

Oxley Highway to Kempsey Pacific Highway Upgrade

Biodiversity Offset Strategy

May 2016

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1. Introduction

1.1. Project background

Roads and Maritime Services is planning to upgrade a 37 kilometre section of the Pacific Highway, from approximately 700m north of the Oxley Highway Interchange to tie in with the Kempsey to Eungai Pacific Highway Upgrade (see Figure 1). The Project forms part of the Pacific Highway Upgrade Program, a joint commitment by the NSW State Government and the Federal Government to upgrade the Pacific Highway between Hexham and the Queensland border. Two main sections of the Project would deviate from the existing Pacific Highway. These are in the vicinity of the Hastings River and the Wilson River.

A new grade separated interchange is planned in the area of Blackmans Point Road south of Telegraph Point and a half interchange is proposed in the area of Haydons Wharf Road, north of telegraph point. These would both provide access into Telegraph Point which would be bypassed as part of the Project. The design of the carriageway arrangement would allow for a six- lane divided carriageway in the future.

Funding has been provided in the current \$3.6 billion five year program to progress planning and pre-construction activities. This includes cadastral and detail survey investigations as well as geotechnical investigations, which are currently underway.

Planning for the Oxley Highway to Kempsey Pacific Highway Upgrade Project, and indeed all projects within the Pacific Highway Upgrade program, has generally followed a hierarchy of principles with regard to biodiversity values along the road corridor:

- 1. Avoid impact.
- 2. Minimise impact.
- 3. Mitigate impacts.

Where impacts are unavoidable, mitigation and management measures are incorporated into the Project to reduce impacts. In some instances there are residual impacts that cannot be adequately mitigated. Residual impacts identified for the Project include:

- A loss of native vegetation.
- A loss of habitat for a variety of protected and threatened native fauna species.

1.2. Purpose of this report

The Oxley Highway to Kempsey Pacific Highway Upgrade (the Project) has been approved under Part 3A of the NSW *Environmental Planning and Assessment Act 1979*. The conditions of approval required the development of a Biodiversity Offset and Mitigation Strategy and Package. This report has been prepared to satisfy the Minster's Condition of Approval B8 outlined below.

"The Proponent shall in consultation with the EPA and DPI (Fishing and Aquaculture) develop a **Biodiversity Offset Strategy** that identifies the available options for offsetting the biodiversity impacts of the project in perpetuity, with consideration to the *Principles for the use of biodiversity offsets in NSW* (Office of Environment and Heritage Website

http://www.environment.nsw.gov.au/biocertification/offsets.htm dated 17 June 2011). Unless otherwise agreed to the EPA and DPI (Fishing and Aquiculture), offsets shall be provided on a like-for-like basis and at a minimum ratio of 4:1 for areas of high conservation value (including EEC, salt marsh and poorly conserved vegetation communities identified as being more than 75% cleared in the catchment management area) and 2:1 for the remainder of native vegetation areas (including mangroves, seagrass, and non-EEC riparian vegetation). The Strategy shall include, but not necessarily be limited to:

- (a) the aims and objectives of the biodiversity offset strategy;
- (b) confirmation of the vegetation type/ habitat (in hectares) to be cleared and their condition, and the size of offsets required (in hectares);
- (c) details of the type of available offset measures that have been identified to compensate

for the loss of threatened species and vulnerable and endangered ecological communities and/ or their habitats, and native vegetation (including mangroves, seagrasses, salt marsh and riparian vegetation). The measures shall achieve a neutral or net beneficial outcome for all the biodiversity values likely to be impacted directly or indirectly during both construction and operation of the project;

- (d) the decision-making framework that would be used to select the final suite of offset measures to achieve the aims and objectives of the Strategy, including the ranking of offset measures;
- the process for addressing and incorporating offset measures arising from changes in biodiversity impacts (where these changes are generally consistent with the biodiversity impacts identified for the project in the documents listed under condition A1), including:
 - i. changes to footprint due to detailed design;
 - ii. changes to predicted impacts as a result of changes to mitigation measures;
 - iii. the identification of additional species/ habitat through pre-clearance surveys and construction; and
 - iv. additional impacts associated with the establishment of ancillary facilities; and
- (f) options for the securing and management of biodiversity offsets in perpetuity.

The Biodiversity Offset Strategy shall be submitted to the Director General for approval no later than 6 weeks prior to the commencement of construction that would result in the disturbance of native vegetation, unless otherwise agreed by the Director General.

The Proponent may elect to satisfy the requirements of this condition by identifying a suitable offset strategy which addresses impacts from multiple Pacific Highway Upgrade projects within the North Coast Bio-region. Any such strategy, including an agreement made with the EPA, must be made in consultation with the Department and approved by the Director General within a timeframe agreed to by the Director General."

Additionally the Minster's Condition of Approval MCoA B9 also requires the development of a Biodiversity Offset Package as outlined below.

"Within two years of the date of approval of the Biodiversity Offset Strategy, unless otherwise agreed by the Director General, the Proponent shall prepare and submit a **Biodiversity Offset Package** for the approval of the Director General. The Package shall be developed in consultation with the EPA and DPI (Fishing and Aquiculture), and shall include, but not necessarily be limited to:

- details of the final suite of the biodiversity offset measures to be implemented for the project demonstrating how it achieves the requirements of the Biodiversity Offset Strategy (including specified offset ratios);
- (b) the final selected means of securing the biodiversity values of the Package in perpetuity, including ongoing management, maintenance and monitoring requirements; and
- (c) timing and responsibilities for the implementation of the provisions of the package over time.

The requirements of the Package shall be implemented by the responsible parties according to the timeframes set out in the Package, unless otherwise agreed by the Director General."



Figure 1 Overview of the Oxley Highway to Kempsey Project

Biodiversity Offset Strategy background

I.2.2. NSW biodiversity offset

In accordance with the Ministers Condition of Approval (MCoA) B8 a Biodiversity Offset Strategy (BOS) was submitted to the Director General for approval on 31 October 2013. This strategy was approved on 27 January 2014.

RMS currently owns about 1100 ha of land within the Collombatti-Clybucca floodplain, purchased as partial fulfilment of the biodiversity offset obligations of the Oxley Highway to Kempsey and Kempsey to Eungai sections of the Pacific Highway upgrade under both Federal and State approvals. Under existing like-for-like biodiversity obligations, only 600 ha of these lands can be used, leaving about 500 ha of high conservation value wetland complex areas in residual and a shortfall of over 500 ha of sub-tropical floodplain forest EEC and wet sclerophyll forest (shrubby sub formation).

During the development of the NSW Biodiversity Offset Package (BOP) the Clybucca Government Working Group identified that Roads and Maritime ownership of a large portion of the Collombatti-Clybucca wetland complex presents a once in a generation opportunity to remediate the area. After substantial consultation with agencies and the Clybucca Government Working Group, Roads and Maritime is seeking approval to depart from the existing like-for-like biodiversity offset obligations to protect higher conservation vegetation communities, as provided for under the NSW offset principles for major projects. Further details on this preferred option is included in Section 5.2 of this report.

I.2.3. Federal biodiversity offset

On 24 January 2014 the Project received approval from the Department of the Environment under *Environment Protection and Biodiversity Conservation Act 1999* (EPBC 2012/6518). This approval was subject to 15 Conditions of Approval (CoA). CoA 5 states:

"To compensate for the loss of 240 hectares of threatened species habitat the person taking the action must prepare and submit a Biodiversity Offset Management Plan (BOMP) for the Ministers written approval within 6 months of commencement of the action."

A BOMP was submitted to the Department of the Environment on 16 January 2015. A final BOMP was resubmitted to the Department of the Environment on 9 March 2016, addressing comments made on the first version. At the time of preparation of this strategy this BOMP had not yet been approved.

1.3. Objective of the Biodiversity Offset Strategy

The objective of the Biodiversity Offset Strategy is to deliver a Biodiversity Offset Package that aims to achieve a net beneficial biodiversity outcome for the region as a result of the Project. The measures used to gauge success of this objective will be:

- An outcome that maintains or improves biodiversity values.
- Successfully securing the long-term (in perpetuity) protection and management of lands containing endangered ecological communities and habitat for threatened species (key habitat).
- Meeting the minimum requirements for offsets as specified in the conditions of approval.
- Is consistent with the principles outlined in Section 3.3.
- The total area of lands used to offset the biodiversity impacts shall exceed the direct and indirect (edge effects) impacts.
- The process for setting the scope and quantum of the biodiversity offsets is transparent and justifiable on environmental, social and economic grounds.

1.4. Integration with other ecological reports

The Biodiversity Offset Strategy is part of a suite of reports that document how the biodiversity impacts of the Project will be mitigated or offset, and how mitigation actions will be managed and monitored. These reports address the NSW Minister for Planning and Environment's Condition of Approval B8.



The process for the development of these reports is outlined in Figure 2 below.

Figure 2 The process for the development of the offset strategy and package

1.5. Structure of this report

The structure of this Biodiversity Offset Strategy is as follows:

- Section 2 identifies the impacts of the Project.
- Section 3 details the management of biodiversity impacts, following the principles of avoiding, mitigating and offsetting impacts, and presents the decision making framework for determining offset measures.

1.6. Nomenclature

In this report plant species are referred to by both their scientific and common names (if applicable) when first mentioned. Subsequent references to these species cite the scientific name only. Conversely, animal species are referred to by both their common and scientific names when first mentioned, and subsequently by their common names only.

2. Project impacts

2.1. Environmental context

The Project is located within the Port Macquarie-Hastings and Kempsey local government areas on the NSW mid-north coast. The Project duplicates the existing Pacific Highway for the majority of its length and spans two major rivers; the Hastings and Wilsons River (the Wilson River is a tributary of the Hastings River). A number of second and third order streams flow through the Project area, such as Maria River, Smiths Creek, Pipers Creek, Cooperabung Creek, Stumpy Creek and Fernbank Creek.

