, lowland moist eucalypt forest adjoining rainforest and, sometimes, in areas with rock outcrops.	1	Low
Dwarf Heath Casuarina (*Allocasuarina defungens*)	E	E	Tall heath on sand, also on clay and sandstone.	Nil	None
Euphrasia arguta	CE	CE	Known from three sites in/near Nundle State Forest in eucalypt forest with a mixed grass and shrub understorey.	Nil	None
Grove's Paperbark (*Melaleuca groveana*)	V	-	Heath and shrubland, often in exposed sites, rocky outcrops and cliffs at high elevations, also in dry woodlands.	6	Low
Hairy-joint Grass (*Arthraxon hispidus*)	V	V	Moist shady places in or on the edges of rainforest and wet eucalypt forest, often near creeks or swamps.	Nil	None
Leafless Tongue-orchid (*Cryptostylis hunteriana*)	V	V	Known from a range of communities, including swamp-heath and woodland.	Nil	Low
Macadamia Nut (*Macadamia integrifolia*)	-	V	Subtropical rainforest.	Nil	None

Common Name *(Scientific Name)*	TSC Act	EPBC Act	Habitat requirements	Number of records (source: BioNet)	Likelihood of occurrence
Milky Silkpod (*Parsonsia dorrigoensis*)	E	E	Subtropical and warm temperate rainforest, on rainforest margins, and in moist eucalypt forest up to 800 m on brown clay soils.	Nil	None
Rainforest Cassia (*Senna acclinis*)	E	-	Edges of subtropical and dry rainforest.	3	None
Scant Pomaderris (*Pomaderris queenslandica*)	E	-	Moist eucalypt forest or sheltered woodlands with a shrubby understorey, and occasionally along creeks.	1	Low
Southern Swamp Orchid (*Phaius australis*)	E	E	Swampy grassland or swampy forest including rainforest, eucalypt or paperbark forest mostly in coastal areas.	1	None
Spider Orchid (*Dendrobium melaleucaphilum*)	E	-	Grows frequently on *Melaleuca styphelioides*, less commonly on rainforest trees or on rocks in coastal districts. Occurs in coastal districts and nearby ranges, extending from Queensland to lower Blue Mountains.	2	Moderate
Tall Velvet Sea-berry (*Haloragis exalata subsp. velutina*)	V	V	Damp places near watercourses, also in woodland and steep rocky slopes of gorges.	Nil	Low
White-flowered Wax Plant (*Cynanchum elegans*)	E	E	Dry, littoral or subtropical rainforest, and occasionally in scrub or woodland.	Nil	None

Habitat assessment table - threatened fauna

Common Name *(Scientific Name)*	TSC Act	EPBC Act	Habitat requirements	Number of records (source: BioNet)	Likelihood of occurrence
Australasian Bittern (*Botaurus poiciloptilus*)	E	E	Permanent freshwater wetlands with tall dense vegetation, particularly bullrushes and spikerushes.	Nil	None
Australian Painted Snipe (*Rostratula benghalensis australis*)	E	V	Well-vegetated shallows and margins of wetlands, dams, sewage ponds, wet pastures, marshy areas, irrigation systems, lignum, tea-tree scrub, and open timber.	Nil	None
Barking Owl (*Ninox connivens*)	V	-	Eucalypt woodland, open forest, swamp woodlands and timber along watercourses.	2	Moderate
Black-breasted Button-quail (*Turnix melanogaster*)	V	V	Drier rainforests and vine scrubs, often in association with Hoop Pine and a deep moist leaf litter layer. During drought it may move to adjacent wetter rainforests.	Nil	None
Black-necked Stork (*Ephippiorhynchus asiaticus*)	E	-	Swamps, mangroves, mudflats, dry floodplains.	4	None
Brolga (*Grus rubicunda*)	V	-	Shallow swamps, floodplains, grasslands and pastoral lands, usually in pairs or parties.	1	None
Brown Treecreeper (*Climacteris picumnus victoriae*)	V	-	Eucalypt forests and woodlands of inland plains and slopes of the Great Dividing Range, and less commonly on coastal plains and ranges.	2	Moderate
Brush-tailed Phascogale (*Phascogale tapoatafa*)	V	-	Drier forests and woodlands with hollow-bearing trees and sparse ground cover.	5	Moderate
Comb-crested Jacana (*Irediparra gallinacea*)	V	-	Among vegetation floating on slow-moving rivers and permanent lagoons, swamps, lakes and dams.	2	None
Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*)	V	-	Forest or woodland, roost in caves, old mines and stormwater channels.	19	Recorded
Eastern Bristlebird (*Dasyornis brachypterus*)	E	E	High elevation open forest, woodland with dense tussock or sedge understorey adjacent to rainforest or wet eucalypt forest.	Nil	None
Eastern Cave Bat	V	-	Cave roosting species found in dry open	4	Low

Common Name *(Scientific Name)*	TSC Act	EPBC Act	Habitat requirements	Number of records (source: BioNet)	Likelihood of occurrence
(*Vespadelus troughtoni*)			forest and woodland near cliffs and rocky overhangs.		
Eastern Freetail-bat (*Mormopterus norfolkensis*)	V	-	Dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range.	4	Moderate
Eastern Osprey (*Pandion cristatus*)	V	-	Forages for fish in fresh, brackish or saline waters of rivers, lakes, estuaries with suitable nesting sites nearby.	2	None
Giant Barred Frog (*Mixophyes iteratus*)	E	E	Deep, damp leaf litter in rainforests, moist eucalypt forest and near dry eucalypt forest.	4	Low
Glossy Black-Cockatoo (*Calyptorhynchus lathami*)	V	-	Sheoaks in coastal forests and woodlands, timbered watercourses, and moist and dry eucalypt forests of the coast and the Great Divide up to 1,000 m.	111	Recorded
Golden-tipped Bat (*Kerivoula papuensis*)	V	-	Rainforest and adjacent sclerophyll forest. Roost in abandoned hanging Yellow-throated Scrubwren and Brown Gerygone nests.	10	Low
Greater Broad-nosed Bat (*Scoteanax rueppellii*)	V	-	Woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest.	5	Moderate
Greater Glider (*Petauroides volans*)	-	V	Ranges and coastal plains of eastern Australia, where it inhabits a variety of eucalypt forests and woodlands.	18	Moderate
Green and Golden Bell Frog (*Litoria aurea*)	E	V	Amongst vegetation in and around permanent swamps, lagoons, farm dams and on flood-prone river flats, particularly where there are bullrushes or spikerushes.	Nil	None
Green-thighed Frog (*Litoria brevipalmata*)	V	-	Rainforest, moist to dry eucalypt forest and heath, typically where surface water gathers after rain.	4	Moderate
Grey-headed Flying-fox (*Pteropus poliocephalus*)	V	V	Subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops.	34	Moderate
Koala (*Phascolarctos*	V	V	Appropriate food trees in forests and	82	Moderate

Common Name *(Scientific Name)*	TSC Act	EPBC Act	Habitat requirements	Number of records (source: BioNet)	Likelihood of occurrence
cinereus)			woodlands, and treed urban areas.		
Large-eared Pied Bat (*Chalinolobus dwyeri*)	V	V	Sandstone cliffs and fertile woodland valley habitat within close proximity	Nil	None
Little Bentwing-bat (*Miniopterus australis*)	V	-	Moist eucalypt forest, rainforest and dense coastal scrub.	43	Recorded
Little Lorikeet (*Glossopsitta pusilla)*	V	-	Distributed in forests and woodlands from the coast to the western slopes of the Great Dividing Range, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri.	21	Moderate
Long-nosed Potoroo (*Potorous tridactylus tridactylus*)	V	V	Cool temperate rainforest, moist and dry forests, and wet heathland, inhabiting dense layers of grass, ferns, vines and shrubs.	Nil	None
Masked Owl (*Tyto novaehollandiae*)	V	-	Dry eucalypt forest and woodlands.	17	Moderate
New Holland Mouse (*Pseudomys novaehollandiae*)	-	V	Occurs in open heathlands, open woodlands with a heathland understorey, and vegetated sand dunes.	Nil	None
Olive Whistler (*Pachycephala olivacea*)	V	-	Wet high altitude forests above 500 m.	1	Low
Painted Honeyeater (*Grantiella picta*)	V	V	Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests. Specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus Amyema.	Nil	Low
Powerful Owl (*Ninox strenua*)	V	-	Woodland and open forest to tall moist forest and rainforest, common along drainage lines.	8	Moderate
Red Goshawk (*Erythrotriorchis radiatus*)	CE	V	In NSW, preferred habitats include mixed subtropical rainforest, Melaleuca swamp forest and riparian Eucalyptus forest of coastal rivers.	Nil	Low
Regent Honeyeater (*Anthochaera phrygia*)	CE	CE	Dry open forest and woodland with an abundance of nectar-producing eucalypts, particularly box-ironbark woodland, swamp mahogany forests, and riverine sheoak	Nil	Low

Common Name *(Scientific Name)*	TSC Act	EPBC Act	Habitat requirements	Number of records (source: BioNet)	Likelihood of occurrence
			woodlands.		
Scarlet Robin (*Petroica boodang*)	V	-	Dry eucalypt forests and woodlands, usually with an open grassy understorey with few scattered shrubs. An abundance of logs and fallen timber appear to be an important habitat feature for this species.	1	Low
Sooty Owl (*Tyto tenebricosa*)	V	-	Dry, subtropical and warm temperate rainforests and wet eucalypt forests.	15	Low
Southern Myotis (*Myotis macropus*)	V	-	Bodies of water, rainforest streams, large lakes, reservoirs.	11	Low
Spotted Harrier (*Circus assimilis*)	V	-	Grassy open woodland, inland riparian woodland, grassland and shrub steppe.	2	Low
Spotted-tailed Quoll (*Dasyurus maculatus maculatus*)	V	E	Dry and moist eucalypt forests and rainforests, fallen hollow logs, large rocky outcrops.	20	Moderate
Square-tailed Kite (*Lophoictinia isura*)	V	-	Dry woodland and open forest, particularly along major rivers and belts of trees in urban or semi-urban areas. Home range can extend over at least 100 km².	10	Moderate
Stephens' Banded Snake (*Hoplocephalus stephensii*)	V	-	Rainforest and eucalypt forests and rocky areas up to 950 m.	1	Low
Stuttering Frog (*Mixophyes balbus*)	V	V	Cool rainforest, moist eucalypt forest and occasionally along creeks in dry eucalypt forest.	6	Low
Swift Parrot (*Lathamus discolor*)	E	CE	Forests, woodlands, plantations, and banksias.	1	Moderate
Varied Sittella (*Daphoenositta chrysoptera*)	V	-	Inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland.	7	Moderate
White-bellied Sea-Eagle (*Haliaeetus leucogaster*)	V	-	Around the Australian coastline and inland along rivers and wetlands of the Murray Darling Basin.	1	None
Wompoo Fruit-Dove	V	-	Rainforests, low-elevation moist eucalypt	6	Low

Common Name *(Scientific Name)*	TSC Act	EPBC Act	Habitat requirements	Number of records (source: BioNet)	Likelihood of occurrence
(*Ptilinopus magnificus*)			forest, and Brush Box forests.		
Yellow-bellied Glider (*Petaurus australis*)	V	-	Tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils.	28	Low

Appendix E – Assessments of significance

From Appendix D and the survey results, assessments of significance have been completed for the following threatened species.

Amphibians:
- Green-thighed Frog

Birds:
- Barking Owl
- Brown Treecreeper
- Glossy Black-Cockatoo
- Little Lorikeet
- Masked Owl
- Powerful Owl
- Square-tailed Kite
- Swift Parrot
- Varied Sittella.

Microbats:
- Eastern Bentwing-bat
- Eastern Freetail-bat
- Greater Broad-nosed Bat
- Little Bentwing-bat.

Other mammals:
- Brush-tailed Phascogale
- Grey-headed Flying-fox
- Koala
- Spotted-tailed Quoll.

a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

Green-thighed Frog

Green-thighed Frogs occur in a range of habitats from rainforest and moist eucalypt forest to dry eucalypt forest and heath, typically in areas where surface water gathers after rain. They prefer wetter forests in the south of its range, but extends into drier forests in northern NSW and southern Queensland. Breeding occurs following heavy rainfall from spring to autumn, with larger temporary pools and flooded areas preferred. Frogs may aggregate around breeding sites and eggs are laid in loose clumps among waterplants, including water weeds. The larvae are free swimming.

Threatening processes for this species include:

- Changes to drainage patterns which reduce periodic local flooding
- Damage to semi-permanent and ephemeral ponds and flood-prone vegetation
- Clearing of habitat for development
- Clearing of habitat for agriculture
- Habitat disturbance through timber harvesting

- Reduction in water quality through pasture fertilisation
- Reduction in habitat and water quality as a result of grazing
- Reduction of leaf-litter and cover of fallen logs through burning for agricultural purposes.

Potential Impacts from the Proposal

The proposal would result in the loss of up to 155 m² of habitat along the main watercourse and associated flanking sclerophyll habitat. Given that the watercourse would be largely unaffected and adjacent habitat areas would be retained the proposal represents a minor reduction of habitat which may be utilised by the Green-thighed Frog. On this basis it would be highly unlikely that an adverse effect on the life cycle of the Green-thighed Frog would occur such that a viable local population of the species is likely to be placed at risk of extinction.

Barking Owl

The Barking Owl inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It roosts in shaded portions of tree canopies, including tall midstorey trees with dense foliage such as *Acacia* and *Casuarina* species. Barking Owls preferentially hunt small arboreal mammals such as Squirrel Gliders and Ringtail Possums, but when loss of tree hollows decreases these prey populations the owl becomes more reliant on birds, invertebrates and terrestrial mammals such as rodents and rabbits.

The species requires very large permanent territories in most habitats due to sparse prey densities. Monogamous pairs hunt over as much as 6000 hectares, with 2000 hectares being more typical in NSW habitats. Nesting occurs in living eucalypts and sometimes dead trees are also used. Nest sites are used repeatedly over years by a pair, but they may switch sites if disturbed by predators (eg goannas). Nesting occurs during mid-winter and spring but is variable between pairs and among years. Laying generally occurs during August and fledging occurs in November. Fledging occurs 2-3 weeks later.

