



Mitigating Impacts on Biodiversity in the Ingleside Locality by Improving Fauna Connectivity

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1. Rationale

The Department of Planning and Environment, Urban Growth NSW and Pittwater Council are currently investigating development potential in Ingleside. Concurrently Roads and Maritime Services are planning a major upgrade of Mona Vale Road between Mona Vale and Terrey Hills. Together these developments could have a major effect on fauna connectivity and regional biodiversity.

In dealing with impacts of its planned development on biodiversity, The Department of Planning and Environment is committed to Biodiversity Certification which, according to the NSW government's Biodiversity Certification Methodology, may be conferred on land where it will improve or maintain biodiversity values (NSW Department of Environment and Climate Change, 2011). The prime principle set by the NSW Office of Environment and Heritage for the use of biodiversity offsets when determining environmental impacts is "Impacts must be avoided first by using prevention and mitigation measures" (OEH, 2014).

The stated aims of RMS are consistent with OEH principles. They are:

- Avoid and minimise impacts first
- Mitigate impacts where avoidance is not possible
- Offset where residual impacts cannot be avoided

(NSW RTA, 2011)

Preservation of biodiversity in and around Ingleside depends on connectivity between Ku-ring-gai Chase National Park and a number of reserves and remnant bushland areas to the south and east of Ingleside and Mona Vale Road.

Pittwater Natural Heritage Association acknowledges the efforts to address many of the issues associated with preservation of biodiversity in and around Ingleside made to date by Roads and Maritime Services, Department of Planning and Environment, Pittwater Council and others involved in both the Ingleside development and Mona Vale Road upgrade.

However, as we only get one chance to get this right, we propose further action which is needed to mitigate impacts on biodiversity in the Ingleside area. In this submission we present evidence for designing fauna corridors and road crossing structures that will avoid and mitigate impacts on biodiversity within the Ingleside precinct and the surrounding area.

2. Summary of main points

Pittwater Natural Heritage Association submits that:

- The upgrade of Mona Vale Road combined with development of the Ingleside precinct will have a potential additive effect which would increase the risk to biodiversity in the Ingleside area;
- Maintenance of biodiversity in the Ingleside area is dependent on effective fauna connectivity;
- To achieve the goal of effective fauna connectivity a series of fauna corridors and targeted fauna crossing structures on Mona Vale Road and other roads within the Ingleside precinct are required;
- The most effective solution to connectivity for Mona Vale Road East is in an array of crossing structures including a vegetated overpass, multiple fauna underpasses and canopy bridges;
- Fauna road crossings must be located so as to meet with major fauna corridors through the Ingleside precinct;
- The effort of RMS to construct fauna road crossings will be wasted unless associated fauna corridors through the Ingleside precinct are of sufficient width, are vegetated appropriately, are in public ownership and protected in perpetuity and include fauna crossings on minor roads within the precinct so as form an effective connectivity network;
- The best outcome for fauna connectivity and biodiversity will be achieved by a joint approach by all relevant stakeholders in developments within and around the Ingleside precinct: Roads and Maritime Services, Department of Planning and Infrastructure, Pittwater Council, Rural Fire Service, electricity and other service providers and Office of Environment and Heritage, resulting in development of a fauna connectivity strategy which maintains fauna population persistence.

3. The problem

Development of Ingleside and upgrade of Mona Vale Road to four lanes will not only affect biodiversity within the Ingleside precinct itself, but surrounding reserves and bushland remnants such as Katandra Bushland Sanctuary, Ingleside Chase Reserve and Warriewood Wetland as well as Garigal National Park and Ku-ring-gai Chase National Park.

Ramp et al (2014) states that Ku-ring-gai Chase National acts as a source for regional wallaby populations. This would no doubt be true for a range of other species in the Northern Beaches area. The wide range of native fauna species in Katandra Bushland Sanctuary and Ingleside Chase Reserve are particularly at risk of local extinction caused by isolation from the larger populations in the nearby national parks.

Marlow (2014) provides evidence of roadkill collected by local volunteers that shows that roadkill is endemic in the area. In discussing the effects need for connectivity she states that: "since it is likely

that the Northern Beaches will be affected by stochastic events such as bushfire, as happened in 1994, it is imperative that links between ... bushland reserves are maintained or improved”.

The two major elements needed for effective links between bushland reserves are effective fauna corridors and appropriate fauna crossing structures on major and minor roads within the precinct, most importantly Mona Vale Road.

4. Fauna species in the Ingleside area

The Ingleside locality is rich in fauna species, many of them listed as vulnerable or endangered. The *Ingleside – Executive Summary of Ecology, Riparian and Bushfire Investigations* (Ecological 2014) lists the following “ecosystem credit species” predicted to occur in the Ingleside precinct (Table 1), all of them listed as vulnerable under the NSW Threatened Species Conservation Act, and two are listed as endangered under the Commonwealth Environmental Protection and Biodiversity Conservation Act.