Land use within the Project area includes residential, rural, commercial, industrial, state forests, national parks and reserves. Rural land use (grazing, aquaculture, oyster farming, orchards, tea tree plantations, vineyards, poultry farms, and other agricultural activities), state forests and conservation areas are the dominant land uses. About 30% of the Project area is currently cleared and an additional 7% comprises managed state forest; the Project traverses Cairncross State Forest, Ballengarra State Forest and Maria River State Forest. The project also traverses Rawdon Creek Nature Reserve and Cooperabung Creek Nature Reserve.

The Project intercepts five regional and two sub-regional corridors (Scotts 2003) that may facilitate the movement of fauna between coastal and inland habitats in response to seasonal resource ability and habitat conditions. Regional corridors are likely to support resident populations of certain fauna species, and to supplement habitats of wide-ranging, nomadic and migratory species. Sub-regional corridors serve more as routes for dispersal and movement for assemblage reference species and wide-ranging species, rather than habitats in their own right (Scotts 2003).

2.2. Impacts of the project

Potential impacts on flora and fauna have been minimised and avoided where possible throughout the route selection and development of the concept design for the Upgrade.

In some instances there are unavoidable impacts of the Project that cannot be avoided, minimised or mitigated. In this situation, residual impacts identified for the Project include:

- A loss of native vegetation, including Endangered Ecological Communities.
- A loss of habitat for threatened flora species.
- A loss of habitat for a variety of protected and threatened native fauna species.

2.2.1. Loss of native vegetation

The Upgrade will result in the loss of about 240 hectares of native vegetation. Ten vegetation communities have been identified within the study area (GHD 2010). Four of these communities comprise Endangered Ecological Communities (EEC), as listed under the Threatened Species Conservation Act 1995 (TSC Act). None of these vegetation communities are commensurate with an Endangered Ecological Community listed under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

Table 1 provides a summary of the area of each vegetation community that will be impacted by construction of the project, including clearing for the upgrade (including for ancillary activities), and a six metre construction buffer. Artificial vegetation communities, such as plantations, cropland or market gardens, and highly modified vegetation communities, such as cleared open pasture, are not included.

The naming of vegetation communities within the project's Environmental Assessment is not consistent with the Office of Environment and Heritage (OEH) Vegetation Information System (VIS) Classification database. To enable a comparison between vegetation impacted by the project and vegetation available within proposed biodiversity offset lands the vegetation communities within the EA have been converted into the VIS classification. This conversion was undertaken using the description of vegetation communities within the Flora and Fauna Working Paper within the project's Environmental Assessment.

The vegetation classification conversion also enables areas of fauna habitat impacted by the project to be calculated based on OEH Threatened Species Profile Database. Further details on offsetting fauna habitat are detailed in section 2.2.3 of this report.

Vegetation Community (EA description)	Corresponding VIS classification	Area to be impacted (hectares)	Endangered Ecological Community	High conservation value? ²
Moist Floodplain Closed Forest with Rainforest Elements	 Mixture (possibly ecotonal community of) ³ NR122 (PCT695) Blackbutt - Turpentine - Tallowwood shrubby open forest of the coastal foothills of the central NSW North Coast Bioregion NR160 (PCT827) Flooded Gum - Tallowwood - Brush Box moist open forest of the coastal ranges of the North Coast 	5	Subtropical Coastal Floodplain	Y
Riparian Forest	NR160 (PCT827) Flooded Gum - Tallowwood - Brush Box moist open forest of the coastal ranges of the North Coast	9	Subtropical Coastal Floodplain	Y
Paperbark Swamp Forest	NR217 (PCT1064) Paperbark swamp forest of the coastal lowlands of the North Coast	11	Swamp Sclerophyll Forest	Y
Swamp Mahogany/Forest Red Gum Swamp Forest	NR254 (PCT1230) Swamp Mahogany swamp forest of the coastal lowlands of the North Coast	10	Swamp Sclerophyll Forest	Y
Swamp Oak Forest	NR255 (PCT1235) Swamp Oak swamp forest of the coastal lowlands of the North Coast	1	Swamp Oak Floodplain Forest	Y
Wetland	NR150 (PCT782) Coastal freshwater meadows and forblands of lagoons and wetlands	3	Freshwater Wetlands	Υ
Moist Floodplain Forest	NR125 (PCT698) Blackbutt grassy open forest of the lower Clarence Valley of the NSW North Coast	31	Nil	Y

Table 1 Vegetation communities identified in the Project corridor

¹ Area impacted includes the construction area with a 6m construction buffer (ha)

² All native vegetation except mangroves and seagrass as per Minister's Condition of Approval B8.

³ Threatened species associated with either of these vegetation communities will have this clearing amount included within the total area of impacted habitat in section 2.2.3

Vegetation Community (EA description)	Corresponding VIS classification	Area to be impacted (hectares)	Endangered Ecological Community	High conservation value? ²
Moist Gully Forest	NR126 (PCT699) Blackbutt tall moist forest of the coastal ranges of the central and southern NSW North Coast Bioregion	30	Nil	Y
Moist Slope Forest	NR219 (PCT1073) Pink Bloodwood - Tallowwood moist open forest of the far northern ranges of the NSW North Coast Bioregion	90	Nil	Y
Dry Ridgetop Forest	NR243 (PCT1208) Spotted Gum - Brush Box moist forest of ranges of the southern Clarence Valley of the NSW North Coast Bioregion (best fit)	50	No	Y
Mangroves and Seagrass	N.A	0.2753 4	No	Ν
Salt Marsh	N.A	0.016 4	No	Ν
Total Area Impacted		240		

Note: clearing of plantation and highly modified environments are not included

⁴ Mangroves, Seagrass and Salt Marsh clearing area is based on approved clearing amounts.

2.2.2. Loss of Flora Species

No threatened flora species, listed under either the NSW TSC Act or the Commonwealth EPBC Act or rare species on the Rare or Threatened Australian Plants database were recorded within the study area during the targeted field investigation conducted between 2005 and 2007.

Maundia triglochinoides was identified in the Project corridor in August 2012 and targeted surveys in potential habitat were undertaken in November 2012. The species was identified at four distinct locations (Table 2).

Table 2 Area of direct impact to Maundia triglochinoides

Location	Area directly impact by the Project (inc. temporary works)
Fernbank Creek	0.75 ha
Wilson River Floodplain – wetlands	0.03 ha
Wilson River Floodplain - canal	0.09 ha
Barrys Creek	-
Total	0.87 ha

At a minimum the area of *Maundia triglochinoides* impacted by the project will be provided within the biodiversity offsets. The BOP would detail refined *Maundia triglochinoides* impact area and recalculated required offset areas.

In the event that *Maundia triglochinoides* recolonizes in an area that was previously included within the clearing figures, the required offset amount may be reduced in consultation with EPA.

2.2.3. Loss of Fauna Habitat

The Project requires the removal of about 240 hectares of native vegetation. Fauna habitat resources that will be removed as a result of clearing native vegetation include:

- Trees and shrubs that offer nesting and roosting habitat to a variety of birds.
- Hollow-bearing trees. Tree hollows offer sheltering, nesting and roosting habitat to a variety of hollow-dependent species including gliders, possums, insectivorous bats, large forest owls, tree frogs, reptiles and small to medium sized birds.
- Flowering plants including a diversity of myrtaceous species (eucalypts, bloodwoods and paperbarks) and other flowering species such as banksias and acacias. These species offer foraging resources including nectar, pollen, eucalypt sap and acacia gum to arboreal mammals, birds and flying foxes
- Large woody debris and large hollow logs, that offer sheltering and breeding habitat for small terrestrial mammals, reptiles and birds.
- Green-thighed frog breeding ponds. Construction of the Project will directly impact (remove) or indirectly impact at least seven known breeding and non-breeding habitat areas for the Green-thighed Frog.

Loss of Hollow Bearing Trees

A total of 603 hollow bearing trees (HBTS) have been identified within the Project, containing an estimated 3,642 tree hollows (Lewis 2013b). The HBT survey identified a number of areas containing a high density (>6 HBTs/hectare) of tree hollows (Table 3). Further details on the distribution of these hollows, their suitability to fauna and the proposed mitigation measures to be implemented can be found in the *Oxley Highway to Kempsey Nest Box Plan of Management* (Lewis 2013b).

Table 3 Locations of high densities of hollow-bearing trees (HBTs)

Chainage	Number of HBTs	Comment
0-2400	71	In an area referred to as Sancrox South
3450 - 4000	34	In an area largely restricted to the riparian and swamp sclerophyll forest habitats (ie EEC) to the south of Fernbank Creek
7400 – 7600	11	Clustered in the southern end of Cairncross State Forest
10100-10350	12	To the south of the widened median in Cairncross State Forest
10700-11300	50	In the central and northern part of the Cairncross widened median in Cairncross State Forest
12025-12300	24	Toward the north extent of Cairncross State Forest within an area of Swamp Sclerophyll Forest EEC
23165-23400	11	In the upper reaches of Barrys Creek
24040-25550	77	Through the middle reaches of Barrys Creek north to Mingaletta which appears to be an important fauna corridor
28900-29225	19	In the Kundabung area which provides a localised concentration of tree hollows and possibly hollow dependant fauna
32700-33025	17	Southern end of Maria State Forest merging into private lands
34700-34900	17	Within a drainage line and surrounding lower slopes to the east of Bloodwood Rest Area in Maria River State Forest
35035-35300	28	Located on the low ridge and southern slopes to the south of Middle Gate Road in Maria River State Forest

Disturbance to Microbat Roosting Habitat

In addition, construction activities may disturb known and potential microbat roosts that have been identified during inspections of existing culvert and bridge structures along the Project. Four species of microbats have been identified roosting in culvert and bridge structures associated with the existing Pacific Highway (Table 4). An additional four species have been recorded in proximity to culvert and bridge structures, suggesting these species may roost in these structures on occasion (Lewis 2013c).