Threatening processes for this species include:

- Clearing and degradation of habitat, mostly through cultivation, intense grazing and the establishment of exotic pastures
- Inappropriate forest harvesting practices that remove old, hollow-bearing trees and change open forest structure to dense regrowth
- Firewood harvesting resulting in the removal of fallen logs and felling of large dead trees
- Too-frequent fire leading to degradation of understorey vegetation which provides shelter and foraging substrates for prey species
- Disturbance of nesting and excessive disturbance of foraging by inappropriate use of call-playback surveys.

Potential Impacts from the Proposal

The proposal would result in the loss of up to 4.38 hectares of dry sclerophyll forest and up to 26 hollow-bearing trees may require removal. Given the occurrence of extensive forested habitat within the locality, the proposal represents a minor reduction of foraging habitat which may be utilised by the Barking Owl. On this basis it would be highly unlikely that an adverse effect on the life cycle of the Barking Owl would occur such that a viable local population of the species is likely to be placed at risk of extinction.

Brown Treecreeper

The Brown Treecreeper occurs in eucalypt woodlands and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species. Fallen timber is an important habitat component for foraging. Hollows in standing dead or live trees and tree stumps are essential for nesting.

When foraging in trees and on the ground, they peck and probe for insects, mostly ants, amongst the litter, tussocks and fallen timber, and along trunks and lateral branches; up to 80% of the diet is comprised of ants; other invertebrates (including spiders, insects larvae, moths, beetles, flies, hemipteran bugs, cockroaches, termites and lacewings) make up the remaining percentage; nectar from Mugga Ironbark (*Eucalyptus sideroxylon*) and paperbarks, and sap are also eaten, along with lizards and food scraps; young birds are fed ants, insect larvae, moths, craneflies, spiders and butterfly and moth larvae.

The species breeds in pairs or co-operatively in territories which range in size from 1.1 to 10.7 hectares (mean = 4.4 hectares). Each group is composed of a breeding pair with retained male offspring and, rarely, retained female offspring.

Threatening processes for this species include:

- Historical loss of woodland, forest and mallee habitats as a result of agriculture, forestry, mining and residential development
- Fragmentation of woodland and forest remnants which isolates populations and causes local extinctions
- Ongoing degradation of habitat, particularly the loss of tree hollows and fallen timber from firewood collection and overgrazing
- Lack of regeneration of eucalypt overstorey in woodland due to overgrazing and too-frequent fires
- Loss of ground litter from compaction and overgrazing
- Inappropriate forestry management practices
- Loss of understorey habitat
- Competition from invasive weeds
- Aggressive exclusion from forest and woodland habitat by over abundant Noisy Miners.

Potential Impacts from the Proposal

The proposal would result in the loss of up to 4.38 hectares of dry sclerophyll forest and up to 26 hollow-bearing trees may require removal. Given the occurrence of extensive forested habitat within the locality, the proposal represents a minor reduction of foraging habitat which may be utilised by the Brown Treecreeper. On this basis it would be highly unlikely that an adverse effect on the life cycle of the Brown Treecreeper would occur such that a viable local population of the species is likely to be placed at risk of extinction.

Glossy Black-cockatoo

The range of the Glossy Black-cockatoo is large, extending from coastal central Queensland south to East Gippsland in Victoria, with an isolated population on Kangaroo Island, South Australia. Further inland this species occurs on the tablelands and central western plains of NSW, with a small population in the Riverina. The Glossy Black-cockatoo feeds almost exclusively on the seeds of several species of she-oak (*Casuarina* and *Allocasuarina* species). In eastern New South

Wales, this species forages in open forest and woodlands of the coast and the Great Dividing Range where stands of She-oak occur, particularly Black She-oak (*Allocasuarina littoralis*) and Forest Oak (*A. torulosa*). The Glossy Black-cockatoo is dependent on large hollow-bearing eucalypts for nest sites. A single egg is laid between March and May.

Threatening processes for this species include:

- Reduction of suitable habitat through clearing for development
- Decline of hollow bearing trees over time due to land management activities
- Excessively frequent fire which eliminates sheoaks from areas, prevents the development of mature sheoak stands, and destroys nest trees
- Firewood collection resulting in loss of hollow bearing trees, reduced recruitment of hollow bearing trees, and disturbance of breeding attempts
- Decline in extent and productivity of sheoak foraging habitat due to feral herbivores
- Limited information on the location of nesting aggregations and the distribution of high quality breeding habitat
- Disturbance from coal seam gas and open cut coal mining causing loss of foraging and breeding habitat as well as disturbing reproductive attempts
- Forestry activity resulting in loss of hollow bearing trees, reduced recruitment of hollow bearing trees, degradation of foraging habitat, and disturbance of breeding attempts
- Decline in extent and productivity of sheoak foraging habitat caused by moisture stress due to climate change
- Degradation of foraging habitat and reduced regeneration of sheoak stands due to grazing by domestic stock
- Loss of foraging habitat due to slashing/underscrubbing
- Change in the spatial and temporal distribution of foraging resources due to global warming
- Illegal bird smuggling and egg-collecting
- Habitat infestation by weeds such as African Boxthorn, Gazania, Buffel Grass and other invasive grasses.

Potential Impacts from the Proposal

The proposal would result in the loss of up to 4.38 hectares of dry sclerophyll forest and up to 26 hollow-bearing trees may require removal. Given the occurrence of extensive forested habitat within the locality, the proposal represents a minor reduction of foraging habitat which may be utilised by the Glossy Black-cockatoo. On this basis it would be highly unlikely that an adverse effect on the life cycle of the Glossy Black-cockatoo would occur such that a viable local population of the species is likely to be placed at risk of extinction.

Little Lorikeet

The distribution of the Little Lorikeet encompasses the coast, tablelands and slopes of eastern Australia from Cape York to South Australia. Nomadic movements are common, influenced by season and food availability, although some areas retain residents for much of the year. The Little Lorikeet mostly forages in the canopy of open eucalypt forest and woodland, utilising *Eucalyptus*, *Angophora, Melaleuca* and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. This species feeds mostly on nectar and pollen, but occasionally also on native fruits such as mistletoe. Nests are generally located in proximity to feeding areas if possible, most typically selecting hollows in the limb or trunk of a smooth-barked

Eucalyptus. Entrance is small (3 centimetres) and usually high above the ground (2 – 15 metres). These nest sites are often used repeatedly for decades, suggesting that preferred sites are limited. Riparian trees are often chosen, including species like *Allocasuarina*. The nesting season extends from May to September.

Threatening processes for this species include:

- Clearing of woodlands for agriculture
- The loss of old hollow bearing trees
- Competition with the introduced Honeybee
- Infestation of habitat by invasive weeds
- Inappropriate fire regimes
- Aggressive exclusion from forest and woodland habitat by over abundant Noisy Miners
- Climate change impacts including reduction in resources due to drought
- Degradation of woodland habitat and vegetation structure due to overgrazing.

Potential Impacts from the Proposal

The proposal would result in the loss of up to 4.38 hectares of dry sclerophyll forest and up to 26 hollow-bearing trees may require removal. Given the occurrence of extensive forested habitat within the locality, the proposal represents a minor reduction of foraging habitat which may be utilised by the Little Lorikeet. On this basis it would be highly unlikely that an adverse effect on the life cycle of the Little Lorikeet would occur such that a viable local population of the species is likely to be placed at risk of extinction.

Masked Owl

Masked Owls live in dry eucalypt forests and woodlands from sea level to 1100 metres. While forest owls, they often hunts along the edges of forests, including roadsides. The typical diet consists of tree-dwelling and ground mammals, especially rats. Pairs have a large home-range of 500 to 1000 hectares. They roosts and breed in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting.

Threatening processes for this species include:

- Loss of mature hollow-bearing trees and changes to forest and woodland structure, which leads to fewer such trees in the future
- Clearing of habitat for grazing, agriculture, forestry or other development
- A combination of grazing and regular burning is a threat, through the effects on the quality of ground cover for mammal prey, particularly in open, grassy forests
- Secondary poisoning from rodenticides
- Being hit by vehicles.

Potential Impacts from the Proposal

The proposal would result in the loss of up to 4.38 hectares of dry sclerophyll forest and up to 26 hollow-bearing trees may require removal. Given the occurrence of extensive forested habitat within the locality, the proposal represents a minor reduction of foraging habitat which may be utilised by the Masked Owl. On this basis it would be highly unlikely that an adverse effect on the life cycle of the Masked Owl would occur such that a viable local population of the species is likely to be placed at risk of extinction.

Powerful Owl

The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation comprising species such as Turpentine *Syncarpia glomulifera*, Black She-oak *Allocasuarina littoralis*, Blackwood *Acacia melanoxylon*, Rough-barked Apple *Angophora floribunda*, Cherry Ballart *Exocarpus cupressiformis* and a number of eucalypt species.

The main prey items are medium-sized arboreal marsupials, particularly the Greater Glider, Common Ringtail Possum and Sugar Glider. Flying foxes are important prey in some areas; birds comprise about 10-50% of the diet depending on the availability of preferred mammals. As most prey species require hollows and a shrub layer, these are important habitat components for the owl. Pairs of Powerful Owls demonstrate high fidelity to a large territory, the size of which varies with habitat quality and thus prey densities. In good habitats a mere 400 can support a pair; where hollow trees and prey have been depleted the owls need up to 4000 hectares. Powerful Owls nest in large tree hollows (at least 0.5 metres deep), in large eucalypts (diameter at breast height of 80-240 centimetres) that are at least 150 years old. Powerful Owls are monogamous and mate for life. Nesting occurs from late autumn to mid-winter, but is slightly earlier in north-eastern NSW (late summer - mid autumn). Clutches consist of two dull white eggs and incubation lasts approximately 38 days.

Threatening processes for this species include:

- Historical loss and fragmentation of suitable forest and woodland habitat from land clearing for residential and agricultural development. This loss also affects the populations of arboreal prey species, particularly the Greater Glider which reduces food availability for the Powerful Owl.
- Inappropriate forest harvesting practices that have changed forest structure and removed old growth hollow-bearing trees. Loss of hollow-bearing trees reduces the availability of suitable nest sites and prey habitat
- Can be extremely sensitive to disturbance around the nest site, particularly during pre-laying, laying and downy chick stages. Disturbance during the breeding period may affect breeding success
- High frequency hazard reduction burning may also reduce the longevity of individuals by affecting prey availability
- Road kills
- Secondary poisoning
- Predation of fledglings by foxes, dogs and cats.

Potential Impacts from the Proposal

The proposal would result in the loss of up to 4.38 hectares of dry sclerophyll forest and up to 26 hollow-bearing trees may require removal. Given the occurrence of extensive forested habitat within the locality, the proposal represents a minor reduction of foraging habitat which may be utilised by the Powerful Owl. On this basis it would be highly unlikely that an adverse effect on the life cycle of the Powerful Owl would occur such that a viable local population of the species is likely to be placed at risk of extinction.

Square-tailed Kite

Square-tailed Kites are found in a variety of timbered habitats including dry woodlands and open forests, with a particular preference for timbered watercourses. In arid north-western NSW, has been observed in stony country with a ground cover of chenopods and grasses, open acacia scrub and patches of low open eucalypt woodland. The species is a specialist hunter of passerines, especially honeyeaters, and most particularly nestlings, and insects in the tree canopy, picking most prey items from the outer foliage. Square-tailed Kites occupy large hunting ranges of more than 100 km².

Breeding is from July to February, with nest sites generally located along or near watercourses, in a fork or on large horizontal limbs.

Threatening processes for this species include:

- Clearing, logging, burning, and grazing of habitats resulting in a reduction in nesting and feeding resources
- Disturbance to or removal of potential nest trees near watercourses
- Illegal egg collection and shooting.

Potential Impacts from the Proposal

The proposal would result in the loss of up to 4.38 hectares of dry sclerophyll forest and up to 26 hollow-bearing trees may require removal. Given the occurrence of extensive forested habitat within the locality, the proposal represents a minor reduction of foraging habitat which may be utilised by the Square-tailed Kite. On this basis it would be highly unlikely that an adverse effect on the life cycle of the Square-tailed Kite would occur such that a viable local population of the species is likely to be placed at risk of extinction.

Swift Parrot

The Swift Parrot breeds in Tasmania during spring and summer, migrating in autumn and winter to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. In New South Wales the Swift Parrot mostly occurs on the coast and south-west slopes.

On the mainland the Swift Parrot can occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany (*Eucalyptus robusta*), Spotted Gum (*Corymbia maculata*), Red Bloodwood (*C. gummifera*), Mugga Ironbark (*E. sideroxylon*), and White Box (*E. albens*). Commonly used lerp infested trees include Inland Grey Box (*E. macrocarpa*), Grey Box (*E. moluccana*) and Blackbutt (*E. pilularis*). Birds return to some foraging sites on a cyclic basis depending on food availability. Following winter they return to Tasmania where they breed from September to January, nesting in old trees with hollows and feeding in forests dominated by Tasmanian Blue Gum (*Eucalyptus globulus*).

Threatening processes for this species include:

- Habitat loss and degradation
- Changes in spatial and temporal distribution of habitat due to climate change
- Reduction in food resources due to drought
- Competition for food resources
- Collision mortality

- Psittacine Beak and Feather Disease
- Fragmentation of woodland habitat
- Infestation by invasive weeds
- Inappropriate fire regimes
- Aggressive exclusion from forest and woodland habitat by over abundant Noisy Miners.

Potential Impacts from the Proposal

The proposal would result in the loss of up to 4.38 hectares of dry sclerophyll forest and up to 26 hollow-bearing trees may require removal. The proposal site has moderate value to the Swift Parrot, when considered in the context of extensive dry sclerophyll forest in the locality and that the species is highly mobile. The proposal would result in a small reduction in habitat for the species (i.e. nectar providing trees) which is negligible in a local context. No breeding occurs on mainland Australia. On this basis, the proposed work would be unlikely to have an adverse effect on the life cycle of the Swift Parrot such that a viable local population of the species is placed at risk of extinction.