2.2.4. Impacts on Threatened Fauna Species

The Project requires the removal of about 240 hectares of native vegetation, which includes habitat for threatened fauna species and areas of regional and sub-regional fauna corridors. A total of 18 threatened fauna species were recorded in the study area during field investigations undertaken between 2005 and 2007. An additional five species are considered highly likely to occur in the study area based on habitat preferences and habitat availability (Table 4). No fish species currently listed under the TSC Act or the EPBC Act were identified during the Environmental Assessment, previous studies conducted in this area that were reviewed as part of this assessment, or subsequent surveys. Appendix G of Volume 2 of the Oxley Highway to Kempsey Environmental Assessment (September 2010) lists all of the fauna species recorded in the project study area.

Table 4 Threatened species potentially impacted by loss of habitat

Scientific Name	Common Name	Status under TSC Act	Status under EPBC Act	Presence in Project area
Calyptorhynchus lathami	Glossy Black Cockatoo	V		Known to occur
Ephippiorhynchis asiaticus	Black-necked stork	E	-	Known to occur
Falsistrellus tasmaniensis	Eastern false pipistrelle	V		Known to occur
Litoria brevipalmata	Green-thighed frog	V		Known to occur

Scientific Name	Common Name	Status under TSC Act	Status under EPBC Act	Presence in Project area
Lophoictinia isura	Square-tailed Kite	V		Known to occur
Micronomus norfolkensis	Eastern freetail-bat	V		Known to occur
Miniopterus australis	Little bent-wing bat	V		Known to occur
Miniopterus schriebersii oceanensis	Eastern bent-wing bat	V	-	Known to occur
Mixophyes iteratus	Giant barred frog	E	E	Known to occur
Myotis macropus	Southern Myotis	V		Known to occur
Ninox strenua	Powerful Owl	V		Known to occur
Pandion haliaetus	Osprey	V	М	Known to occur
Petaurus Australia	Yellow-bellied glider	V		Known to occur
Petaurus norfolcensis	Squirrel Glider	V		Known to occur
Phascolarctos cinereus	Koala	V	V	Known to occur
Planigale maculata	Common planigale	V		Known to occur
Pteropus poliocephalus	Grey-headed flying fox	V	V	Known to occur
Ptilinopus regina	Rose-crowned Fruit dove	V		Known to occur
Scoteanas rueppellii	Greater Broad-nosed bat	V		Known to occur
Tyto novaehollandiae	Masked Owl	V		Known to occur
Tyto tenebricosa	Sooty Owl	V		Known to occur
Dasyusrus maculata	Spotted-tailed Quoll	V		Highly likely to occur
Phascogale tapoatafa	Brush-tailed phascogale	V		Highly likely to occur

2.2.5. Habitat Fragmentation

A major impact of roads is habitat fragmentation, where a division of otherwise continuous habitat reduces habitat connectivity. Habitat adjoining the Project supports a diversity of fauna species that may be adversely affected by habitat fragmentation and resultant barrier effects (mortality of wildlife due to collisions with vehicles; avoidance of roads by wildlife as a result of noise, light and pollutants associated with vehicles; and invasion along road edges by weeds and feral animals), including threatened species listed under the *Threatened Species Conservation Act* (TSC Act) and *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) (Table 4).

Habitat fragmentation will result in sections of the Project where the alignment of the new carriageway deviates from the existing Pacific Highway Alignment and traverses areas of continuous habitat, including:

- Fernbank Creek and the floodplains of the Hastings River.
- Cairncross State Forest and the floodplains of the Wilsons River.
- Maria River State Forest.

Where the new carriageway will be constructed adjacent to the existing Pacific Highway alignment, a minimal increase in habitat fragmentation is expected. However, the widened road corridor in these areas, to accommodate the two carriageways, may increase existing barrier effects of the Pacific Highway.

Chapter 4 of the Oxley Highway to Kempsey Environmental Assessment Volume 2 Flora and

Fauna Working Paper (GHD 2010) provides further detail on the quantitative assessment of the likely landscape-scale impacts including fragmentation and habitat connectivity of the Project.

2.3. Summary of Impacts

Assessments of the impact of the Upgrade on Endangered Ecological Communities and threatened fauna species were undertaken as part the Environmental Assessment. The assessments were based on the draft *Guidelines for Threatened Species Assessment for Part 3A Applications* (Department of Environment and Conservation 2005b) and the relevant guidelines under the EPBC Act. Species were considered for assessment based on database records, species identified during Environmental Assessments indicated that the Project will potentially impact on eight threatened fauna species (see Table 4) and four endangered ecological communities, namely:

- Swamp Oak Floodplain Forest (EEC).
- Swamp Sclerophyll Forest (EEC).
- Subtropical Coastal Floodplain Forest (EEC).
- Freshwater Wetlands (EEC).

It is expected the Project will impact <0.2ha of threatened aquatic fauna or sensitive aquatic habitats such as seagrasses or mangroves.

Full details of the impact assessments are provided in the Oxley Highway to Kempsey Environmental Assessment Volume 2 Flora and Fauna Working Paper and the EPBC Matters Report.

3. Management of Impacts on Biodiversity

Measures to manage the impact of the Project on biodiversity have been developed as part of the environmental assessment for the Project. These are outlined in Section 15.4 of the Oxley Highway to Kempsey Environmental Assessment and Chapter 6 of the Oxley Highway to Kempsey Environmental Assessment Volume 2 Flora and Fauna Working Paper (GHD 2010). Management measures for biodiversity impacts were developed following the general principles, in order of preference:

- Avoiding impacts.
- Mitigating impacts.
- Offsetting impacts.

A summary of the key measures relevant to biodiversity impacts are outlined below. For further detail refer to Section 15.4 of the Oxley Highway to Kempsey Environmental Assessment and Section 6 of the Oxley Highway to Kempsey Environmental Assessment Volume 2, Flora and Fauna Working Paper and the revised Statement of Commitments.

3.1. Avoid

Impacts on biodiversity values within the region have been avoided through the route selection process and development of the concept design alignment. The route selection process was conducted during 2004-2006. For this process several criteria were developed to assess the potential impacts of each option on biodiversity. These included:

- Extent of vegetation clearing.
- Assessment of impacts on threatened species habitats and Endangered Ecological Communities.
- Impacts on waterways.
- Extent of impacts on SEPP 14 wetlands.
- Fragmentation of fauna movement corridors.

The following measures would be undertaken during detailed design & construction, to avoid impact upon biodiversity:

- Engineering solutions to minimise direct impact would be further investigated.
- Protective fencing will be installed to mark the limits of clearing (i.e. 'no-go' areas) surrounding the footprint to ensure clearing does not occur beyond the area necessary for the Upgrade.
- A two stage clearing process would be adopted to reduce the potential for fauna injury or mortality, and an ecologist would inspect bridges and culverts for bats prior to demolition.
- Selection and construction of ancillary areas would be undertaken to minimise the overall impact of construction and avoid unnecessary vegetation and habitat removal.
- Development of vegetation management strategies for retained areas of vegetation, including weed management, native plantings, and the collection of seed, would be undertaken.

3.2. Mitigate

Management measures designed to reduce impacts on biodiversity include:

- Fauna crossing measures.
- Fauna fencing.
- Revegetation measures.
- Translocation of mangroves and seagrasses (if deemed feasible).
- Installation of nest and microbat roost boxes.
- Widening of the median.
- Other fauna mitigation measures, such as implementing the unexpected threatened species finds procedure and pre-clearing surveys.
- Biodiversity monitoring measures.

3.2.1. Fauna Crossing Measures

The Project incorporates several physical structures that aim to maintain habitat connectivity, allowing fauna to safely move between areas of habitat to the east and west of the Project. These structures include combined and dedicated fauna underpasses, rope bridges, glider poles, a widened median and associated fauna fencing. Underpasses will typically facilitate movement of smaller animals, while the widened median, rope bridges and glider poles will allow for the safe crossing or arboreal and gliding mammals. The fauna crossing measures have been provided at strategic locations to ensure habitat connectivity for a range of threatened species including, but not limited to, Koala, Spotted-tail Quoll, Squirrel Glider, Yellow-bellied Glider, Brush-tailed Phascogale, Green-thighed Frog and Giant Barred Frog.

Underpasses

The Project includes over 120 underpasses that may facilitate the passage of fauna species, which include:

- Nine waterway bridges that include provision for fauna passage (Fernbank Creek, Hastings River, Wilsons River, Cooperabung Creek, Barrys Creek, Smiths Creek, Pipers Creek, Maria River and Stumpy Creek).
- Eleven dedicated underpasses.
- Thirty combined culverts.

Table 5 and 6 identify the indicative sizes, lengths and locations of the proposed combined and dedicated fauna crossing points and the structures that are planned to be used to provide fauna passage.

Culvert I.D. (RMS, 2011)	Culvert I.D. (new)	Stn.	Crossing type	Cells	Diameter (m)	Height (m)	Length (m) (Approved)	Target species (other species that may use crossing)	Fauna furniture	Fish Passage
4F	F 1.04	1040	Dedicated	1	3.0	3.0	50	Koala (macropods, small mammals, reptiles, amphibians)	Rails and refuge poles (koalas)	No
6F	F1.62	1670	Dedicated	1	3.0	3.0	48	Koala (macropods, possums, small mammals, reptiles, amphibians)	Rails and refuge poles (koalas)	No
9	C.2.60	2610	Combined	1+1	3.3+3.6	2.1	88	(Frogs, reptiles, small mammals if dry)	Rails and refuge poles (koalas)	Yes Class 3
10	C3.59	3590	Combined	2+2	1.5+3.0	1.2+1.8	41+20+40+20	(frogs, reptiles, small mammals if dry)	No	Yes Class 3
13	C4.46	4450	Combined	3.0	3.0	2.1	41.6	Koala (Small macropods, possums, small mammals, frogs, reptiles)	Rails and refuge poles (koalas)	No

 Table 5 Combined and dedicated fauna crossing structures to be implemented within the OH2Ku stage

Culvert I.D. (RMS, 2011)	Culvert I.D. (new)	Stn.	Crossing type	Cells	Diameter (m)	Height (m)	Length (m) (Approved)	Target species (other species that may use crossing)	Fauna furniture	Fish Passage
-	C4.50	4550	Combined	1	3.6	1.8	50.2	(Frogs, reptiles, small mammals if dry)	No	Yes Class 2
15		4600- 4900	Twin bridges- Fernbank Creek	-	-	-	Overall length: 275 (nb) 250 (sb)	(Koalas, possums, macropods, wetland and open country birds, reptiles, amphibians)	No	Yes Class 2
19	-	5500- 6100	Twin Bridges- Hastings River	-	-	-	570	(Koalas, possums, macropods, wetland and open country birds, reptiles, amphibians)	No	Yes Class 1
21	C6.72	6720	Combined	1	3	2.4	30.6	(Koala, spotted-tailed quoll, possums, smaller macropods, small mammals, reptiles, amphibians)	Rails and refuge poles (koalas)	No
22	C7.26	7270	Combined	1	3	2.4	41.6	Koala (spotted-tailed quoll, possums, smaller macropods, small mammals, reptiles,	Rails and refuge poles (koalas)	No

Culvert I.D. (RMS, 2011)	Culvert I.D. (new)	Stn.	Crossing type	Cells	Diameter (m)	Height (m)	Length (m) (Approved)	Target species (other species that may use crossing) amphibians)	Fauna furniture	Fish Passage
29	C9.21	9210	Combined	1	3	3	38	Koala (Possums, spotted-tailed quoll, macropods, small mammals, reptiles, amphibians-possibly Green-thighed frog)	Rails and refuge poles (koalas)	No
30F	F9.70	9700	Dedicated	1	3	3	38	Koala (Spotted-tailed quoll, macropods, small mammals, reptiles, amphibians	Rails and refuge poles (koalas) Rocks, logs, hollow logs (frogs) Rocks, hollow logs (quolls)	No
-	C11.08	11070	New combined culvert	1	3	2.4	17.1	(Frogs, possibly Green- thighed frogs, reptiles, koala, spotted-tailed quoll, small mammals if dry)	Rails and refuge poles (koalas)	No
32A	C11.14	11140	Combined	1	3	2.4	19.6	(Frogs, possibly Green- thighed frogs, reptiles, koala, spotted-tailed quoll,	Rails and refuge poles	No

Biodiversity Offset Strategy for Oxley Highway to Kempsey Pacific Highway Upgrade

Culvert I.D. (RMS, 2011)	Culvert I.D. (new)	Stn.	Crossing type	Cells	Diameter (m)	Height (m)	Length (m) (Approved)	Target species (other species that may use crossing)	Fauna furniture	Fish Passage
								small mammals if dry)	(koalas)	
32F	F11.67	11660	Dedicated	1	3	2.4	38	Koala (Spotted-tailed quoll, macropods, small mammals, reptiles, amphibians)	Rails and poles (koalas) Rocks, logs, hollow logs (quolls)	No
40	-	16400- 17000	Twin bridges- Wilsons River	-	-	-	Overall length: 522	(Koala, small –dasyurids, rodents, medium- possums, and larger mammals-macropods, birds, reptiles, amphibians)	No	Yes Class 1
44	-	17200- 17300	Twin bridges- North Coast Railway Line	-	-	-	Length: 68	(Koala, small to large mammals including macropods, birds, reptiles, amphibians)	No	No
51	C17.70	17700	Combined	1	3	3	40.4	(Koalas, macropods, small mammals, birds, reptiles, amphibians)	No	No

Biodiversity Offset Strategy for Oxley Highway to Kempsey Pacific Highway Upgrade

Culvert I.D. (RMS, 2011)	Culvert I.D. (new)	Stn.	Crossing type	Cells	Diameter (m)	Height (m)	Length (m) (Approved)	Target species (other species that may use crossing)	Fauna furniture	Fish Passage
57	-	19700	Twin Bridges- Cooperabung Creek	-	-	-	Overall length: 36	(Koalas, small medium and larger mammals- macropods, birds, reptiles, amphibians)	No	Yes Class 2
57 (west)	-	19700	Bridge- Cooperabung Creek (western access road)	-	-	-	Overall length: 35	(Koalas, small medium and larger mammals- macropods, birds, reptiles, amphibians)		Yes Class 2
57 (east)	-	19700	Bridge- Cooperabung Creek (eastern access road)	-	-	-	Overall length: 35	(Koalas, small medium and larger mammals- macropods, birds, reptiles, amphibians)		Yes Class 2
59	C20.26	20260	Combined	1	3	2.4	43	(Frogs, reptiles, small mammals if dry)	No	No
60F	F20.54A	20560	Dedicated	1	3	3	53	Koala (Spotted-tailed quoll, macropods, small mammals, reptiles, amphibians)	Rails and refuge poles (koalas) Rocks, hollow logs (quolls)	No

Culvert I.D. (RMS, 2011)	Culvert I.D. (new)	Stn.	Crossing type	Cells	Diameter (m)	Height (m)	Length (m) (Approved)	Target species (other species that may use crossing)	Fauna furniture	Fish Passage
-	F20.54B	20540	New dedicated	1	3	3	31	Koala (Spotted-tailed quoll, macropods, small mammals, reptiles, amphibians)	Rails and refuge poles (koalas) Rocks, hollow logs (quolls)	No
63F	F21.24	21240	Dedicated	1	3	3	58	Koala (macropods, spotted- tailed quoll, small mammals, reptiles, amphibians)	Rails and refuge poles (koalas) Rocks, hollow logs (quolls)	No
-	C21.52	21520	New combined	1	3	3	32	(Frogs, reptiles, small mammals if dry)	Rails and refuge poles (koalas)	No
64	C21.54	21530	Combined	1	3	3	53.9	Koala (possums, spotted-tail quoll, macropods, small mammals, reptiles, amphibians)	Rails and refuge poles (koalas)	No

Culvert I.D. (RMS, 2011)	Culvert I.D. (new)	Stn.	Crossing type	Cells	Diameter (m)	Height (m)	Length (m) (Approved)	Target species (other species that may use crossing)	Fauna furniture	Fish Passage
-	C21.78	21780	New combined	1	3	3	39	(Frogs, reptiles, small mammals if dry)	Rails and refuge poles (koalas)	No
65	C21.80	21780	Combined	1	3	3	56.3	Koala (possums, spotted-tailed quoll, macropods, small mammals, reptiles, amphibians)	Rails and refuge poles (koalas)	No
66	C22.18	22180	Incidental	2	2100		70	Koala (possums, spotted-tailed quoll, macropods, small mammals, reptiles, amphibians)	No. Insufficient dimensions to accommodation furniture. Fauna passage is provided by 67F, 100m to north.	Yes Class 3
67F	F22.32	22320	Dedicated	1	3.6	3.6	59.4	Koala (possums, spotted-tailed quoll, macropods, small mammals, reptiles, amphibians)	Rails and refuge poles (koalas) Rocks, hollow logs (quolls)	No

Culvert I.D. (RMS, 2011)	Culvert I.D. (new)	Stn.	Crossing type	Cells	Diameter (m)	Height (m)	Length (m) (Approved)	Target species (other species that may use crossing)	Fauna furniture	Fish Passage
71F	C23.05	23060	Combined	1	3	3	40.4	(Frogs, reptiles, small mammals if dry)	Rails and refuge poles (koalas)	No
73	-	23940	Barrys Creek twin bridges	-	-	-	Overall length: 40	Koala (possums, spotted-tailed quoll, macropods, small mammals, reptiles, amphibians)	Rails and refuge poles (koalas) Rocks, hollow logs (quolls)	Yes Class 2

Culvert I.D. (RMS 2011)	Culvert I.D. (new)	Stn.	Crossing type	Cells	Diameter (m)	Height (m)	Revised length (m) (Approve d)	Target species (other species that may use crossing)	Habitat	Fauna furniture	Fish Passage
80	C25.70	25700	Combined	1	3	2.7	47	(Frogs, reptiles, small mammals if dry)	Riparian forest, vegetative connectivity to vegetation at C25.74.	No	No
83F	F26.40	26400	Dedicated	1	3	3	49.17	Koala (macropods, spotted- tailed quoll, small mammals, reptiles, amphibians)	Links fragmented native vegetation to east and west	Rails and refuge poles (koalas) Rocks, hollow logs (quolls)	No
84	C26.78	26780	Combined	1	3	3	49	Koala (macropods, spotted- tailed quoll, small mammals, reptiles, amphibians)	Limited connectivity to west	Rails and refuge poles (koalas)	Yes Class 2 Concrete sills included

Table 6 Combined and dedicated fauna crossing structures to be implemented within the K2K stage (subject to detailed design)

Culvert I.D. (RMS 2011)	Culvert I.D. (new)	Stn.	Crossing type	Cells	Diameter (m)	Height (m)	Revised length (m) (Approve d)	Target species (other species that may use crossing)	Habitat	Fauna furniture	Fish Passage
-	C27.50	27500	Combined	1	3	3	37	Koala (macropods, spotted- tailed quoll, small mammals, reptiles, amphibians)	Sub-regional corridor linking extensive areas of key habitat within state forests to east and west.	Rails and refuge poles (koalas)	No
86	C27.51	27510	Combined	1	3	3	45.5	Koala (macropods, spotted- tailed quoll, small mammals, reptiles, amphibians)	Sub-regional corridor linking extensive areas of key habitat within state forests to east and west.	Rails and refuge poles (koalas)	Yes Class 3
88	-	28250	Twin bridges- Smiths Creek	-	-	-	Overall length: 55	(Koala, macropods, spotted-tailed quoll, small to medium mammals, reptiles, amphibians)	On edge of sub- regional corridor, riparian vegetation continuous within riparian corridor to east and west	No	Yes Class 2