Varied Sittella

The Varied Sittella inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and *Acacia* woodland. It feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees and small branches and twigs in the tree canopy. A cup-shaped nest of plant fibres and cobwebs is built in an upright tree fork high in the living tree canopy; the same fork or tree is often re-used in successive years. Generation length is estimated to be 5 years.

Threatening processes for this species include:

- Apparent decline has been attributed to declining habitat. The sedentary nature of the Varied Sittella makes cleared land a potential barrier to movement
- The Varied Sittella is also adversely affected by the dominance of Noisy Miners in woodland patches
- Threats include habitat degradation through small-scale clearing for fencelines and road verges, rural tree decline, loss of paddock trees and connectivity, 'tidying up' on farms, and firewood collection
- Infestation of habitat by invasive weeds
- Inappropriate fire regimes
- Climate change impacts including reduction in resources due to drought
- Overgrazing by stock impacting on leaf litter and shrub layer.

Potential Impacts from the Proposal

The proposal would result in the loss of up to 4.38 hectares of dry sclerophyll forest and up to 26 hollow-bearing trees may require removal. Given the occurrence of extensive forested habitat within the locality, the proposal represents a minor reduction of foraging habitat which may be utilised by the Varied Sittella. On this basis it would be highly unlikely that an adverse effect on the life cycle of the Varied Sittella would occur such that a viable local population of the species is likely to be placed at risk of extinction.

Eastern & Little Bentwing-bat

Bent-wing Bats occur along the east and north-west coasts of Australia where they forage in forested areas, catching moths and other flying insects above the tree tops. Caves are the primary roosting habitat, but this species also use derelict mines, storm-water tunnels, buildings and other man-made structures. Maternity caves with very specific temperature and humidity regimes are used annually in spring and summer for the birth and rearing of young. At other times of the year, populations disperse within about 300 kilometre range of maternity caves. Breeding or roosting colonies can number from 100 to 150,000 individuals.

Threatening processes for these species include:

- Disturbance of colonies, especially in nursery or hibernating caves, may be catastrophic
- Destruction of caves that provide seasonal or potential roosting sites
- Changes to habitat, especially surrounding maternity/nursery caves and winter roosts
- Pesticides on insects and in water consumed by bats bio accumulates, resulting in poisoning of individuals
- Predation from foxes, particularly around maternity caves, winter roosts and roosts within culverts, tunnels and under bridges
- Predation from feral cats, particularly around maternity caves, winter roosts and roosts within culverts, tunnels and under bridges
- Introduction of exotic pathogens such as the White-nosed fungus
- Hazard reduction and wildfire fires during the breeding season
- Large scale wildfire or hazard reduction can impact on foraging resources
- Poor knowledge of reproductive success and population dynamics.

Potential Impacts of the Proposal

The proposal would result in the loss of up to 4.38 hectares of dry sclerophyll forest and up to 26 hollow-bearing trees may require removal. Given the occurrence of extensive forested habitat within the locality, the proposal represents a minor reduction of foraging habitat which may be utilised by Bent-wing Bats. On this basis it would be highly unlikely that an adverse effect on the life cycle of the Bent-wing Bats would occur such that a viable local population of the species is likely to be placed at risk of extinction.

Eastern Freetail-bat

Eastern Freetail-bats occur in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. They mainly roost in tree hollows but would also roost under bark or in man-made structures. Roosting is usually solitary but communal roosting has also been recorded. Females give birth in late November/early December.

Threatening processes for this species include:

- Loss of hollow-bearing trees
- Loss of foraging habitat
- Application of pesticides in or adjacent to foraging areas
- Artificial light sources spilling onto foraging and/or roosting habitat
- Large scale wildfire or hazard reduction burns on foraging and/or roosting habitat.

Potential Impacts from the Proposal

The proposal would result in the loss of up to 4.38 hectares of dry sclerophyll forest and up to 26 hollow-bearing trees may require removal. Given the occurrence of extensive forested habitat within the locality, the proposal represents a minor reduction of foraging and roosting habitat which may be utilised by the Eastern Freetail-bat. On this basis it would be highly unlikely that an adverse effect on the life cycle of the Eastern Freetail-bat would occur such that a viable local population of the species is likely to be placed at risk of extinction.

Greater Broad-nosed Bat

The Greater Broad-nosed Bat utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Although usually roosting in tree hollows, the species has also been found in buildings. Open woodland habitat and dry open forest suits the direct flight of this species as it searches for beetles and other large, slow-flying insects; this species has been known to eat other bat species. Little is known of the reproductive cycle, however a single young is born in January; prior to birth, females congregate at maternity sites located in suitable trees, where they appear to exclude males during the birth and raising of a single young.

Threatening processes for this species include:

- Disturbance to roosting and summer breeding sites
- Foraging habitats are being cleared for residential and agricultural developments, including clearing by residents within rural subdivisions
- Loss of hollow-bearing trees
- Pesticides and herbicides may reduce the availability of insects, or result in the accumulation of toxic residues in individuals' fat stores
- Changes to water regimes are likely to impact food resources, as is the use of pesticides and herbicides near waterways.

Potential Impacts from the Proposal

The proposal would result in the loss of up to 4.38 hectares of dry sclerophyll forest and up to 26 hollow-bearing trees may require removal. Given the occurrence of extensive forested habitat within the locality, the proposal represents a minor reduction of foraging habitat which may be utilised by the Greater Broad-nosed Bat. On this basis it would be highly unlikely that an adverse effect on the life cycle of the Greater Broad-nosed Bat would occur such that a viable local population of the species is likely to be placed at risk of extinction.

Brush-tailed Phascogale

Brush-tailed Phascogales prefer dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. They are agile climbers foraging preferentially in rough barked trees of 25 centimetres DBH or greater. The diet mostly comprises arthropods but also includes other invertebrates, nectar and sometimes small vertebrates. Females have exclusive territories of approximately 20 – 40 hectares, while males have overlapping territories often greater than 100 hectares. Brush-tailed Phascogales nest and shelter in tree hollows with entrances 2.5 – 4 centimetres wide and use many different hollows over a short time span. Mating occurs May - July; males die soon after the mating season whereas females can live for up to three years but generally only produce one litter.

Threatening processes for this species include:

- Loss and fragmentation of habitat
- Loss of hollow-bearing trees
- Predation by foxes and cats
- Competition for nesting hollows with the introduced honeybee.

Potential Impacts of the Proposal

The proposal would result in the loss of up to 4.38 hectares of dry sclerophyll forest and up to 26 hollow-bearing trees may require removal. The proposal would also increase the risk of phascogale roadkill once the new alignment is constructed. Given the occurrence of extensive forested habitat within the locality, the proposal represents a minor reduction of foraging habitat which may be utilised by the Brush-tailed Phascogale. On this basis it would be highly unlikely that an adverse effect on the life cycle of the Brush-tailed Phascogale would occur such that a viable local population of the species is likely to be placed at risk of extinction.

Grey-headed Flying-fox

Grey-headed Flying-foxes have a distribution that typically extends approximately 200 kilometres from the coast of Eastern Australia, from Rockhampton in Queensland to Adelaide in South Australia. Foraging areas include subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Feed on the nectar and pollen of native trees, in particular *Eucalyptus, Melaleuca* and *Banksia*, and fruits of rainforest trees and vines, as well as from cultivated gardens and orchards. Roosting camps are generally located within 20 kilometres of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Individual camps may have tens of thousands of animals and are used for mating, and for giving birth and rearing young. Annual mating commences in January and conception occurs in April or May; a single young is born in October or November. Site fidelity to camps is high; some camps have been used for over a century. Can travel up to 50 kilometres from the camp to forage; commuting distances are more often <20 kilometres.

Eby and Law (2008) have identified 10 trees that are key foraging resource for the Grey-headed Flying-fox in north-east NSW, consisting of Swamp Mahogany (*Eucalytus robusta*), Coastal Blackbutt (*E. pilularis*), Grey Ironbark (*E. siderophloia*), Forest Red Gum (*E. tereticornis*), Spotted Gum (*Corymbia variegata*), Large-leaved Spotted Gum (*C. henryi*), Red Bloodwood (*C. gummifera*), Pink Bloodwood (*C. intermedia*), Broad-leaved Paperbark (*Melaleuca quinquenervia*) and Silky Oak (*Grevillea robusta*).

Threatening processes for this species include:

- Clearing of woodlands for agriculture
- Loss of roosting and foraging sites
- Electrocution on powerlines, entanglement in netting and on barbed-wire
- Heat stress
- Conflict with humans
- Incomplete knowledge of abundance and distribution across the species' range.

Potential Impacts of the Proposal

The proposal would result in the loss of up to 4.38 hectares of dry sclerophyll forest and up to 26 hollow-bearing trees may require removal. Given the occurrence of extensive forested habitat within the locality, the proposal represents a minor reduction of foraging habitat which may be utilised by the Grey-headed Flying-fox. On this basis it would be highly unlikely that an adverse effect on the life cycle of the Grey-headed Flying-fox would occur such that a viable local population of the species is likely to be placed at risk of extinction.

Koala

The Koala has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. In New South Wales it mainly occurs on the central and north coasts, with populations on the western side of the Great Dividing Range.

Habitat consists of eucalypt woodlands and forests, in which the Koala feeds on more than 70 eucalypt species and 30 non-eucalypt species. Preferred browse species are differ across regions. Koalas are inactive for most of the day and do most of their feeding and moving during the night. Although predominantly arboreal, Koalas would descend and traverse open ground to move between trees. Home range size varies with quality of habitat, ranging from less than 2 hectares to several hundred hectares in size. Generally solitary, the Koala has complex social hierarchies based on a dominant male with a territory that overlaps that of several females, with sub-ordinate males on the periphery. Females breed at two years of age and produce one young per year.

The *Port Macquarie-Hastings Koala Habitat and Population Assessment* [PMHKHPA] (Biolink 2013) identifies four principal tree species preferred by Koalas within the LGA: Forest Red Gum (*Eucalyptus tereticornis*), Swamp Mahogany (*E. robusta*), Small-fruited Grey Gum (*E. propinqua*) and Tallowwood (*E. microcorys*).

Threatening processes for this species include:

- Loss, modification and fragmentation of habitat
- Predation by feral and domestic dogs
- Intense fires that scorch or kill the tree canopy
- Road-kills
- Human-induced climate change, especially drought.

Potential Impacts of the Proposal

The proposal would result in the loss of up to 4.38 hectares of dry sclerophyll forest, which comprises Secondary A Koala habitat (as per definitions by Biolink 2013). The proposal would also increase the risk of Koala roadkill once the new alignment is constructed. Given the occurrence of extensive forested habitat within the locality, the proposal represents a minor reduction of habitat which may be utilised by the Koala. On this basis it would be highly unlikely that an adverse effect on the life cycle of the Koala would occur such that a viable local population of the species is likely to be placed at risk of extinction.

Spotted-tailed Quoll

The Spotted-tailed Quoll occurs across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock outcrops and rocky-cliff faces as den sites. The species is mostly nocturnal, although would hunt during the day; spends most of the time on the ground, although also an excellent climber and would hunt possums and gliders in tree hollows and prey on roosting birds.

Quolls are generalist predators with a preference for medium-sized (500 grams – 5 kilograms) mammals and consume a variety of prey, including gliders, possums, small wallabies, rats, birds, bandicoots, rabbits, reptiles and insects; carrion and domestic fowl are also taken. Females occupy home ranges up to about 750 hectares and males up to 3500 hectares. Average litter size is five; both sexes mature at about one year of age. Life expectancy in the wild is about 3-4 years.

Threatening processes for this species include:

- Loss, fragmentation and degradation of habitat
- Competition with introduced predators such as cats and foxes
- Deliberate poisoning, shooting and trapping, primarily in response to chicken predation
- Roadkill.

Potential Impacts of the Proposal

The proposal would result in the loss of up to 4.38 hectares of dry sclerophyll forest and up to 26 hollow-bearing trees may require removal. The proposal would also increase the risk of quoll roadkill once the new alignment is constructed. Given the occurrence of extensive forested habitat within the locality, the proposal represents a minor reduction of foraging habitat which may be utilised by the Spotted-tailed Quoll. On this basis it would be highly unlikely that an adverse effect on the life cycle of the Spotted-tailed Quoll would occur such that a viable local population of the species is likely to be placed at risk of extinction.

b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

No threatened populations occur; consideration under this part of the assessment is not required.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

No EECs occur; consideration under this part of the assessment is not required.

d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,

The proposal would result in habitat loss as follows:

- Amphibians: Loss of ~155 m² of foraging habitat along western watercourse; disturbance to minor watercourses
- Birds: Loss of 4.38 hectares of foraging habitat and up to 26 habitat trees (for hollow-utilising species)
- Microbats: Loss of 4.38 hectares of foraging habitat and up to 26 habitat trees (for hollow-utilising species)
- Other mammals: Loss of 4.38 hectares of foraging habitat and up to 26 habitat trees (for hollow-utilising species).

In the context of large areas of well-connected forest in the immediate locality within private holdings, Broken Bago State Forest and Bago Bluff National Park (4023 hectares), the work would result in a minor loss of habitat for all the subject species.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

The work would fragment an area of relatively undisturbed forest, and result in a permanent road corridor of 30 – 40 metres width (average), with a maximum width of 70 metres. As most of the subject species are highly mobile, the impacts of this fragmentation are not expected to be significant. However, large gaps across a road corridor may affect the dispersal of species vulnerable to roadkill, namely the Brush-tailed Phascogale, Koala and Spotted-tailed Quoll. Amphibians would not be impacted, as the western watercourse may be traversed via the installed culverts.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

The habitat to be removed is expected to form a relatively modest part of the home range of all of the subject species with regard to foraging, breeding or roosting requirements, given the extensive forest resources in the locality.

e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

No areas of critical habitat listed under the TSC Act occur within the PMH LGA.

f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

Part 4 of the TSC Act states *'The object of a recovery plan is to promote the recovery of the threatened species, population or ecological community to which it relates to a position of viability in nature.*" Any action which adversely affects threatened species or their habitat, or contributes to relevant key threatening processes (KTP) may be interpreted as being inconsistent with this general objective.