Culvert I.D. (RMS 2011)	Culvert I.D. (new)	Stn.	Crossing type	Cells	Diameter (m)	Height (m)	Revised length (m) (Approve d)	Target species (other species that may use crossing)	Habitat	Fauna furniture	Fish Passage
88 (west)	-	28250	Bridge- Smiths Creek service road	-	-	-	Overall length: 35	(Koala, macropods, spotted-tailed quoll, small to medium mammals, reptiles, amphibians)	Adjacent to sub regional corridor	No	Yes Class 2
89	C28.68	28680	Combined	3	2.4	2.4	48	(Koala, macropods, small mammals, reptiles, amphibians)	Links fragmented vegetation to east and west	No	Yes Class 2
91	C30.10	30100	Combined	1	3	3	49	(Frogs, reptiles, small mammals if dry)	Links fragmented vegetation to east and west Supports standing water and aquatic vegetation	No	No

Culvert I.D. (RMS 2011)	Culvert I.D. (new)	Stn.	Crossing type	Cells	Diameter (m)	Height (m)	Revised length (m) (Approve d)	Target species (other species that may use crossing)	Habitat	Fauna furniture	Fish Passage
92	-	30600	Twin bridges- Pipers Creek	-	-	-	Overall length: 44.7	(Koala, spotted-tailed quoll, small medium and larger mammals, macropods, birds, reptiles, amphibians)	Riparian vegetation is continuous within riparian corridor to east and west Creek flowing at site visit 7/9/12	No	Yes Class 2
92 (west)	-	30600	Existing Bridge- Pipers Creek service road	-	-	-	Overall length:30	(Koala, spotted-tailed quoll, small medium and larger mammals, macropods, birds, reptiles, amphibians)	Riparian Forest associated with Pipers Creek	No	Yes Class 2
92 (east)	-	30600	Bridge- Pipers Creek access road	-	-	-	Overall length: 41	(Koala, spotted-tailed quoll, small medium and larger mammals, macropods, birds, reptiles, amphibians)	Riparian Forest associated with Pipers Creek	No	Yes Class 2
96	C31.90	31900	Combined	1	3	2.1	65	Koala (macropods, small mammals, reptiles, amphibians)	In regional corridor linking extensive areas of key habitat in Maria River and Ballengarra State Forests	No	No

Culvert I.D. (RMS 2011)	Culvert I.D. (new)	Stn.	Crossing type	Cells	Diameter (m)	Height (m)	Revised length (m) (Approve d)	Target specie (other specie may use cros	es ies that ssing)	Habitat	Fauna furniture	Fish Passage
97	C32.35	32350	Combined	1	3	3	64	Koala (macropods, mammals, amphibians)	small reptiles,	In regional corridor linking extensive areas of key habitat in Maria River and Ballengarra State Forests	No	No
98	C32.66	32700	Combined	1	3	2.4	66	Koala (possums, tailed macropods, mammals, amphibians)	spotted- quoll, small reptiles,	In regional corridor linking extensive areas of key habitat in Maria River and Ballengarra State Forests Relatively dry passage at site inspection (7/9/12)	Rails and refuge poles (koalas)	No
-	32.67	32700	Combined	1	3	2.4	21	Koala (possums, tailed macropods, mammals, amphibians)	spotted- quoll, small reptiles,	In regional corridor linking extensive areas of key habitat in Maria River and Ballengarra State Forests	Rails and refuge poles (koalas)	No

Culvert I.D. (RMS 2011)	Culvert I.D. (new)	Stn.	Crossing type	Cells	Diameter (m)	Height (m)	Revised length (m) (Approve d)	Target species (other species that may use crossing)	Habitat	Fauna furniture	Fish Passage
99	C33.10	33100	Combined	1	3	3	57	Koala (possums, spotted- tailed quoll, macropods, small mammals, reptiles, amphibians possibly Green-thighed frog)	In regional corridor linking extensive areas of key habitat in Maria River	Rails and refuge poles (koalas)	No
100F	F33.40	33400	Dedicated	1	3	3	49	Koala (possums, spotted- tailed quoll, macropods, small mammals, reptiles, amphibians possibly Green-thighed frog)	Maria River State Forest	Rails and refuge poles (koalas)	No
102	C34.10	34100	Combined	1	3	3	60	Koala (spotted-tailed quoll, possums, small- medium macropods, small mammals, reptiles, amphibians possibly Green- thighed frog)	Key regional corridor	Rails and refuge poles (koalas)	No

Culvert I.D. (RMS 2011)	Culvert I.D. (new)	Stn.	Crossing type	Cells	Diameter (m)	Height (m)	Revised length (m) (Approve d)	Target species (other species that may use crossing)	Habitat	Fauna furniture	Fish Passage
103	F34.72	34700	Dedicated	1	3	3	48	Koala (possums, spotted- tailed quoll, macropods, small mammals, reptiles, amphibians possibly Green-thighed frog)	Moist Gully Forest Maria River National Park Key regional corridor	Rails and refuge poles (koalas) Rocks, logs, hollow logs (frogs) Rocks, hollow logs (quolls)	No
106	C35.70	35700	Combined	1	3	3	50	Koala (possums, spotted- tailed quoll, macropods, small mammals, reptiles, amphibians possibly Green-thighed frog)	Moist Gully Forest Maria River National Park Key regional corridor	Rails and refuge poles (koalas)	Yes Class 3

Culvert I.D. (RMS 2011)	Culvert I.D. (new)	Stn.	Crossing type	Cells	Diameter (m)	Height (m)	Revised length (m) (Approve d)	Target species (other species that may use crossing)	Habitat	Fauna furniture	Fish Passage
109	C36.40	36400	Combined	1	3	3	66	Koala (possums, spotted- tailed quoll, macropods, small mammals, reptiles, amphibians possibly Green-thighed frog and giant barred frog)	Moist Gully Forest Adjacent to key regional corridor Maria River National Park Continuous vegetation to east and west of alignment	Rails and refuge poles (koalas)	Yes Class 3
-	-	37730- 37790	North bound bridge over Stumpy Creek	-	-	-	Overall length: 36	(Koala, spotted-tailed quoll, macropods, small to medium mammals, reptiles, amphibians possibly Green-thighed frog)	In regional corridor linking fragmented habitat to west and extensive areas of key habitat in Maria River to east	No	Yes Class 3
		37730- 37790	South bound bridge over Stumpy Creek	-	-	-	Overall length: 31	(Koala, spotted-tailed quoll, macropods, small to medium mammals, reptiles, amphibians possibly Green-thighed frog)	In regional corridor linking fragmented habitat to west and extensive areas of key habitat in Maria River to east	No	Yes Class 3

Culvert I.D. (RMS 2011)	Culvert I.D. (new)	Stn.	Crossing type	Cells	Diameter (m)	Height (m)	Revised length (m) (Approve d)	Target species (other species that may use crossing)	Habitat	Fauna furniture	Fish Passage
		37730- 37790	Service Rd bridge over Stumpy Creek (existing)	-	-	-	Overall length: 27	(Koala, spotted-tailed quoll, macropods, small to medium mammals, reptiles, amphibians possibly Green-thighed frog)	In regional corridor linking fragmented habitat to west and extensive areas of key habitat in Maria River to east	No	Yes Class 3

Rope Bridges

Rope bridges will be installed at five locations (eight rope bridges) between the Oxley Highway and Kundabung section and at three locations (three rope bridges) between the Kundabung and Kempsey section of the Project. Any changes to the number of crossings will be undertaken in consultation with EPA.

Gilder Poles

Glider poles will be installed at three locations (one location consist of two crossing points) between the Oxley Highway to Kundabung section and at three locations between the Kundabung and Kempsey section of the Project. Any changes to the number of crossings will be undertaken in consultation with EPA.

3.2.2. Fauna Fencing

Three types of fauna fencing will be installed:

- Standard floppy-top fencing.
- Frog fencing.
- Phascogale fencing.

Standard fauna fencing will be installed:

- Where the Project traverses Cairncross, Ballengarra and Maria River State Forests.
- Where the Project traverses regional habitat corridors.
- Between dual carriageway bridges and culverts where there are gaps between structures to prevent fauna accessing the median strip.
- On the outside of all spill containment / water quality treatment basins to prevent fauna from accessing polluted water sources.

Frog fencing will be installed in areas where the presence of Giant Barred Frogs has been confirmed, in areas of Green-thighed Frog breeding ponds, and or where there is an obvious threat of frogs accessing the new carriageway.

Phascogale fencing will be installed at areas of known or high potential habitat, to direct phascogales away from the highway and towards underpasses.

Detailed descriptions and locations of all fauna fencing can be found in Section 4.5 of the *Ecological Monitoring Program* (Hyder 2013).

3.2.3. Revegetation

Areas disturbed during the construction of the Project will be progressively revegetated and rehabilitated as construction works progress across the two main stages.

Revegetation measures will include planting a range of locally occurring native shrubs, trees and ground covers and where possible linking bushland remnants. Species will be selected based on the surrounding vegetation communities that are impacted by the Upgrade.

Revegetation and rehabilitation works will include measures to provide or enhance fauna habitat features for threatened species, such as:

- Planting of preferred food trees for native fauna, including appropriate eucalypt species for the Koala and Yellow-bellied Glider and *Allocasuarina spp* for the Glossy Black Cockatoo,
- Provide fringing vegetation around riparian zones to enhance habitat for frogs including the Giant Barred Frog and Green-thighed Frog. At some specific locations, fringing ground covers will be used to enhance constructed breeding ponds for the Green-thighed Frog.
- Incorporation of specific microhabitat features (ie in fauna underpasses) including but not limited to fauna logs and large rocks, to provide refuge habitat to ground dwelling fauna including the Spotted-tailed Quoll.
- Redistribution of habitat features and resources for native fauna identified by a qualified ecologist (eg: hollow-bearing trees, hollow logs and bush rocks), which have been removed from construction sites, along the route of the Project. The relocation will be undertaken to limit damage to existing vegetation and will not occur in high condition remnant vegetation.

Revegetation measures will be implemented through the Urban Design and Landscaping Plan which will be developed during detailed design phase of the project in consultation with the EPA and the Department of Planning and Environment. Weeds and landscaping will be maintained for a period of three years post construction completion.

Riparian vegetation will be restored and rehabilitated in and around watercourses affected by the Upgrade in consultation with the EPA and the Department of Primary Industries (Fisheries). Consultation will include timeframes and reporting on the completion of works.

3.2.4. Translocation of Mangroves and Seagrass

An aquatic vegetation management strategy for mangroves and seagrass will be developed as part of the Flora and Fauna Management Sub-Plan required by MCoA B31(b)(vii). This plan will include investigations into the potential for the translocation of the mangroves and/ or seagrass impacted by the Project. The Flora and Fauna Management Sub-Plan will be developed in consultation with EPA and DPI (Fisheries).

Investigations found that translocation was not feasible. Compensatory habitat for impacted plants is identified in Section 4.3 of this report.

3.2.5. Installation of Nest Boxes and Microbat Roost Boxes

Nest Boxes

A Nest Box Management Plan has been prepared by Lewis Ecological Surveys (2013b). The Management Plan describes the attributes of tree hollows to be removed, the number of nest boxes needed to mitigate the loss of tree hollows, the design and distribution of nest boxes and ongoing management of nest boxes.

The Management Plan calculated that 723 nest boxes of various sizes are required for the Oxley Highway to Kempsey project with:

- 469 nest boxes required for the Oxley highway to Kundabung section (Ch.0-24040).
- 254 nest boxes required for the Kundabung to Kempsey section (Ch.24040-37850).

The use of various nest box designs are considered suitable for a broad range of fauna including scansorial fauna (Antechinus), small gliders (Feather-tail Glider and Sugar Glider), larger gliders (Squirrel Glider, Yellow-bellied Glider, Greater Glider), possums (Common Brushtail Possum, Short-eared Possum and Common Ringtail Possum), medium sized parrots/lorikeets, cockatoo (Black Cockatoos), small Owls (Southern Boobook and Barn Owl), and large Forest Owls (Masked Owl, Sooty Owl, Powerful Owl).

Microbat Roost Boxes

A *Microchiropteran Bat Management Strategy* has been prepared by Lewis Ecological Surveys (2013c). The Management Strategy describes existing locations of roosting microbats and management strategies used to avoid, minimise and mitigate impacts on identified bat roosts, which includes the installation of bat roost boxes. 160 bat roost boxes will installed 6-12 months prior to planned roost exclusion from existing structures.

3.2.6. Widened Median

A widened, vegetated median in Cairncross State Forest, between Ch. 10300 and 11400 has been retained, to provide a 'stepping stone' opportunity for gliders, predominantly the Yellow Bellied Glider and the Squirrel Glider.

Retaining tall trees in the median that separates the carriageways may mitigate the barrier effect of roads on gliders, provided that the gap in tree cover is within their glide distance capacity. Median widening is an alternative means of providing safe crossing opportunities for gliding species in locations where mature vegetation between carriageways would allow gliding species to cross the upgraded highway in a staged manner (GHD 2011).

3.2.7. Other Fauna Mitigation Measures

Additional mitigation measures identified in the Environmental Assessment and Statement of Commitments include:

- Limits of clearing were clearly marked on site with temporary fencing prior to clearing commencing.
- A suitably qualified ecologist undertook pre-clearing surveys. Fauna species found in areas to be cleared immediately prior to clearing activities were relocated by a qualified ecologist into suitable habitat as close as possible to the area in which they were found.
- Strategies were developed to deal with incidents involving individual animals during construction activities. The strategies were developed in consultation with local Office of Environment and Heritage officers, WIRES and / or other relevant local wildlife carer groups.
- Surveys were undertaken for threatened bat species by a suitably qualified ecologist to identify any roosting bats prior to the demolition of any existing highway bridges.
- Targeted surveys for the threatened Green-thighed Frog and giant barred frog have been undertaken prior to construction. These provided more information on the presence and/or local distribution of these species which would allow minor refinements to the design and/or appropriate mitigation measures.
- Construction of Green-thighed Frog breeding ponds in accordance with Oxley Highway to Kempsey: Green Thighed Frog Management Strategy (Lewis, 2013a).
- The two properties between Cairncross State Forest and the Wilson River that could not be surveyed due to the fact that property access was not available were surveyed prior to construction, and appropriate mitigation measures implemented based on the results of these surveys.

3.2.8. Monitoring of Mitigation Measures

An Ecological Monitoring Program has been developed for the Project in consultation with EPA and DPI (Fisheries) to address the Department of Planning Minister's Condition of Approval (MCoA) B10 and with the then DSEWPaC as part of the request for additional information in relation to the Referral under the EPBC Act.

The Ecological Monitoring Program aims to:

- Outline the environmental context of the Project, identify potential impacts of the Project and the subsequent requirement for mitigation measures.
- Detail the requirements for baseline monitoring of threatened species (known or likely to occur in the Project area that may be adversely affected by the Project) to be undertaken before construction of the Project commences.
- Describe the timing and methodology for monitoring of mitigation measures, during construction and upon completion of the Project, and detail performance measures that will measure the effectiveness of mitigation measures.
- Identify potential contingency measures that may be implemented if any mitigation measure proves to be insufficient.
- Describe the maintenance requirements that are relevant to the mitigation measures.
- Detail the reporting requirements, related to monitoring events.

In total the Ecological Monitoring Program will be implemented for eight years:

- Monitoring commenced in Year 0 (prior to the commencement of construction activities), so that baseline surveys could be completed.
- Monitoring during construction has/will occur in Years 1 to 3.
- Monitoring upon completion of the Project will occur periodically within Years 4 to 8.

3.3. Offset

The Ministers Condition of Approval B8 requires the development of a Biodiversity Offset Strategy with consideration to the Principals for the use of biodiversity offsets in NSW. Since Project approval, the Office of Environment and Heritage (OEH) have published the NSW Biodiversity Offset Policy for Major Projects (OWH 2014). This policy has been developed to address proposals for State Significant Infrastructure (SSI). As this Project is a SSI project, this policy has been applied. The Policy provides six principles for state significant infrastructure that should be used as a framework for considering environmental impacts and developing offset proposals (OEH 2014).

These principles are addressed in section 3.3.1.

The Commonwealth Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) (now the Department of the Environment) provides principles for offsets in the *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy*. These principles have been addressed in the Oxley Highway to Kempsey Biodiversity Offset Management Plan.

3.3.1. NSW offset principles for major projects (state significant development and infrastructure)

1. Before offsets are considered, impacts must first be avoided and unavoidable impacts minimised through mitigation measures. Only then should offsets be considered for the remaining impacts.

Management measures for biodiversity impacts for the Project were developed following these general principles, in order of preference:

- Avoiding impacts.
- Mitigating impacts.
- Offsetting impacts.

A summary of the key measures implemented to avoid and mitigate biodiversity impacts have been provided in Sections 3.1 and 3.2 of this strategy. Where impacts could not be avoided, all reasonable attempts have been made to minimise the impacts as much as possible. As a last resort, offset measures have also been proposed to address any remaining impacts.

2. Offset requirements should be based on a reliable and transparent assessment of losses and gains.

The assessment of the impact of the Project on biodiversity values has been clearly outlined in this report, and Roads and Maritime considers this report to provide a transparent assessment of these losses. Additionally, all vegetation impacted by the Project has been offset at the higher ratio, which provides a straightforward assessment of the gains of the strategy.

3. Offsets must be targeted to the biodiversity values being lost or to higher conservation priorities.

The decision making framework outlined in Section 4of this report ensures that offsets are targeted to the biodiversity values being lost or to higher conservation priorities. The framework explains the like-for-like offsets met and the planned departure from the like-for-like requirements to protect a higher conservation vegetation community.

The potential offsets have undergone ecological assessment to ensure they meet the requirements of the decision making framework. Specifically, this assessment has identified that the offset contains similar or higher conservation vegetation communities, that these communities comprise vegetation that is of moderate to good condition (according to OEH native vegetation benchmarks database), EECs to be offset are of equal or greater conservation status of those lost as a result of the Project, and that the land enables connectivity between adjacent areas of vegetation, where possible.

This assessment has been undertaken by suitable, qualified ecologists and the report prepared will be included in the Biodiversity Offset Package. Any additional offset land will be subject to the same assessment procedure.

4. Offsets must be additional to other legal requirements.

The biodiversity protection and management requirements outlined in this strategy for offsets would be in addition to any legal requirements for biodiversity on that land, including any improvements to the condition of native vegetation required by other legislation or legal restrictions on clearing required under the *Native Vegetation Act 2003*.

5. Offsets must be enduring, enforceable and auditable.

As discussed in Section 4.4, offsets would only be selected if they can be subject to good governance arrangements and protected in perpetuity. The Biodiversity Offset Package will include detail on how this will be achieved for each specific offset area, including plans of management, resourcing, legal security and accountability mechanisms. Two mechanisms are available to Roads and Maritime to ensure in-perpetuity protection for offset sites:

1. a BioBanking Agreement under the Threatened Species Conservation Act 1995.

2. transfer of acquired lands to the National Parks estate.

Roads and Maritime have identified BioBanking Agreements as being the preferred mechanism for securing the offset sites proposed in Section 4 of this Strategy. Any alternative mechanism will be implemented in accordance with NSW Biodiversity Offset policy for Major Projects (OEH 2014).

6. Supplementary measures can be used in lieu of offsets.

In this instance, land-based offsetting is considered feasible and practical, as such, supplementary measures are not being considered in lieu of offsets.