Approved recovery plans have been prepared under the TSC Act for the Barking Owl, Masked Owl and Koala. The proposal does not affect the aims or proposed actions of any of the prepared recovery plans, threat abatement plans or recovery actions for any of the subject species as part of the Save Our Species conservation program.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

A KTP is defined under the TSC Act as a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities. The current list of KTPs under the TSC Act, and whether the proposal is recognised as a KTP is shown in Table E1.

Table E1: Key threatening processes

Listed key threatening process (as described in the final determination of the Scientific Committee to list the threatening process)	**Is the development or activity of a class of development or activity that is recognised as a threatening process?**		
	Likely	**Possible**	**Unlikely**
Alteration of habitat following subsidence due to longwall mining			✓
Aggressive exclusion of birds by noisy miners (*Manorina melanocephala*)			✓
Alteration of habitat following subsidence due to longwall mining			✓
Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands			✓
Anthropogenic climate change			✓
Bush rock removal			✓
Clearing of native vegetation	✓		
Competition and grazing by the feral European Rabbit (*Oryctolagus cuniculus*)			✓
Competition and habitat degradation by feral goats (*Capra hircus*)			✓
Competition from feral honeybees (*Apis mellifera*)			✓
Death or injury to marine species following capture in shark control programs on ocean beaches			✓
Entanglement in or ingestion of anthropogenic debris in marine and estuarine environments			✓
Forest Eucalypt dieback associated with over-abundant psyllids and bell miners			✓
High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition			✓
Herbivory and environmental degradation caused by feral deer			✓
Importation of red imported fire ants (*Solenopsis invicta*)			✓
Infection by *Psittacine circoviral* (beak and feather) disease affecting endangered psittacine species and populations			✓
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis			✓
Infection of native plants by *Phytophthora cinnamomi*			✓
Introduction and Establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae			✓
Introduction of the large earth bumblebee (*Bombus terrestris*)			✓
Invasion and establishment of exotic vines and scramblers			✓
Invasion and establishment of Scotch broom (*Cytisus scoparius*)			✓
Invasion and establishment of the Cane Toad (*Bufo marinus*)			✓
Invasion, establishment and spread of *Lantana camara*			✓
Invasion of native plant communities by African Olive (*Olea europaea L. subsp. cuspidata*)			✓
Invasion of native plant communities by *Chrysanthemoides monilifera* (bitou bush and boneseed)			✓
Invasion of native plant communities by exotic perennial grasses			✓
Invasion of the yellow crazy ant (*Anoplolepis gracilipes* (Fr. Smith)) into NSW			✓
Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants			✓
Loss of hollow-bearing trees	✓		✓

Listed key threatening process (as described in the final determination of the Scientific Committee to list the threatening process)	Is the development or activity of a class of development or activity that is recognised as a threatening process?		
	Likely	Possible	Unlikely
Loss or degradation (or both) of sites used for hill-topping by butterflies			✓
Predation and hybridisation of feral dogs (*Canis lupus familiaris*)			✓
Predation by the European red fox (*Vulpes vulpes*)			✓
Predation by the feral cat (*Felis catus*)			✓
Predation by *Gambusia holbrooki* Girard, 1859 (Plague Minnow or Mosquito Fish)			✓
Predation by the Ship Rat (*Rattus rattus*) on Lord Howe Island			✓
Predation, habitat degradation, competition and disease transmission by feral pigs (*Sus scrofa*)			✓
Removal of dead wood and dead trees	✓		

The proposal would contribute to the KTPs 'clearing of native vegetation', 'Loss of hollow-bearing trees' and 'Removal of dead wood and dead trees'. Clearing is defined under the TSC Act as '*the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss, or long-term modification, of the structure, composition and ecological function of stand or stands'*.

As noted, the proposal would result in the loss of 4.38 hectares of native vegetation (sclerophyll forest) and up to 26 hollow-bearing trees. The work as proposed would not result in any significant habitat loss for any of the subject species in a local context.

Conclusion
It is considered unlikely that local populations of any of the subject species would be placed at significant risk of extinction as a result of the proposal.

rms.nsw.gov.au

contactus@rms.nsw.gov.au

Customer feedback
Roads and Maritime
Locked Bag 928,
North Sydney NSW 2059

Transport
Roads & Maritime
Services

Appendix E

PACHCI clearance letter

10 August 2017

Ms Anna Stewart
Roads and Maritime Services
76 Victoria Street
GRAFTON NSW 2460

Dear Ms Stewart,

Preliminary assessment results for HW11 Oxley Highway, realignment from Rosewood Rd to Huntingdon Rd, S0270 and 0280

Based on Stage 1 of the *Procedure for Aboriginal cultural heritage consultation and investigation* (PACHCI).

The project, as described in the Stage 1 assessment checklist, was assessed as being unlikely to have an impact on Aboriginal cultural heritage.

The assessment is based on the following due diligence considerations:

- The project is unlikely to harm known Aboriginal objects or places.
- The AHIMS search **did not** indicate any known Aboriginal objects or places in the study area.
- The study area **does not** contain landscape features that indicate the presence of Aboriginal objects, based on the Office of Environment and Heritage's *Due diligence Code of Practice for the Protection of Aboriginal objects in NSW* and the Roads and Maritime Services' procedure.
- The cultural heritage potential of the study area appears to be reduced due to past disturbance.
- There is an absence of sandstone rock outcrops likely to contain Aboriginal art.

Safe Guards: Please be vigilant for potential Aboriginal objects when work commences.

Your project may proceed in accordance with the environmental impact assessment process, as relevant, and all other relevant approvals.

If the scope of your project changes, you must contact me and your regional environmental staff to reassess any potential impacts on Aboriginal cultural heritage.

If any potential Aboriginal objects (including skeletal remains) are discovered during the course of the project, all works in the vicinity of the find must cease. Follow the steps outlined in the Roads and Maritime Services ***Unexpected Heritage Items, Heritage Procedure 02, November 2015***.

For further assistance in this matter and do not hesitate to contact me.

Yours sincerely

Barry Williams
Aboriginal Cultural Heritage Officer
Northern Region
Roads and Maritime Services

76 Victoria Street, Grafton NSW 2460 **|** PO Box 576 Grafton NSW 2460
T 02 6604 9317 **| M** 0418 604 439 **| F** 02 6640 1304 **| E** barry.williams@rms.nsw.gov.au **www.rms.nsw.gov.au | 131 782**

Appendix F

EPA contaminated sites search results

Healthy Environment, Healthy Community, Healthy Business

Home Contaminated land Record of notices

Search results

Your search for:LGA: Port Macquarie-Hastings Council

Search Again
Refine Search

did not find any records in our database.

If a site does not appear on the record it may still be affected by contamination. For example:

- Contamination may be present but the site has not been regulated by the EPA under the Contaminated Land Management Act 1997 or the Environmentally Hazardous Chemicals Act 1985.
- The EPA may be regulating contamination at the site through a licence or notice under the Protection of the Environment Operations Act 1997 (POEO Act).
- Contamination at the site may be being managed under the planning process.

Search TIP

To search for a specific site, search by LGA (local government area) and carefully review all sites listed.

... more search tips

More information about particular sites may be available from:

- The POEO public register
- The appropriate planning authority: for example, on a planning certificate issued by the local council under section 149 of the Environmental Planning and Assessment Act.

See What's in the record and What's not in the record.

If you want to know whether a specific site has been the subject of notices issued by the EPA under the CLM Act, we suggest that you search by Local Government Area only and carefully review the sites that are listed.
This public record provides information about sites regulated by the EPA under the Contaminated Land Management Act 1997, including sites currently and previously regulated under the Environmentally Hazardous Chemicals Act 1985. Your inquiry using the above search criteria has not matched any record of current or former regulation. You should consider searching again using different criteria. The fact that a site does not appear on the record does not necessarily mean that it is not affected by contamination. The site may have been notified to the EPA but not yet assessed, or contamination may be present but the site is not yet being regulated by the EPA. Further information about particular sites may be available from the appropriate planning authority, for example, on a planning certificate issued by the local council under section 149 of the Environmental Planning and Assessment Act. In addition the EPA may be regulating contamination at the site through a licence under the Protection of the Environment Operations Act 1997. You may wish to search the POEO public register

29 March 2017

Connect Feedback

Web suppo
Public cons

Appendix G

Noise and vibration assessment

ACOUSTICS AND AIR

HW11 OXLEY HIGHWAY – ROSEWOOD ROAD REALIGNMENT

REF NOISE AND VIBRATION ASSESSMENT

REPORT NO. 00750
VERSION B

SEPTEMBER 2017

PREPARED FOR

GEOLINK
PO BOX 1446
COFFS HARBOUR, NSW 2450

DOCUMENT CONTROL

Version	Status	Date	Prepared By	Reviewed By
A	Draft	4 May 2017	Adam Bioletti	Brian Clarke
B	Final	16 September 2017	Adam Bioletti	

Note

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Quality Assurance

We are committed to and have implemented AS/NZS ISO 9001:2008 "Quality Management Systems – Requirements". This management system has been externally certified and Licence No. QEC 13457 has been issued.

AAAC

This firm is a member firm of the Association of Australian Acoustical Consultants and the work here reported has been carried out in accordance with the terms of that membership.

Celebrating 50 Years in 2012

Wilkinson Murray is an independent firm established in 1962, originally as Carr & Wilkinson. In 1976 Barry Murray joined founding partner Roger Wilkinson and the firm adopted the name which remains today. From a successful operation in Australia, Wilkinson Murray expanded its reach into Asia by opening a Hong Kong office early in 2006. 2010 saw the introduction of our Queensland office and 2011 the introduction of our Orange office to service a growing client base in these regions. From these offices, Wilkinson Murray services the entire Asia-Pacific region.

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GLOSSARY OF ACOUSTIC TERMS

Most environments are affected by environmental noise which continuously varies, largely as a result of road traffic. To describe the overall noise environment, a number of noise descriptors have been developed and these involve statistical and other analysis of the varying noise over sampling periods, typically taken as 15 minutes. These descriptors, which are demonstrated in the graph below, are here defined.

Maximum Noise Level (L_{Amax}) – The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.

L_{A1} – The L_{A1} level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the L_{A1} level for 99% of the time.

L_{A10} – The L_{A10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise.

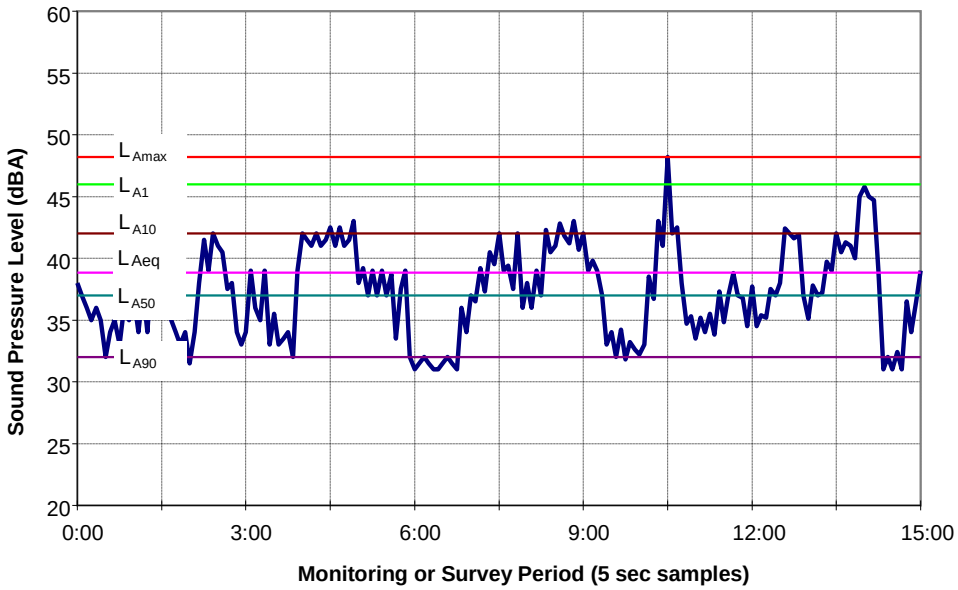
L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

L_{Aeq} – The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.

ABL – The Assessment Background Level is the single figure background level representing each assessment period (daytime, evening and night time) for each day. It is determined by calculating the 10th percentile (lowest 10th percent) background level (L_{A90}) for each period.

RBL – The Rating Background Level for each period is the median value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period – daytime, evening and night time.

Typical Graph of Sound Pressure Level vs Time



1 INTRODUCTION

NSW Roads and Maritime Services (RMS) are proposing to improve road safety and journey reliability by re-aligning the Oxley Highway near Rosewood Road, approximately 6km west of Wauchope, NSW.

Wilkinson Murray has been commissioned to undertake a noise and vibration impact assessment for the proposed works. This noise and vibration impact assessment investigates potential noise and vibration impacts from construction and operation of the proposal.

This noise and vibration impact assessment was conducted in general accordance with the following NSW Government guidelines and policies:

- *Noise Criteria Guideline* (RMS, 2015);
- *NSW Road Noise Policy* (DECCW, 2011);
- *Construction Noise and Vibration Guideline* (RMS, 2016);
- *Noise Criteria Guideline* (RMS, 2015);
- *Interim Construction Noise Guideline* (DECC, 2009); and,
- *Assessing Vibration: a technical guideline* (DEC, 2006)

At the time of preparing this assessment, several options for the realignment were being considered. The options being considered were sufficiently similar to permit this assessment, based on indicative areas for construction and also the eventual road.

This assessment has been undertaken as a desktop study.