4. Delivery of Biodiversity Offset Strategy

The Biodiversity Offset Strategy proposes to secure additional native vegetation protected through an appropriate legal instrument that ensures the land is managed for conservation.

4.1. Offsetting Native Vegetation

4.1.1. Native Vegetation Offset areas

The NSW Minster for Planning Condition of Approval (MCoA) B8 states that unless otherwise agreed to by EPA and DPI (Fishing and Aquaculture), the Biodiversity Offset Strategy shall provide offsets on a like for like basis and at a minimum ratio of 4:1 for areas of high conservation value (Endangered Ecological Communities (EEC), key threatened species habitat and poorly conserved vegetation communities impacted by the Project) and 2:1 for the remainder of native vegetation areas to offset the direct and indirect impacts of the Project (mangroves, seagrass, saltmarsh and non-EEC riparian vegetation). For the Oxley Highway to Kempsey Project, all native vegetation (excluding mangroves and seagrass, as per MCoA B8) is considered high conservation value, and as such, is being offset at a ratio of 4:1. Table 7 summarises the anticipated biodiversity impacts and offsets required for each formation and EEC. As the vegetation removed by the project was not classified as per the PCT classification system, impacts on vegetation will be offset with vegetation at a formation level or EEC level, unless otherwise detailed in section 4.1.2.

Minor changes to the clearing quantities are anticipated during the construction period. These changes may arise due to minor design refinements or supplementary works (such as utility or property adjustments) or by implementing measures to avoid impacts. The Biodiversity Offset Package would detail refined clearing figures and re-calculated required offset areas by adopting a 4:1 offset ratio.

The vegetation types identified within the Projects Environmental Assessment have been converted in accordance with OEH NSW plant community type (PCT) classification system. Table 7 identifies the PCT conversions and associated formations. Further details on the conversions to a community level are included in Table 1.

Vegetation Community PCT		PCT formation	EEC	Area ⁵ imp acted	Offset Ratio Applied	Offset Area required
				(na)		(ha)
Moist Floodplain Closed Forest with Rainforest Elements	PCT695 & 827 ⁶	Wet Sclerophyll (Shrubby)	Subtropical Coastal Floodplain Forest	14	4:1	56
Riparian Forest	PCT827⁵	Wet Sclerophyll (Shrubby)				
Paperbark Swamp Forest	NR217	Forested Wetlands	Swamp Sclerophyll Forest	21	4:1	84
Swamp Mahogany/Forest Red Gum Swamp Forest	NR254					
Swamp Oak Forest	NR255	Forested Wetlands	Swamp Oak Floodplain Forest	1	4:1	4
Wetland	NR150	Freshwater Wetlands	Freshwater Wetlands	3	4:1	12
Moist Floodplain Forest	PCT698	Wet Sclerophyll (Grassy)	N/A	31	4:1	124
Moist Gully Forest	PCT699	Wet Sclerophyll (Shrubby)	N/A	170	4:1	680
Moist Slopes Forest	PCT1073					
Dry Ridgetop Forest	PCT1208					
Total				240		960

Table 7 Indicative biodiversity offset areas required as a result of clearing impacts from the Project

4.1.2. Native vegetation offset variation

As detailed in section 5.2.1, Roads and Maritime own a number of potential biodiversity offset properties, including land within the Collombatti-Clybucca Wetland.

Preliminary calculations of vegetation within these parcels have been undertaken. These calculations have identified a deficit of sub-tropical floodplain forest EEC and wet sclerophyll forest (shrubby sub formation) when a like for like offsetting arrangement is applied. Indicative offset areas for all other EECs and formations as detailed in Table 7 are provided within the parcels.

In accordance with Principal 3 of the Biodiversity Offset Policy for Major Projects, wet sclerophyll forest (shrubby sub formation) will be substituted with a community at a higher conservation value. For example the deficit area of wet sclerophyll forest (shrubby sub formation) will be offset with an equal area of swamp sclerophyll forest, swamp oak floodplain forest or freshwater wetlands.

The deficit of sub-tropical floodplain forest EEC will be substituted with a community of an equal or higher conservation value that has undergone a similar of greater amount of past clearing. Table 8 details the estimated cleared percentage of each EEC in the region. This table identified that swamp sclerophyll forest, swamp oak floodplain forest and freshwater wetlands have all been subject to a greater level of past clearing. As a result, the deficit of subtropical floodplain forest EEC will be substituted with any of those EECs.

⁵ Area impacted includes a six meter construction buffer

⁶ These PCT have been identified as a best fit for the purposes of threatened species offsetting. OEHs PCT classification system do not identify these PCTs as corresponding to subtropical coastal floodplain forest EEC. Subtropical coastal floodplain forest EEC will be used for vegetation offsetting as detailed below and the converted PCT ID for threated species offsetting as detailed in section 4.2.2.

Table 8 extend of endangered ecological communities within the Mid-North Coast Region of NSW

<u>v</u>	0	Ŭ
Endangered Ecological Community	Extent in the Region in 1999 ⁷	Cleared estimate for the region ⁶
Swamp sclerophyll forest	29,155 ha	75%
Swamp oak floodplain forest	2883 ha	75%
Subtropical coastal floodplain forest	60,018 ha	60-70%
Freshwater wetlands	24,118 ha	40-80% ⁸

4.2. Offsetting Threatened Species Habitat

4.2.1. Federally listed threatened species

Biodiversity offsets for federally listed threatened species have been addressed in the Biodiversity Offset Management Plan (BOMP), which has been prepared in accordance with the Federal CoA5. The BOMP provides offsets for Koala, Giant Barred Frog, Spotted-tail Quoll and Grey-headed Flying-fox. Where appropriate, the offsets provided within this BOMP will also be utilised to meet the Minister for Planning and Environments offsetting requirements, so have not been considered further within this strategy.

4.2.2. NSW listed threatened species

Threatened species habitat impacted by the project is identified in Table 8. This area has been calculated based on the vegetation associations of each threatened species according to OEH's threatened species profile database. The BOP will detail the total amount of threatened species habitat provided in the offset lands for each threatened species. At a minimum the area of habitat provided within offset areas will equal the area of habitat impacted by the project.

Based on preliminary calculations, this ratio is expected to be exceeded for most threatened species impacted by the project. For one species, the rose crowned fruit dove this offsetting ratio will not be achieved. Just over 50 hectares of habitat is provided in the potential offset lands versus the 104 hectares impacted by the project. There are no other fauna species in the same order that use similar habitat to the rose crowned fruit dove that have been impacted by the project. As a result, the deficit of rose crowned fruit dove habitat will be provided for an alternative species at the same class level that is under the same or greater level of threat.

⁷ Source: Oxley Highway to Kempsey – Upgrading the Pacific Highway Environmental Assessment Vol 2 Working Papers Sept 2010 p37 ⁸ The extent of freshwater wetlands shown may be overestimated as the NPWS Map Unit 141 includes two vegetation communities – forested wetlands and freshwater wetlands. However only the freshwater wetland comminute strictly corresponds to the EEC

Table 8 Offset requirements for NSV	V threatened species impacted by the project	
Threatened species fauna species	Associated vegetation ID in the Project	Threatened species habitat impacted by the project (hectares)
Black-necked stork (Ephippiorhynchus asiaticus)	, NR150, NR217, NR254, NR255	25
Brush-tailed phascogale (<i>Phascogale tapoatafa</i>)	NR217, NR254, NR255.	22
Common planigale (<i>Planigale maculata</i>).	NR122, NR125, NR126, NR150, NR160, NR217, NR219, NR243, NR254, NR255	240
Eastern bentwing-bat (<i>Miniopterus schreibersii</i>)	NR122, NR125, NR126, NR150, NR160, NR217, NR219, NR243, NR254, NR255	240
Eastern false pipistrelle (<i>Falsistrellus tasmaniensis)</i>	NR125, NR126, NR219, NR243, NR122, NR160	215
Eastern freetail-bat (<i>Micronomus norfolkensis)</i>	NR122, NR125, NR126, NR150, NR160, NR217, NR219, NR243, NR254, NR255	240
Glossy black cockatoo (Calyptorhynchus lathami)	NR122, NR125, NR126, NR160, NR217, NR219, NR243, NR254, NR255.	237
Greater broad-nosed bat (probable) (<i>Scoteanax rueppellii</i>)	NR122, NR125, NR126, NR160, NR217, NR219, NR243, NR254, NR255	237
Green-thighed frog (<i>Litoris brevipalmata)</i>	NR122, NR125, NR126, NR150, NR160, NR217, NR219, NR243, NR254, NR255	240
Little bentwing-bat (<i>Miniopterus australis</i>)	NR122, NR125, NR126, NR160, NR217, NR219, NR243, NR254, NR255	237
Masked Owl (<i>Tyto novaehollandiae)</i>	NR122, NR125, NR126, NR160, NR219, NR243, NR254, NR255	225
Osprey (<i>Pandion haliaetus</i>)	NR150, NR217, NR254, NR255	25
Powerful owl (<i>Ninox stenua</i>)	NR122, NR125, NR126, NR160, NR217, NR219, NR243, NR254, NR255	237
Rose-crowned fruit-dove (<i>Ptilinopus regina)</i>	NR160 and NR219	104
Sooty owl (<i>Tyto tenebricosa)</i>	NR122, NR126, NR160, NR219, NR243	184

Threatened species fauna species	Associated vegetation ID in the Project	Threatened species habitat impacted by
		the project (hectares)
Southern myotis (<i>Myotis macropus)</i>	NR122, NR125, NR126, NR150, NR160, NR217, NR219, NR243, NR254, NR255	240
Square-tailed kite (<i>Lophoictinia isura</i>)	NR122, NR125, NR126, NR160, NR219, NR243, NR254, NR255	226
Squirrel glider (<i>Petaurus norfolcensis</i>)	NR122, NR125, NR126, NR217, NR219, NR254	177
Yellow-bellied glider (<i>Petaurus australis</i>)	NR122, NR125, NR126, NR160, NR217, NR219, NR243, NR254	236

4.3. Offsetting mangroves, seagrass and salt marsh

Mangroves, seagrass and salt marsh will be offset in consultation with NSW Department of Primary Industries (Fisheries). This offset may be provided as part of a larger offset package including other Pacific Highway projects. Offsets will be based on the final clearing amounts.