2 THE PROPOSAL

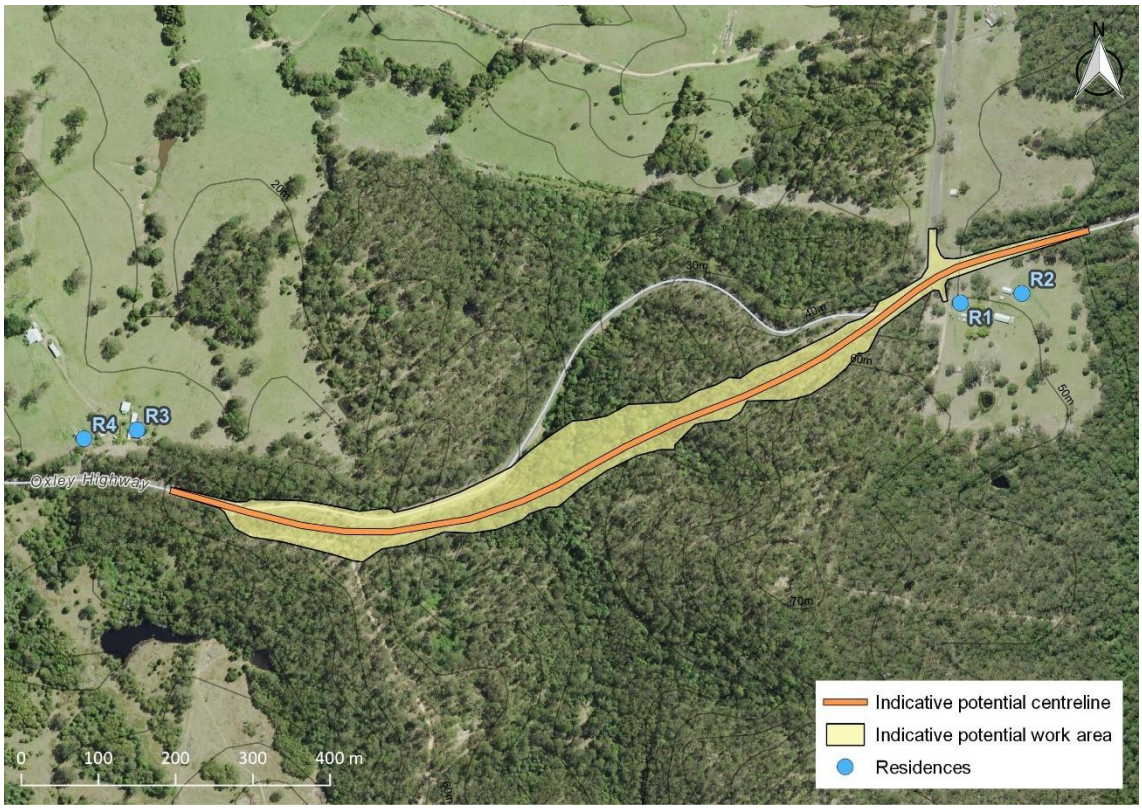
2.1 Proposal Description

RMS propose to realign approximately 1.25km of the Oxley Highway, about 6km west of Wauchope within the Port Macquarie-Hasting local government area. The proposal includes upgrading the Oxley Highway – Rosewood Road interstation.

Figure 2-1 presents an indication of the potential work area and an indicative road alignment.

A number of ancillary facilities would be required to support the construction of the proposal. The exact location of these facilities have not been determined at the time of writing (due to ongoing design changes).

Figure 2-1 Site Map



2.2 Construction Activities

This section provides a summary of the likely construction methodology, staging, work hours, plant and equipment that would be used. For the purpose of this REF, an indicative construction plan and methodology are provided.

2.2.1 Work Methodology

Table 2-1 outlines the general work methodology that would be followed for the work. It should

be noted that the actual staging plan would be developed by the contractor, and that the phases presented in Table 2-1 are presented for the purpose of assessment and should only be regarded as indicative. Note that some activities would occur concurrently.

Table 2-1 General Construction Phases and Activities

Construction Phase	Activities	Anticipated Duration
Environmental management system (EMS)	Prepare EMS Prepare environmental management plans Obtain statutory approvals and licences.	N/A
Early work	Survey the construction site Issue resident notification about proposed construction activities Fence the site boundaries and areas to be used for stockpile sites and compound areas Fence the sensitive environmental and heritage areas Installation of temporary erosion, sedimentation and drainage controls Undertake other activities determined by the environmental representative (construction contractor or Roads and Maritime) to have minimal environmental impact.	4 weeks
Site preparation	Remove vegetation Establish access tracks Establishment of construction phase traffic control which includes temporary traffic signs, safety barriers, line marking changes and similar	4 weeks
Box culvert construction	Delivery and placement of precast structures	16 weeks
Bulk earthworks	Formation of road alignment Excavation of soil and rock Hammering/rock breaking, loading, haulage, compaction of fill areas and grading.	60 weeks
Blasting	Bulk removal of rock	Intermittent
Crushing	Onsite crushing of rock	20 weeks
Paving / asphalting	Delivery of raw materials Placement of surface material	3 weeks
Re-surfacing works	Milling the existing asphalt	2 weeks
Road furniture installation	Signposting Line marking Safety barrier installation	2 weeks
Finishing	Remove site compounds Rehabilitate site	6 weeks

2.2.2 Construction hours and duration

Work would be undertaken during the following periods:

- Monday – Friday 7.00 am to 6.00 pm
- Saturday 8.00 am to 5.00 pm
- Sunday and Public Holidays No work

We note that the period 1.00pm to 5.00pm Saturday is outside the Environmental Protection Authority (EPA) standard construction hours.

The work is anticipated to take approximately 18 months to complete.

2.2.3 Plant and equipment

An indicative list of plant and equipment that would typically be required is provided below. (Additional equipment requirements would be determined during detailed design by the construction contractor.)

- Mulcher
- Chainsaws
- Bulldozers
- Scrapers
- Excavators
- Excavators with hydraulic hammers
- Graders
- Dump trucks
- Compactors
- Rollers (vibratory, pad foot, smooth drum and multi tyred)
- Water cart
- Road trucks
- Mobile crane
- Franna crane
- Asphalt paver
- Asphalt profiler
- Power tools (grinder, drill, etc.)
- Hand tools (hammer, saw, etc.)

3 SITE DESCRIPTION

This chapter describes the study area and identifies sensitive receptors.

The area is rural. Four residences have been identified within approximately 100m of the existing Oxley Highway at each end of the work area. These sensitive receiver locations are illustrated in Figure 2-1.

The topography varies across the site. The nearest receivers are at a similar height to the existing highway. The horizontal and vertical road alignment near the receivers is proposed to remain similar to the existing highway.

4 EXISTING NOISE ENVIRONMENT

Noise measurements were not undertaken as part of this study.

Indicative background noise levels for various environments are provided in Australian Standard AS 1055.2:1997 "Acoustics -Description and measurement of environmental noise". Of the noise area categories included in AS 1055.2:1997, 'R2' best describes the environment surrounding the works – "*Areas with low density transportation*". The estimated background noise levels for 'R2' category areas are:

- Day (7am-6pm Monday to Saturday and 9am-6pm Sunday) 45 dBA
- Evening (6pm-10pm Monday to Sunday) 40 dBA
- Night (10pm-7am Monday to Saturday and 10pm-9am Sunday) 35 dBA

For the purpose of deriving site-specific construction noise criteria, these estimated background levels are considered appropriate.

5 ASSESSMENT OF OPERATIONAL ROAD TRAFFIC NOISE IMPACTS

The *NSW Noise Criteria Guideline* (RNP) (DECCW, 2009) provides detailed information on operational noise criteria for road, and traffic generating developments. In April 2015, RMS released the *Noise Criteria Guideline* (NCG) (RMS, 2015). The purpose of the NCG is to ensure a consistent approach to assessing potential operational noise impacts from RMS road projects.

The NCG distinguishes between, and provides a framework for the assessment of noise from, three road project categories:

- New;
- Redeveloped; and,
- Minor Works

In accordance with Section 5 of the NCG, the proposal is classified as Minor Works since the works are proposed primarily to improve road safety and are not intended to increase the traffic carrying capacity of the overall road or accommodate a significant increase in heavy vehicle traffic.

The NCG recommends that in the case where Minor Works increase existing noise levels at the most affected receiver by more than 2.0dBA, the existing road criteria, as prescribed by the RNP should be applied. That is, if it can be demonstrated that road noise levels will not increase by more than 2 dBA due to a Minor Works Project, no further assessment or mitigation of road noise is warranted.

The proposal would not increase noise levels by more than 2 dBA because:

- the road is not proposed to be moved closer to any residence;
- there would be no increase to the traffic volume or change to the traffic mix;
- the posted speed would not increase; and
- gradients would be reduced.

It is likely that the proposal would reduce maximum noise level events such as truck engine braking and heavy accelerations due to straightening and levelling the road.

Considering the above, further assessment of operational noise is not warranted.

6 ASSESSMENT OF CONSTRUCTION NOISE IMPACTS

6.1 Construction Noise Management Levels

The *Interim Construction Noise Guideline* (ICNG) (DECC, 2009) recommends noise management levels (NML) to reduce the likelihood of noise impacts arising from construction activities. The ICNG NML for residential receivers are shown in Table 6-1.

Table 6-1 ICNG Noise Management Levels for residential receivers

Time of Day	Management Level $L_{Aeq,15min}$	How to Apply
Recommended Standard Hours: Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or Public Holidays	Noise affected RBL + 10 dBA	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured $L_{Aeq,15min}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dBA	The highly noise affected level represents the point above which there may be strong community reaction to noise. • Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting 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 works near schools, or mid-morning or mid-afternoon for works 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	Noise affected RBL + 5 dB	• A strong justification would typically be required for works 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 practices have been applied and noise is more than 5dB(A) above the noise affected level, the proponent should negotiate with the community.

The proposal specific construction NML for residential receivers are presented in Table 6-2.

Table 6-2 Construction NML – Residential Receivers

Acceptable $L_{Aeq,\ 15\ min}$ Noise Level				Highly Affected Level (Standard Hours)
Standard Construction Hours	Outside Standard Construction Hours RBL + 5 (dBA)			
RBL + 10 (dBA)	Day	Evening	Night	
55	50	45	40	75

6.2 Sleep Disturbance

It is unlikely that construction activity would be undertaken at night and separate assessment would be required if it is. Notwithstanding this, it is worthwhile introducing sleep disturbance criteria in this assessment as these criteria may influence future decisions to undertake night works.

Regarding sleep disturbance, the ICNG states:

> *"Where construction works are planned to extend over more than two consecutive nights, and a quantitative assessment method is used, the analysis should cover the maximum noise level, and the extent and the number of times that the maximum noise levels exceeds the RBL…"*

All out of hours works would be conducted in accordance with the CNVG; and therefore, residential receivers would not be exposed to significant construction noise levels for more than two consecutive nights. Accordingly, a detailed assessment of sleep disturbance is not warranted.

Notwithstanding the above, it is prudent to establish criteria for the assessment of sleep disturbance. If the Contractor deems that out of hours works near individual dwellings are required over more than two consecutive nights, a detailed assessment of potential sleep disturbance should be conducted.

Noise sources that operate over short durations at night have the potential to cause sleep disturbance despite complying with criteria based upon the L_{Aeq} noise descriptor. For this reason, the NSW INP suggests that a screening test be applied such that if the $L_{A1,1min}$ or L_{Amax} noise levels do not exceed the background noise level by more than 15 dBA, then it is unlikely that the development has the potential to cause sleep disturbance.

The EPA's Application Notes state:

> *"Research on sleep disturbance is reviewed in the NSW Road Noise Policy. This review concluded that the range of results is sufficiently diverse that it was not reasonable to issue new noise criteria for sleep disturbance.*
>
> *From the research, the EPA recognised that the current sleep disturbance criterion of an $L_{A1,(1\ min)}$ not exceeding the $L_{A90,(15\ min)}$ by more than 15 dB(A) is not ideal. Nevertheless, as there is insufficient evidence to determine what should replace it, the EPA will continue to use it as a guide to identify the likelihood of sleep disturbance. This means that where the criterion is met, sleep disturbance is not likely, but where it is not met, a more detailed analysis is required."*

The night time RBL is estimated as 35 dBA. Therefore, the sleep disturbance screening criterion becomes 50 dBA.

It is noted that this level externally would equate to an internal noise level below the reported threshold of awakening reactions (42 dBA, *Night Noise Guidelines for Europe*, World Health Organisation 2009).

The *NSW Road Noise Policy* states that from the research on sleep disturbance to date it can be concluded that:

- Maximum internal noise levels below 50-55 dBA are unlikely to cause awakening reactions; and,
- One or two noise events per night, with maximum internal noise levels of 65-70dBA, are not likely to affect health and wellbeing significantly.

Assuming that the typical noise reduction through a bedroom facade with normally open windows is 10dBA, then an external noise level of 60-65 dBA is unlikely to cause sleep disturbance. Noting this, the adopted sleep disturbance screening criterion is considered to be conservative.

The sleep disturbance criterion is only applicable to night time (10.00pm to 7.00am) work.

6.3 Construction Plant Sound Power Levels

Sound levels of typical equipment are listed in Table 6-3. The Table gives both Sound Power Level (SWL) and Sound Pressure Level (SPL) at seven metres for the equipment. SWL is independent of measurement position. Verification of plant noise is typically done by measuring the SPL at seven metres.

Based on the information in Table 6-3, source noise levels from a number of sample construction phases have been calculated, and are presented in Table 6-4. While noise levels have not been predicted for every activity outlined in Table 2-1, the stages assessed herein are considered representative of the majority of activities and will allow the range of potential construction noise impacts to be adequately identified.

Table 6-4 presents typical worst-case construction source noise levels, and does not include noise levels for some low impact activities.

Table 6-3 Typical Construction Plant Sound Levels

Plant	Sound Power Level (dBA)	Sound Pressure Level at 7m (dBA)
Mulcher	116	91
Chainsaw	114	89
Bulldozers	116	91
Scrapers	110	85
Excavators	110	85
Excavators with hydraulic hammers	122*	97
Graders	113	88
Dump trucks	110	85
Compactors	106	81
Rollers (vibratory, pad foot, smooth drum and multi tyred)	109	84
Water cart	107	82
Road trucks	108	83
Mobile crane	113	88
Franna crane	98	73
Asphalt paver	114	89
Asphalt profiler	117*	92
Crushing plant	118	93
Power tools (grinder, drill, etc.)	95-110	70-85
Hand tools (hammer, saw, etc.)	95	70

* Indicates that a 5dB(A) penalty is applicable for tonal, annoying or impulsive sound sources in accordance with ICNG. This penalty is not indicated in the presented SWL and SPL.

Table 6-4 Construction Phase Sound Power Levels

Code	Activity	Typical Equipment Used	Total $L_{Aeq,15min}$ Sound Power Level (SWL) used for Calculations
E	Site establishment and early work	Franna crane, delivery trucks, bulldozer, excavator, mulcher, chainsaw, dump truck	118
BC	Box culvert construction	Delivery truck, mobile crane	113
BE	Bulk earthworks	Bulldozer, scraper, excavator, hydraulic hammer, grader, dump truck, compactor, roller, water cart	127
CR	Crushing	Rock crusher, excavator, dump truck	118
PA	Paving / asphalting	Asphalt paver, dump truck, asphalt truck, smooth drum roller, multi tyred roller	114
PM	Re-surfacing (milling)	Asphalt profiler, dump truck	118
C	Compound	Various	114

* Indicates that a 5dB(A) penalty is applicable for tonal, annoying or impulsive sound sources in accordance with ICNG. This penalty is indicated in the presented SWL and SPL.

6.4 Predicted Construction Noise Levels

Table 6-5 presents the predicted construction noise levels at the identified receivers. These predictions consider attenuation due to distance, air absorption and a conservative estimate of ground attenuation. Table 6-6 presents the predicted $L_{Aeq,15min}$ noise levels for each scenario at various distances.

Table 6-5 Predicted Construction $L_{Aeq,15min}$ Noise Levels (dBA)

			Receiver			
			1	2	3	4
Acceptable $L_{Aeq,15min}$ Noise Level (dBA)	**Standard Construction Hours**		55			
	Outside Standard Construction Hours	**Day**	50			
		Evening	45			
		Night	40			
Scenario						
E	Site establishment and early work		40-*80*	40-*76*	40-70	40-66
BC	Box culvert construction		35-75	35-71	35-65	35-61
BE	Bulk earthworks		49-*89*	49-*85*	49-*79*	49-75
CR	Crushing		40-*80*	40-*76*	40-70	40-66
PA	Paving / asphalting		36-*76*	36-72	36-66	36-62
PM	Re-surfacing (milling)		40-*80*	40-*76*	40-70	40-66

Notes: 1. Red italics indicates predictions exceeding the residential highly noise effected level (75dBA)

Table 6-6 Predicted $L_{Aeq,15min}$ Noise Levels at Various Distances

Code	Activity	Predicted Construction $L_{Aeq,15min}$ Noise Levels (dBA)[1]					
		10m	20m	50m	100m	200m	500m
E	Site establishment and early work	*90*	*84*	*76*	69	62	51
BC	Box culvert construction	*85*	*79*	71	64	57	46
BE	Bulk earthworks	*99*	*93*	*85*	*78*	71	60
CR	Crushing	*90*	*84*	*76*	69	62	51
PA	Paving / asphalting	*86*	*80*	72	65	58	47
PM	Re-surfacing (milling)	*90*	*84*	*76*	69	62	51
C	Compound	*86*	*80*	72	65	58	47

Notes: 1. Predictions exclude shielding

Review of Table 6-5 indicates the potential for construction noise levels to exceed the acceptable NMLs during all scenarios, whilst work is in the vicinity of receivers. During the loudest works, the L_{Aeq} noise level at the nearest residence is predicted to be up to 89 dBA, which would result if hydraulic hammers were used nearby to the residence (including a 5 dB penalty). The highly noise affected level ($L_{Aeq,15min}$ 75dBA) is expected to be exceeded whilst works are nearby receivers.

The bulk of the construction work will be more distant from receivers, in the areas requiring significant cut and fill. Receiver noise levels resulting from these activities are predicted to be approximately 60 dBA, excluding shielding that may be present from topography. On the basis of these predictions, moderate exceedances of the acceptable noise level would be expected, however the highly-affected noise level would not be exceeded by the majority of the construction work.

Noise levels from an ancillary compound have been predicted at a number of distances, neglecting shielding. As the location of the compound is not known, a detailed assessment is not possible. However, we can conclude that locating the compound near residences would require some noise management measures to be applied if the acceptable noise level is to be achieved.

7 ASSESSMENT OF CONSTRUCTION VIBRATION IMPACTS

7.1 Construction Vibration Criteria

Impacts from vibration can be considered both in terms of effects on building occupants (human comfort) and the effects on the building structure (building damage). Of these considerations, the human comfort limits are the most stringent. Therefore, for occupied buildings, if compliance with human comfort limits is achieved, it will follow that compliance with the building damage objectives will be achieved.

7.1.1 Human Comfort

The EPA's *Assessing Vibration: A Technical Guideline* (DEC, 2006) provides acceptable values for continuous and impulsive vibration in the range 1-80 Hz. Both preferred and maximum vibration limits are defined for various locations and are shown in Table 7-1.

Table 7-1 Preferred & Maximum Peak Particle Velocity (PPV) Values for Continuous and Impulsive Vibration

Location	Assessment Period [1]	Preferred Values	Maximum Values
Continuous Vibration			
Critical areas	Day or night time	0.14	0.28
Receivers	Daytime	0.28	0.56
	Night time	0.20	0.40
Offices, schools, educational institutions and places of worship	Day or night time	0.56	1.1
Workshops	Day or night time	1.1	2.2
Impulsive Vibration			
Critical areas	Day or night time	0.14	0.28
Receivers	Daytime	8.6	17.0
	Night time	2.8	5.6
Offices, schools, educational institutions and places of worship	Day or night time	18.0	36.0
Workshops	Day or night time	18.0	36.0

Notes: 1. Daytime is 7.00am to 10.00pm and night time is 10.00pm to 7.00am.

These limits relate to a long-term (15 hours for daytime), continuous exposure to vibration sources. Where vibration is intermittent, a vibration dose is calculated and acceptable values are shown in Table 7-2.

Table 7-2 Acceptable Vibration Dose Values for Intermittent Vibration ($m/s^{1.75}$)

Location	Daytime (1)		Night Time (1)	
	Preferred Value	Maximum Values	Preferred Value	Maximum Value
Critical areas	0.10	0.20	0.10	0.20
Receivers	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

Note 1 – Daytime is 7.00am to 10.00pm and night time is 10.00pm to 7.00am.

The vibration criterion adopted for the assessment of human comfort is 0.4 mm/s PPV (component), and is applicable to assessment of potential impacts during the hours of 7:00am to 10:00pm. This criterion assumes that vibration would persist for a considerable portion of the day. As this is unlikely to be the case, the criterion is inherently conservative.

7.1.2 Building Damage

There are currently no Australian Standards or guidelines to provide guidance on assessing the potential for building damage from vibration. It is common practice to derive goal levels from international standards such as British Standard BS7385:1993

The recommended limits (guide values from BS7385) for transient vibration to ensure minimal risk of cosmetic damage to residential and industrial buildings are presented in Table 7-3.

Table 7-3 Transient Vibration Guide Values - Minimal Risk of Cosmetic Damage

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

For general construction vibration, the dominant frequency of vibration is typically in the range 31.5 – 100 Hz. Because the dominant frequency of vibration cannot be determined with certainty, this assessment has adopted a conservative goal of 20 mm/s for residential buildings.

7.2 Recommended Minimum Working Distances for Vibration

Table 7-4 provides the estimated safe working distances for various vibration emitting plant (sourced from Table 2 of the CVNG and Wilkinson Murray measured data).

Table 7-4 Recommended Minimum Working Distances for Vibration

Plant item	Rating / Description	Minimum working distance	
		Damage (BS 7385)	Human comfort (TMR CoP Vol 2)
Vibratory roller	1-2 tonnes	5m	20m
	2-4 tonnes	6m	20m
	4-6 tonnes	12m	40 m
	7-13 tonnes	15m	100m
	13-18 tonnes	20m	100m
	>18 tonnes	25m	100m
Hydraulic hammer	Small (300kg, 5-12t excavator)	2m	7m
	Medium (900kg, 12-18t excavator)	7m	25m
	Large (1,600kg, >18t excavator)	22m	75m
Vibratory pile driver	Sheet piles	20m	20m
Pile boring	<800mm	2m	4m
Jackhammer	Hand held	1m	2m

7.3 Potential Vibration Impacts

Noting the distance to the nearest residences, it is unlikely that vibration criteria would be exceeded by the works.

8 ASSESSMENT OF CONSTRUCTION TRAFFIC NOISE

This chapter examines the potential for noise impacts due to changes in traffic noise during the construction of the proposal.

8.1 Construction-related Traffic Noise Goals

Appendix A of the CNVG recommends that a screening criterion be applied to evaluate whether construction-related traffic noise warrants assessment against noise goals detailed in the NCG. Appendix A states that where traffic noise levels are not predicted to increase by more than 2 dBA from construction traffic or a temporary reroute, due to a road closure, further assessment is not required.

8.2 Construction-related Traffic Noise Assessment

Construction generated traffic would be limited to workers' vehicles and material transport. These movements would make negligible difference to existing traffic noise levels on the Oxley Highway.

As construction-related traffic is not anticipated to increase traffic noise by more than 2 dBA, no further assessment is required.

9 ASSESSMENT OF BLASTING IMPACTS

There is a potential for blasting to be employed during the construction phase. It is anticipated that if blasting were employed, it would be undertaken in the cuttings.

9.1 Construction Blasting Criteria

Construction blasting should be assessed for its potential to impact human comfort and building structures.

9.1.1 Criteria for Human Comfort

(DEC, 2006) defers to the *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* (ANZECC, 1990). The fundamental criteria are that at any privately-owned residence or other sensitive location:

- the maximum overpressure due to blasting should not exceed 115 decibels (dB) for more than 5% of blasts in any year, and should not exceed 120 dB for any blast; and
- the maximum peak particle ground velocity should not exceed 5 millimetres per second (mm/s) for more than 5% of blasts in any year, and should not exceed 10 mm/s for any blast.

9.1.2 Criteria for the Prevention of Structural Damage to Buildings

At sufficiently high levels, blast overpressure may in itself cause structural damage to some building elements such as windows.

Australian Standard (AS) AS2187.2-2006 *Explosives - Storage and Use. Part 2 Use of explosives* indicates

> "*From Australian and overseas research, damage (even of a cosmetic nature) has not been found to occur at airblast levels below 133dB*."

For assessment of damage due to ground vibration, *AS2187.2 2006* recommends frequency-dependent criteria for vibration damage, derived from British Standard 7385-2 and United States Bureau of Mines Standard RI 8507. For the frequencies typical of blast vibration, a value of 10 mm/s peak particle velocity represents a conservatively low estimate of the level above which structural damage may possibly occur in residential dwellings or light commercial buildings. This limit is appropriate for the surrounding sensitive receivers, though ultimately the human comfort limit dictates the allowable magnitude of vibration at these locations.

9.1.3 Recommended Times and Frequency of Blasting

The ANZECC blasting guideline (ANZECC, 1990) recommend the following times and frequency for blasting activities:

- Blasting should generally only be permitted during the hours of 9.00am to 5.00pm Monday to Saturday;
- Blasting should not take place on Sundays or Public Holidays; and,
- Blasting should generally take place no more than once per day.

The above restrictions do not apply to locations where the effects of blasting are not perceptible at sensitive receivers.

9.2 Prediction of Blasting Overpressure and Vibration Levels

Overpressure and ground vibration levels from blasting are related to the "scaled distance" from the blast. The scaled distance (SD) is defined as:

- $SD = D/W^{1/3}$ for airblast overpressure; and
- $SD = D/W^{1/2}$ for ground vibration,

Where D is the distance from the blast in metres and W is the MIC of explosive, in kg Ammonium Nitrate Fuel Oil (ANFO) equivalent.

For this assessment, Wilkinson Murray has used data from over 7,600 records of blasts undertaken in the Hunter Valley, NSW to derive relationships between scaled distance and overpressure or vibration. These relationships are designed to predict the 95th percentile values of overpressure and vibration, representing levels that would be exceeded by only 5% of blasts.

For overpressure, the following curvilinear relationship was derived to adequately explain the measurement data:

$$\text{Overpressure (dB)} = 201.1 - 62.313 \log_{10}(SD) + 10.79 (\log_{10}(SD))^2$$

For vibration, a linear relationship was derived:

$$\text{Log}_{10}(\text{Peak Particle Velocity}) = 3.015 - 1.4359 \log_{10}(SD)$$

9.3 Maximum Allowable MIC for Blasting

The minimum foreseeable distance between receivers and blasting events is approximately 200 metres. To meet the overpressure criteria set out in Section 9.1 (115dB), traditional blasting at this small distance would require an impractically small MIC (1 kg). This may be able to be overcome through specific blast design, however it is more likely that blasting would not be used in such close proximity to dwellings.

If blasting were used at distances of approximately 500m, an MIC of 15 kg is predicted to achieve compliance with the overpressure criterion.

Vibration levels at 500m due to blasting with a MIC of 15 kg are predicted to be less than 1 mm/s and are well below the established criteria.

If blasting is required, further detailed assessment would be required and a blast management plan prepared.

10 CONSTRUCTION NOISE MITIGATION

Best practice mitigation and management measures should be used to minimise construction noise and vibration at noise sensitive receivers.

The following mitigation measures have been developed in accordance with the *Construction Noise and Vibration Guideline* (CNVG) and the *Interim Construction Noise Guideline* (ICNG).

The following mitigation measures are reproduced from CNVG Appendix B and C, and should be implemented. Where applicable, items have been modified or omitted to suit the current project, based on the exposure and duration.