4.4. Offsetting hollow bearing trees and logs

Field surveys identified 603 hollow bearing trees within the Upgrade, containing an estimated 3642 tree hollows (Lewis 2013b). Mitigating the loss of hollow bearing trees has been addressed within the nest box plan of management for each project.

Assessment of the suitability of potential offset sites will include an assessment of the number of tree hollows and hollow logs to the impacted areas.

4.5. Decision making framework

All biodiversity offsets would be located within the NSW Mid North Coast Bioregion with the aim of offsetting according to the following framework:

- On a like for like basis based on vegetation formation or EEC for the existing offset properties of Norton, Cairncross State Forest, Lallemand and the Roads and Maritime Collombatti-Clybucca floodplain cluster (Blair, Whalen, Yerbury and McAlister/ Latham); and
- 2. Utilising the residual Freshwater Wetland, Swamp Oak and Swamp Sclerophyll EEC present on the Roads and Maritime Collombatti-Clybucca floodplain cluster; and
- 3. Inclusion of an additional area of Freshwater Wetland, Swamp Oak and Swamp Sclerophyll EEC on Priority 1 private owned properties, as identified in the Collombatti-Clybucca Floodplain Remediation Feasibility Study. In the event all Priority 1 lands cannot be secured by either a BioBanking Agreement or voluntary acquisition, Roads and Maritime would seek agreement to an alternative proposal.

The vegetation types within the offset areas will be utilised to determine the area of threatened species habitat provided in offset areas as per section 4.2.2.

It is Roads and Maritime's intention to use these proposed offset sites to fulfil the entire offset requirements for both the Oxley Highway to Kempsey and Kempsey to Eungai projects. One Biodiversity Offset Package, covering both projects will be submitted for approval.

5. Implementation of Strategy

As outlined in the MCoA B8 the Oxley Highway to Kempsey Offset package may also be part of a larger offset package including other Pacific Highway projects. The scope of this larger offset package would be determined using the same methodology as described in this Strategy (subject to Conditions of Approval) and would potentially allow larger more continuous areas of land to be acquired leading to improved conservation outcomes and economies of scale. The current preferred option is that one offset package is prepared for the Oxley Highway to Kempsey and Kempsey to Eungai Pacific Highway upgrade.

The offset strategy is considered consistent with OEH's offset principles. RMS has made a commitment to conservation of offset lands in perpetuity. There are a number of mechanisms to do this, including BioBanking Agreements and the transfer of ownership to the National Parks estate. Roads and Maritime's preferred option is to place Biobanking agreements on the offset sites outlined in Section 4 of this Strategy. Any alternative mechanism will be implemented in accordance with NSW Biodiversity Offset policy for Major Projects (OEH 2014).

It is Roads and Maritime's intention to on-sell each offset property once a BioBanking Agreement has been placed on the title and a Management Action Plan has been developed for each property. The Office of Environment and Heritage will assume responsibility for monitoring, reporting and compliance for each BioBanking Agreement. The Clybucca Government Working Group will continue to take responsibility for developing and implementing a strategic management framework for the Collombatti-Clybucca offset sites as a whole. The Terms of Reference for the Clybucca Government Working Group are at Attachment B. Roads and Maritime have committed to remain a part of this group until such time as all Roads and Maritime owned properties in the Collombatti-Clybucca floodplain have been on-sold.

Condition and habitat assessment of the proposed offset lands has been undertaken to ensure the potential offset land(s) consist of appropriate vegetation type(s) and are of adequate condition that meets the decision-making framework outlined above. This assessment has been undertaken by suitable, qualified ecologists and the report prepared will be included in the Biodiversity Offset Package.

5.1. Management of Unforeseen Additional Impacts

Throughout the construction period there is a possibility of design changes that may impact on additional areas of native vegetation. Where additional clearing is proposed to be undertaken outside of the construction clearing limits a consistency assessment will be undertaken against the Minster for Planning's Conditions of Approval for the project. Consistency assessment(s) will take into account the vegetation type, quality and habitat. If the design change is deemed inconsistent with the Minster for Planning's Conditions of Approval then a modification under Section 75 W of the Environmental Planning and Assessment Act 1979 will be lodged for determination by the Minster for Planning. This process will also enable a detailed record of any additional clearing impacts outside of what was anticipated in the Biodiversity Offset Strategy.

In addition a review at the end of the construction phase of the project will be undertaken to compare the 'as built' area cleared for construction against what was envisaged in the Biodiversity Offset Strategy. In the event that there is an increase in the area of native vegetation impacted above what was anticipated in the Biodiversity Offset Strategy then additional offset measures will be implemented as detailed in section 4.1.1, similarly any savings in clearing will result in reduction in offset quantities. An increase would be determined by the quality of the habitat removed and the mitigation measures implemented to restore the disturbed areas (where this is possible). The extent of any additional measures will be determined in consultation with the EPA, the Department of Planning and Environment and the Department of the Environment.

Additional offset measures may include one or a combination of the following:

- Secure additional native vegetation.
- Additional revegetation in strategic locations.
- Investment in management research related to the rehabilitation and protection of relevant threatened species.

5.2. Biodiversity Offset Package

5.2.1. Preferred Biodiversity Offset Package

Roads and Maritime currently own seven parcels of land that have been identified as potential biodiversity offset lands for the Oxley Highway to Kempsey and Kempsey to Eungai Pacific Highway upgrades. Areas of two of these offset properties have been nominated within the Oxley Highway to Kempsey Federal BOMP to compensate the loss of threatened species habitat as per CoA5. These two offset properties are known as Norton and Cairncross.

Four of the remaining five properties are located within the Collombatti-Clybucca Wetland. These properties known as Whalan, Yerbury, Blair and McCallister/Latham, provide over 950 hectares of native vegetation including over:

- 180 hectares of Swamp Oak Floodplain Forest (EEC).
- 170 hectares of Swamp Sclerophyll Forest (EEC).
- 400 hectares of Freshwater Wetlands (EEC).
- 140 hectares of Wet Sclerophyll Forest (Shrubby subformation).
- 20 hectares of Wet Sclerophyll Forest (Grassy subformation).

Upon approval of this Strategy, Roads and Maritime will also attempt to secure about additional priority lands within the Collombatti-Clybucca Wetland. These additional lands have been identified in the Collombatti-Clybucca Floodplain Remediation Feasibility Study as necessary to effectively remediate the Collombatti-Clybucca wetland complex. Current Roads and Maritime properties extend for the majority of the lowest-lying areas of the floodplain, Doughboy Swamp and Mayes Swamp. However, adjacent areas of the swamps remain as private holdings. Implementation of a remediation strategy without further acquisitions would require significant on-ground works to mitigate risks to adjacent properties. Implementation of this strategy will create additional freshwater wetland habitat, improve surface water quality, reduce black water events and restore fish habitat across the area (WRL, 2015).

The remaining property, known as Lallemand, provides about 100 hectares of Wet Sclerophyll forest (shrubby subformation).

The inclusion of these properties within the combined Oxley Highway to Kempsey and Kempsey to Eungai Pacific Highway upgrade BOP is Roads and Maritimes preferred option.

5.2.2. Submission of the Biodiversity Offset Package

As outlined in the MCoA B8 the Oxley Highway to Kempsey Offset package may also be part of a larger offset package including other Pacific Highway projects. The current preferred option is that one offset package is prepared for the Oxley Highway to Kempsey and Kempsey to Eungai Pacific Highway upgrade.

MCoA B9 requires Roads and Maritime to submit a Biodiversity Offset Package to the Department of Planning and Environment within two years of the approval of this strategy. The initial BOS was approved by the Department on 27 January 2014. Roads and Maritime also have an approved extension of time for the submission of the BOP until 27 January 2017.

The package will be prepared in consultation with the EPA and the Department of the Primary Industries (Fishing and Aquaculture) and will include details of the final suite of measures to be implemented as a result of this strategy, final selection means of securing the biodiversity values of the offset package in perpetuity, including ongoing monitoring, maintenance and management requirements, and timing and responsibilities for the implementation of the package over time.

6. Conclusion

Measures for managing biodiversity impacts arising from the Oxley Highway to Kempsey Upgrade Project were developed following the general principles of avoiding, mitigating and offsetting impacts. Impacts on biodiversity values within the region have been avoided, where possible, through the route selection process and development of the concept design alignment.

Management measures designed to reduce impacts on biodiversity include fauna crossing measures, revegetation measures, development of microbat, Green-thighed Frog and Giant Barred Frog management strategies, additional fauna mitigation measures (i.e. nest and microbat boxes) and monitoring for up to Year 8 of the operation phase of the Upgrade.

The Upgrade will result in direct impacts to about 240 hectares of vegetation. Based on offset ratios of 4:1 for all vegetation to be impacted by the Upgrade, as required by the Minister's Conditions of Approval B8, indicative offset requirements for the Oxley Highway to Kempsey Upgrade will be 960 hectares. The indicative offset requirement as outlined in the Biodiversity Offset Strategy for the K2E project is about 700 ha.

According to the offset framework proposed in this Strategy about 1660 ha of offsets will be provided for the OH2K and K2E projects, including over 770 ha of Freshwater Wetland, Swamp Oak or Swamp Sclerophyll EEC in the Collombatti-Clybucca floodplain.

Roads and Maritime will submit to the Department of Planning and Environment a Biodiversity Offset Package, to be prepared in consultation with EPA and including details of the final suite of measures selected in accordance with this strategy by 27 January 2017.

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Appendix A Agency Comments Appendix B Terms of Reference for Clybucca Government Working Group