Where they are included, additional mitigation measures from CNVG Appendix C are indicated in red italics.

Action Required	Applies to	Details
Management Measures		
Implementation of any project specific mitigation measures required.	Airborne noise. Ground-borne vibration.	In addition to the measures set out in this table, any *project specific* mitigation measures identified in the environmental impact assessment documentation (e.g. REF, submissions or representations report) or approval or licence conditions must be implemented.
Implement community consultation measures.	Airborne noise. Ground-borne vibration.	• *Provide phone calls or specific notification for each of the identified receivers, particularly relating to highly noise emitting activities and activities scheduled outside standard construction hours[1].* • Periodic notification of all identified receivers (monthly letterbox drop or equivalent)[1] • Website • Project info line • Construction Response Line • Email distribution list

Action Required	Applies to	Details
Site inductions.	Airborne noise. Ground-borne vibration.	All employees, contractors and subcontractors are to receive an environmental induction. The induction must at least include: • All relevant project specific and standard noise and vibration mitigation measures • Relevant licence and approval conditions • Permissible hours of work • Any limitations on high noise generating activities • Location of nearest sensitive receivers • Construction employee parking areas • Designated loading/unloading areas and procedures • Site opening/closing times (including deliveries) • Environmental incident procedures.
Behavioural practices.	Airborne noise.	No swearing of unnecessary shouting or loud stereos/radios on site. No Dropping of materials from height, throwing of metal items and slamming of doors.
Monitoring.	Airborne noise. Ground-borne vibration.	*Verification noise monitoring is suggested to be undertaken for highly noise emitting activities.* *Verification noise monitoring is suggested for noisy activities outside standard construction hours.* Monitoring of noise and vibration should be undertaken upon receipt of complaints
Source Controls		
Construction hours and scheduling.	Airborne noise. Ground-borne vibration.	Where feasible and reasonable, construction should be carried out during the standard daytime working hours. Work generating high noise and/or vibration levels should be scheduled during less sensitive time periods. *If work is required to occur at night, assessment of specific activities should be undertaken in accordance with the CNVG and appropriate mitigation measures implemented.*
Construction respite period.	Airborne noise. Ground-borne vibration.	In general, the following respite is provided. High noise and vibration generating activities[2] – e.g. hydraulic hammering – may only be carried out in continuous blocks, not exceeding 3 hours each, with a minimum respite period of one hour in between each block[3].

Action Required	Applies to	Details
Equipment selection.	Airborne noise. Ground-borne vibration.	Use quieter and less vibration emitting construction methods where feasible and reasonable.
Maximum noise levels.	Airborne noise.	The noise levels of plant and equipment must have operating Sound Power or Sound Pressure Levels compliant with the criteria in Table F.1 of the CNVG.
Rental plant and equipment.	Airborne noise.	The noise levels of plant and equipment items are to be considered in rental decisions and in any case cannot be used on site unless compliant with the criteria in Table F.1 of the CNVG.
Use and siting of plant.	Airborne noise.	Simultaneous operation of noisy plant within discernible range of a sensitive receiver is to be avoided. The offset distance between noisy plant and adjacent sensitive receivers is to be maximised. Plant used intermittently to be throttled down or shut down when not in use. Noise-emitting plant to be directed away from sensitive receivers.
Plan worksites and activities to minimise noise and vibration.	Airborne noise. Ground-borne vibration.	Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site.
Non-tonal reversing alarms.	Airborne noise.	Non-tonal reversing beepers (or an equivalent mechanism) must be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out of hours work.
Minimise disturbance arising from delivery of goods to construction sites.	Airborne noise.	Loading and unloading of materials/deliveries is to occur as far as possible from sensitive receivers. Select site access points and roads as far as possible away from sensitive receivers. Dedicated loading/unloading areas to be shielded if close to sensitive receivers. Delivery vehicles to be fitted with straps rather than chains for unloading, wherever possible.
Ancillary compounds.	Airborne noise.	*The location of ancillary compounds should be assessed and suitable noise mitigation determined in accordance with the CNVG. The use of shielding elements should be maximised for compounds in the vicinity of receivers.*

Action Required	Applies to	Details
Path Controls		
Shield stationary or localised noise sources such as pumps, compressors, fans etc.	Airborne noise.	*Whenever practical, work areas should be screened to reduce noise levels at receivers.* Stationary noise sources should be enclosed or shielded whilst ensuring that the occupational health and safety of workers is maintained. Appendix F of AS 2436: 1981 lists materials suitable for shielding.

Notes:
1. Detailing all upcoming construction activities at least 14 days prior to commencement of relevant works.
2. Includes jack and rock hammering, sheet and pile driving, rock breaking and vibratory rolling.
3. "Continuous" includes and period during where there is less than 60 minutes respite between ceasing and recommencing any of the work.

11 CONCLUSION

NSW Roads and Maritime Services (RMS) are proposing to improve road safety and journey reliability by re-aligning the Oxley Highway near Rosewood Road, approximately 6km west of Wauchope, NSW.

Wilkinson Murray has been commissioned to undertake a noise and vibration impact assessment for the proposed works. This noise and vibration impact assessment investigates potential noise and vibration impacts from construction and operation of the proposal.

This noise and vibration impact assessment was conducted in general accordance with relevant NSW Government guidelines and policies.

Operational noise is not predicted to increase as a result of the proposal.

Construction works associated with the proposal will result in construction activities in close proximity to residential receivers. Construction noise levels at sensitive receivers have been predicted for a number of typical construction scenarios, and in a number of instances, are likely to exceed the established noise management levels. The loudest works are predicted to exceed the highly-affected level of 75dBA at nearby residences whilst work is undertaken near these residences. Section 9 of this report details mitigation measures that should be implemented where practical.

No significant vibration emitting plant is anticipated to be required and therefore negligible impacts are expected.

The potential for blasting to remove material in cuttings has been identified in the brief. The proximity of these cuttings to receivers would require careful blast design in order to achieve compliance with criteria. If blasting is required it will be assessed as part of the preparation of a blast management plan.

12 REFERENCES

RMS 2015, *Noise Criteria Guideline,* Roads & Maritime Services, Sydney.

RMS 2016, *Construction Noise and Vibration Guideline*, Roads & Maritime Services, Sydney.

DECCW 2011, *NSW Road Noise Policy*, Department of Environment, Climate Change and Water NSW, Sydney.

EPA 2000, *NSW Industrial Noise Policy*, Environmental Protection Authority, Sydney.

DECC 2009, *Interim Construction Noise Guideline*, Department of Environment and Climate Change NSW, Sydney.

DEC 2006, *Assessing Vibration: a technical guideline*, Department of Environment and Conservation NSW, Sydney.

Appendix H

AHIMS search results

AHIMS Web Services (AWS)
Search Result

Purchase Order/Reference : Rosewood Road

Client Service ID : 221419

Roads and Maritime Services - Grafton

31 Victoria Street
Grafton New South Wales 2460

Attention: Chris Loh

Email: chris.loh@rms.nsw.gov.au

Date: 19 April 2016

Dear Sir or Madam:

AHIMS Web Service search for the following area at Lat, Long From : -31.48, 152.6718 - Lat, Long To : -31.4722, 152.6842 with a Buffer of 50 meters, conducted by Chris Loh on 19 April 2016.

The context area of your search is shown in the map below. Please note that the map does not accurately display the exact boundaries of the search as defined in the paragraph above. The map is to be used for general reference purposes only.

A search of the Office of the Environment and Heritage AHIMS Web Services (Aboriginal Heritage Information Management System) has shown that:

0	Aboriginal sites are recorded in or near the above location.
0	Aboriginal places have been declared in or near the above location. *

If your search shows Aboriginal sites or places what should you do?

- You must do an extensive search if AHIMS has shown that there are Aboriginal sites or places recorded in the search area.
- If you are checking AHIMS as a part of your due diligence, refer to the next steps of the Due Diligence Code of practice.
- You can get further information about Aboriginal places by looking at the gazettal notice that declared it. Aboriginal places gazetted after 2001 are available on the NSW Government Gazette (http://www.nsw.gov.au/gazette) website. Gazettal notices published prior to 2001 can be obtained from Office of Environment and Heritage's Aboriginal Heritage Information Unit upon request

Important information about your AHIMS search

- The information derived from the AHIMS search is only to be used for the purpose for which it was requested. It is not be made available to the public.
- AHIMS records information about Aboriginal sites that have been provided to Office of Environment and Heritage and Aboriginal places that have been declared by the Minister;
- Information recorded on AHIMS may vary in its accuracy and may not be up to date .Location details are recorded as grid references and it is important to note that there may be errors or omissions in these recordings,
- Some parts of New South Wales have not been investigated in detail and there may be fewer records of Aboriginal sites in those areas. These areas may contain Aboriginal sites which are not recorded on AHIMS.
- Aboriginal objects are protected under the National Parks and Wildlife Act 1974 even if they are not recorded as a site on AHIMS.
- This search can form part of your due diligence and remains valid for 12 months.

3 Marist Place, Parramatta NSW 2150
Locked Bag 5020 Parramatta NSW 2220
Tel: (02) 9585 6380 Fax: (02) 9873 8599

ABN 30 841 387 271
Email: ahims@environment.nsw.gov.au
Web: www.environment.nsw.gov.au

Appendix I

Heritage database search results

Office of Environment & Heritage

Home > Topics > Heritage places and items > Search for heritage

Search for NSW heritage

The State Heritage Inventory is a list of heritage items in New South Wales including Aboriginal Places, State Heritage Register, Interim Heritage Orders, State Agency Heritage Registers and Local Environmental Plans.

The Heritage Division is directly responsible for maintaining **Aboriginal Places** and the **State Heritage Register**. A new **combined map search** is now available. For further information about Aboriginal Places and Sites refer to **AHIMS Web Services**

Whilst the Heritage Division seeks to keep the Inventory up to date, it is reliant on State agencies and local councils to provide their data. Always check with the relevant State agency or local council for the most up-to-date information.

Visit **State Heritage Inventory help** if you are unfamiliar with this search facility.

Basic search criteria

Item name/database ID:

Street name:

Suburb/town:

Local Government Area: Please Choose...

Local Aboriginal Land Council (LALC): Please Choose... (For Aboriginal Place and State Heritage Register only)

Heritage listings: Please Choose...

SHR number:

Additional search criteria

NOTE: For items listed by local councils, there may not be information in the additional search criteria fields.

Owner organisation*:

Designer/builder:

Year of construction: from

to:

Item type: Please Choose...

Item group: Please Choose...

Item category: Please Choose...

Australian historic theme: Please Choose...

NSW historic theme: Please Choose...

Significance, description, historical notes:

Information complete:

Search

Reset

***View owner organisation names for section 170 heritage and conservation registers**

Search Aboriginal Places & State Heritage Register

The combined map search below is for Aboriginal Places and State Heritage Register items only. It does not include Interim Heritage Orders, State Agency Heritage Registers and Local Environmental Plans.

The location of Aboriginal Places and State Heritage Register items are marked on the map as a single approximation point for general identification and research purposes only.

Location information for some Aboriginal Places (e.g. burial grounds and sacred sites) have been generalised because of their cultural sensitivity. Location information for restricted Aboriginal Places is not shown at all. If an activity or development is proposed that may potentially impact on or harm (i.e., damage, deface or destroy) an Aboriginal Place, then proponents must undertake a search for the exact boundaries of Aboriginal Places through **AHIMS Web Services**.

Downloading of State Heritage Register spatial datasets and associated metadata into a Geographical Information System (GIS) software package is available through **Data NSW**

Listing Type: ◉ All ○ Aboriginal Places ○ State Heritage Register

Local government area: Port Macquarie-Hastings

Item name/Database ID:

SHR number:

Location:

Local Aboriginal Land Council (LALC): Please Choose...

State theme: Please Choose...

Item type: Please Choose...

Item Group: Please Choose...

Item category: Please Choose...

Search

Reset

Search Aboriginal Places & State Heritage Register

The combined map search below is for Aboriginal Places and State Heritage Register items only. It does not include Interim Heritage Orders, State Agency Heritage Registers and Local Environmental Plans.

The location of Aboriginal Places and State Heritage Register items are marked on the map as a single approximation point for general identification and research purposes only.

Location information for some Aboriginal Places (e.g. burial grounds and sacred sites) have been generalised because of their cultural sensitivity. Location information for restricted Aboriginal Places is not shown at all. If an activity or development is proposed that may potentially impact on or harm (i.e., damage, deface or destroy) an Aboriginal Place, then proponents must undertake a search for the exact boundaries of Aboriginal Places through **AHIMS Web Services**.

Downloading of State Heritage Register spatial datasets and associated metadata into a Geographical Information System (GIS) software package is available through **Data NSW**

Listing Type: ◉ All ○ Aboriginal Places ○ State Heritage Register

Local government area: Port Macquarie-Hastings

Item name/Database ID:

SHR number:

Location:

Local Aboriginal Land Council (LALC): Please Choose...

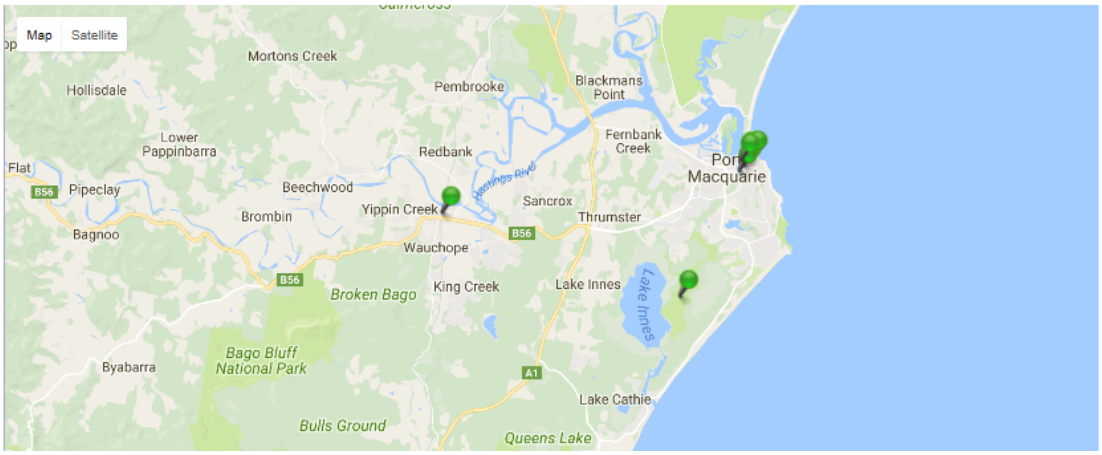
State theme: Please Choose...

Item type: Please Choose...

Item Group: Please Choose...

Item category: Please Choose...

Search Reset



Search Results

1 result found.

Werrikimbe National Park (1977 boundary) Mooraback Rd		Kangaroo Flat, NSW, Australia	(Registered) Register of the National Estate (Non-statutory archive)

Report Produced: Fri Apr 7 12:05:57 2017

Accessibility | Disclaimer | Privacy | © Commonwealth of Australia (cc) BY

Australian Heritage Places Inventory

AUSTRALIAN HERITAGE PLACES INVENTORY

Search for an Australian Heritage Place

Record Identifier: **Place Name:**

Keyword or full name, eg 'customs house' or 'Cairns Customs House' **Location:**

Wauchope Search Clear

Street or Town name, e.g. 'Macquarie' for Macquarie Place (avoid using street types)

Local Government: Local Government Area keyword, eg 'aramac'

State:

New South Wales **Country:**

Part or all of the name of a country, eg - 'fran' **Statement of Significance:**

Description:

Keyword or key phrase eg 'statue' or 'eucalyptus intermedia' **Source:**

One record found. **Records per page:** 10

Place Name	Location	Local Government	Source
Wauchope Railway Station group	North Coast railway, Wauchope	Hastings	NSW Heritage Register

Australian Government

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Appendix J

Oxley Highway community update

Oxley Highway at Gingers Creek, west of Wauchope

Oxley Highway

Community update - November 2016

The Oxley Highway stretches 514 kilometres, starting on the mid north coast of NSW at Port Macquarie and extending west to connect with the inland centres of Tamworth, Gunnedah, Coonabarabran, Gilgandra and Warren. The NSW Government is funding the delivery of vital road improvements along the Oxley Highway. This community update provides information on current activities along the highway between Port Macquarie and the Mitchell Highway at Nevertire.

Improving the Oxley Highway

Roads and Maritime Services is continuing to improve safety and reduce travel times along the Oxley Highway. This important work stems from the Oxley Highway Route Safety Review and the Oxley Highway Corridor Strategy.

The Route Safety Review report was carried out by the NSW Centre for Road Safety and Roads and Maritime, examining the Oxley Highway from the Pacific Highway west of Port Macquarie to the Mitchell Highway at Nevertire.

The NSW Government is providing $10 million to develop and implement some of the recommendations from the safety review, with a focus on improvements to intersections and bridge approach barriers.

The corridor strategy has been developed by a team from Transport NSW and Roads and Maritime. The strategy sets out the NSW Government's 20-year plan to manage and guide the development of the road corridor to improve safety, traffic efficiency and sustainability.

The strategy will be delivered in line with the NSW Long Term Transport Master Plan, Regional Transport Plans and other relevant national and State planning frameworks.

During the 2015 election, the State Government committed $50 million to a program to improve safety and travel times on the Oxley Highway over the next four years. This funding is being invested in developing and delivering projects in areas identified in the corridor strategy.

Speed zone changes

Speed zone changes at three locations between Wauchope and Long Flat have been implemented to improve safety for all road users.

The need for these speed zone changes, which have been made in accordance with the NSW Speed Zoning Guidelines and in consultation with local council, were identified in the Oxley Highway Route Safety Review.

The changes include:

- Reducing the speed limit from 60km/h to 50km/h on a 2.5km section of the highway, west of Beechwood Road to the Wauchope cemetery
- Reducing the speed limit from 100km/h to 80km/h on a 3km section of the highway, west of Bagnoo Road to Long Flat village
- Reducing the speed limit from 60km/h to 50km/h through Long Flat village.

Additional speed zone changes are planned for other sections of the Oxley Highway.

Oxley Highway corridor strategy

Transport for NSW and Roads and Maritime are progressively preparing network and corridor strategies to cover every State road in regional NSW as a response to the challenge of how to best manage transport infrastructure to maximise benefits for our customers. Network and corridor strategies provide the following benefits for the State road network in regional NSW:

- A plan for network/corridor improvement with consideration to all modes of transport
- Transparency to the community, councils and other government agencies with regard to planning and investment decisions
- Consistency in planning, management and operation of roads
- Integration of road safety, traffic and asset maintenance projects.

The Oxley Highway draft corridor strategy has been prepared by multidisciplinary project teams in consultation with key stakeholders, including local councils and government agencies.

The draft strategy was prepared to ensure that the Oxley Highway can support the transport needs of the region over the next 20 years, improving road safety, travel reliability and freight access.

The strategy detailed a series of measures and improvements in travel for our road customers including:

- Investigating opportunities to improve safety and enable access for Higher Productivity Vehicles
- Improving flood immunity

Finished work at Bective Lane, west of Tamworth

- Improving road alignment and overtaking opportunities
- Investigating improvements for cyclist connectivity and better pedestrian facilities.

Following community feedback, changes to the final draft strategy have been completed and a community consultation report is being prepared for release.

Ongoing maintenance work

Roads and Maritime continues to maintain the Oxley Highway by carrying out improvements to slope stability on the mountain between Walcha and Wauchope, as well as improving the road pavement at various locations along the corridor. This work forms part of the ongoing State road maintenance.

Completed projects

Some of the work finished since the beginning of the year includes:

- Widening the approach lanes on the Oxley Highway at the Port Macquarie interchange
- Improving bridge barrier treatments at 10 locations between Wauchope and Walcha
- Improving linemarking at Kindee Road east of Ellenborough
- Improving slope stability at Ralfes Creek, Ellenborough
- Improving linemarking and warning signs in Walcha Council
- Providing new guardrail at various culverts west of Gunnedah.

Widening the road and improving intersections at:

- Apsley Falls Road, about 18km east of Walcha
- Brackendale Road, just east of Walcha
- Surveyors Creek eastern approach, west of Walcha
- Narrow Cutting, about 8km east of Bendemeer
- Bowlers Lane, about 10km west of Tamworth
- Bective Settlement Road, about 14km west of Tamworth
- Appleby Lane, about 22km west of Tamworth
- Bective Lane, about 23km west of Tamworth
- Standrings, about 7km west of Somerton
- Redbank Road, about 13km east of Gunnedah
- Wilkinson Road, about 5km east of Gunnedah.

Current projects being built

Work is underway at the following locations:

- Improving the pavement at various sections along the highway
- Providing new slip lanes and traffic signals at Wrights Road roundabout, Port Macquarie
- Improving bridge barrier treatments at Carroll Creek, Mooki River overflow and Mooki River, west of Carroll
- Improving slope stability, including vegetation clearing, 66km west of Wauchope, Mt Seaview Road.

Upcoming work at Howe Street, Carroll

Pull over areas

Five pull over areas on the mountain, west of Wauchope, were sealed in June. Emergency phones will be installed soon.

Upcoming work

Work is continuing to improve intersections and bridge barriers along the highway. The work at these locations includes improving right turn movements across opposing traffic, increasing warning signs for the upcoming intersections and improving sight distances at the intersection. Work will start over the next few months on the following projects:

- Improving drainage near Comboyne Road turn-off, Gannons Creek
- Extending a westbound overtaking lane near Rushes Creek Road (road to Keepit Dam), west of Somerton
- Improving the intersection at Howe Street, Carroll
- Improving the entry at Mullaley rest area
- Widening the lane and improving intersections at Mullaley Boggabri Road (Grain Valley Road)
- Improving the intersection and lane widening at Mullaley Coolah Road (Black Stump Way).

Projects in development

A number of projects are being developed along the length of the highway, including:

- New overtaking lane and improvements to the alignment at Spencers Cutting
- Intersection improvements between Comboyne Road to Mount Seaview Road at the following locations:
  - Comboyne Road
  - Bagnoo Road
  - Main Street, Ellenborough
  - Wallis Road, Ellenborough
  - Forbes River Road
  - Mount Seaview Road
- Improving the alignment of the Oxley Highway near Rosewood Road, west of Wauchope
- Building a new drainage culvert, 12.5km west of Walcha at Bergen Op Zoom Creek
- Improving signposting at intersection of Bridge Street / Stewart Avenue, Tamworth
- Raising a central median on Bridge Street, between Phillip Street to Mahoney Avenue in Tamworth
- Improving the intersection of Goddard Lane with the Oxley Highway, west of Tamworth
- Providing an eastbound overtaking lane near Rushes Creek Road (road to Keepit Dam), west of Somerton
- Improving flood immunity at Hoss Causeway, east of Carroll
- Improving flood immunity at Tommy Swamp causeway, 6.5km west of Carroll
- Improving the intersection at Boundary Road, Gunnedah.

Landowners and the community will continue to be consulted during the development of these projects. More information will be available on these projects as they progress.

For more information

For more information about the Oxley Highway please contact the project team by:

02 6640 1300

OxleyHighway@rms.nsw.gov.au

More information is also available at www.rms.nsw.gov.au/oxley

Privacy

Roads and Maritime Services ("RMS") is subject to the *Privacy and Personal Information Protection Act 1998* ("PPIP Act") which requires that we comply with the Information Privacy Principles set out in the PPIP Act.

All information in correspondence is collected for the sole purpose of assisting in the assessment of this proposal/ delivering this project. The information received, including names and addresses of respondents, may be published in subsequent documents unless a clear indication is given in the correspondence that all or part of that information is not to be published. Otherwise RMS will only disclose your personal information, without your consent, if authorised by the law. Your personal information will be held by RMS at 76 Victoria St, Grafton NSW. You have the right to access and correct the information if you believe that it is incorrect.

November 2016
RMS 16.507

Improvements on the Oxley Highway

Appendix K

Council and authority consultation responses

Port Macquarie-Hastings Council
PO Box 84
Port Macquarie
NSW Australia 2444
DX 7415
e council@pmhc.nsw.gov.au

ABN 11 236 901 601

PORT MACQUARIE HASTINGS COUNCIL

9 May 2017 Refers to: CRM 7741/2017

Jacob Sickinger
GeoLINK
PO Box 119
LENNOX HEAD NSW 2478
(By email only: jsickinger@geolink.net.au; jclifford@geolink.net.au)

Dear Jacob,

RE: ISEPP Consultation Regarding Oxley Highway Realignment - West of Rosewood Road

Thank you for your correspondence of 13 April 2017 detailing the concept plans and project planning for the realignment of the Oxley Highway west of Rosewood Road.

Council has reviewed the information you have supplied and have no specific comments regarding the project. In response to the question raised about The Paddock Road Council can confirm that this road is not a Council asset and is listed as a Crown Road, we believe it may be a forestry access road. The project may wish to consult with Forestry Corporation NSW, a suitable point of contact is Craig Busby, Roading Manager (North), at craig.busby@fcnsw.com.au.

As this project progresses Council would appreciate being kept informed of the design development and given the opportunity to review further design revisions.

Council would also like to know what is planned for the redundant road reserve area once the Highway has been realigned. Council would be interested in gaining hardstand area within a road reserve to aid road maintenance and construction activities in the surrounding area. Any advice on this matter would be greatly appreciated.

Yours sincerely

Cameron Hawkins
Engineering Planning Manager, Transport and Stormwater Network

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17 Burrawan Street, Port Macquarie NSW 2444
t 02 6581 8111 f 02 6581 8123

WAUCHOPE OFFICE
49 High Street, Wauchope NSW 2446
t 02 6589 6500

LAURIETON OFFICE
9 Laurie Street, Laurieton NSW 2443
t 02 6559 9958

NSW GOVERNMENT | Department of Primary Industries

OUR REF: C17/173

3 May 2017

Mr Jacob Sickinger
GeoLINK
PO Box 119
LENNOX HEAD NSW 2478
Via email: jsickinger@geolink.net.au

Dear Mr Sickinger

Re: Consultation C17/173: Roads and Maritime Services proposed road realignment works, Oxley Highway, Bago, Port Macquarie Hastings LGA

Reference is made to your recent email in relation to potential dredging and reclamation works associated with the above mentioned project forwarded to DPI Fisheries on 19 April 2017.

DPI Fisheries, a division within the Department of Primary Industries, assesses applications for dredging and reclamation works, harming of marine vegetation and obstruction of fish passage in accordance with Part 7 of the *Fisheries Management Act 1994* and the *Policy and Guidelines for Fish Habitat Conservation and Management (2013 Update).*

In this instance, the water features that intersect the subject section of the Oxley Highway are not Key Fish Habitat and the proposed works do not trigger referral under the *Fisheries Management Act 1994*. Consequently, DPI Fisheries has no role in assessing this proposal.

It is noted that the works are within close proximity to Yippin Creek which is located on the eastern edge of the project boundary. If the proposed scope of works changes to incorporate any works within Yippin Creek, which is Key Fish Habitat, then re-referral of the project to DPI Fisheries will be required in accordance with the *Fisheries Management Act 1994*.

In light of the proximity of the works to Key Fish Habitat and the potential for indirect impacts to downstream Key Fish Habitat associated with the component of works within drainage features and first and second order waterways, DPI Fisheries highlight that the Infrastructure SEPP requires that exempt developments, complying developments and emergency works are carried out in accordance with all applicable requirements of the Blue Book (Landcom [2004], *Managing Urban Stormwater: Soils and Construction* [4th Edition]), available at http://www.environment.nsw.gov.au/resources/water/BlueBookVol1.pdf.

If you have any queries, please contact me on 0447 537 168 or jonathan.yantsch@dpi.nsw.gov.au.

Yours sincerely

Jonathan Yantsch
Fisheries Manager, Aquatic Ecosystems (North Coast)

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