Table 1. Ecosystem credit species

Common Name	Scientific name	Status under TSC Act	Status under EPBC Act
Spotted-tailed Quoll	<i>Dasyurus maculatis</i>	Vulnerable	Endangered
Yellow-bellied Glider	<i>Petaurus australis</i>	Vulnerable	
Squirrel Glider	<i>Petaurus nofolcensis</i>	Vulnerable	
Eastern False Pipistrelle	<i>Falsistrellus tasmaniensis</i>	Vulnerable	
Little Bent-wing Bat	<i>Miniopterus australis</i>	Vulnerable	
Greater Broad-nosed Bat	<i>Scoteanax ruppellii</i>	Vulnerable	
Eastern Free-tailed Bat	<i>Mormopterus norfolkensis</i>	Vulnerable	
Glossy Black-cockatoo	<i>Calyptorhynchus lathami</i>	Vulnerable	
Little Eagle	<i>Heiraaetus morphoides</i>	vulnerable	
Little Lorikeet	<i>Glossopsitta pusilla</i>	Vulnerable	
Swift Parrot	<i>Lathamus disclor</i>	Endangered	Endangered
Scarlet Robin	<i>Petroica boodang</i>	Vulnerable	
Barking Owl	<i>Ninox connivens</i>	Vulnerable	
Powerful Owl	<i>Ninox strenua</i>	Vulnerable	
Masked Owl	<i>Tyto novaehollandiae</i>	Vulnerable	

(E= Endangered species, V= Vulnerable species, Ma= Marine species. (Ecological 2014, table 2)

The Ecological report also lists the following fauna species as potentially occurring in the Ingleside area (listed in Table 2). Most of these species have recently been recorded as definitely occurring in the Ingleside precinct and surrounding reserves.

Table 2. Fauna species potentially occurring within the Ingleside Precinct (Ecological)

Common Name	Scientific name	Status under TSC Act	Status under the EPBC Act	Recently recorded in the area
Giant Burrowing Frog	<i>Heleioporus australiacus</i>	Vulnerable	Vulnerable	√
Red-crowned Toadlet	<i>Pseudophryne australis</i>	Vulnerable	Vulnerable	√
Koala	<i>Phascolarctos cinereus</i>	Vulnerable	Vulnerable	
Southern Brown Bandicoot	<i>Isoodon obesulus</i>	Endangered	Endangered	
Eastern Pygmy Possum	<i>Cercartetus nanus</i>	Vulnerable		√
Southern Myotis	<i>Myotis macropus</i>	Vulnerable		√
Gang-gang Cockatoo	<i>Callocephalon fimbriatum</i>	Vulnerable		√
Regent Honeyeater	<i>Anthochaera phrygia</i>	Endangered	Endangered	√
Rosenberg's Goanna	<i>Varanus rosenbergi</i>	Vulnerable		√

In addition to the species listed above a wide range of more common native fauna species are at risk of being killed by motor vehicles or isolated in bushland fragments, which could lead to local extinctions (Tables 3 and 4). Species listed in these tables are included to indicate the species richness of the Ingleside area. Maintaining species richness, that is populations of a wide range of fauna which carry out many biological functions, including as food for endangered species is critical to maintaining biodiversity.

Table 3. Some native fauna species, not listed above, which are found in the Ingleside area

Sugar Glider	Brush Turkey
Feathertail Glider	Lyre Bird
Black-faced Swamp Wallaby	Echidna
Long nosed Bandicoot	Snake necked Turtle
Antechinus	Death Adder
Brushtail possum	Diamond Python
Ringtail Possum	Green Tree-snake
Grey headed Flying Fox	Lace Monitor
Eastern Bent-wing Bat	Striped Marsh Frog
Large-eared Pied Bat	Peron's Tree Frog

Parsons (*Best Practice Guidelines for Enhancing Urban bird Habitat: Scientific Report*, undated) states that in Australia “scientists have noted that small birds appear to be in decline” and that “While preserving and enhancing the remaining natural vegetation and riparian habitats in urban areas is paramount, they should be coupled with the development of a series of corridors connecting these patches throughout the urban matrix.”

In addition to the decline of small birds, Birdlife Australia's 2015 *State of Australia's Birds* reports that a number of species regarded as more common are also decreasing, including Laughing Kookaburra, Tawny Frogmouth, Southern Boobook Owl and Brown Goshawk.

While a four lane road has little effect on movement of larger birds and migratory bird species, it has been shown that it constitutes a barrier for forest-dwelling bird species of smaller bodyweights (Jones and Pickvance, 2013 and Pell and Jones, 2015). However, as these species rely on the cover of vegetation to protect them from predators, they will use a vegetated overpass. Table 4 lists bird species of smaller bodyweight (under 30 grams) that have been found on Warriewood Escarpment. Many, if not all, would also occur in Katandra bushland Sanctuary and other remnant patches of bushland in the Ingleside area.

Table 4. Bird species of smaller bodyweight (under 30 grams) that have been recorded on Warriewood escarpment

Common Name	Scientific name	Weight (grams)
White-throated Treecreeper	<i>Cormobates leucophaea</i>	20
Eastern yellow Robin	<i>Eopsaltria australis</i>	20
Willie Wagtail	<i>Rhipidura leucophrys</i>	20
Golden Whistler	<i>Pachycephala pectoralis</i>	18
Black-faced Monarch	<i>Monarcha melanopsis</i>	16
Varied Sittella	<i>Daphoenositta chrysoptera</i>	15
Leaden Flycatcher	<i>Myiagra rubecula</i>	15
Yellow-faced Honeyeater	<i>Lichenostomus chrysops</i>	15
Scarlet Honeyeater	<i>Myzomela sanguinolenta</i>	11
Silvereye	<i>Zosterops lateralis</i>	10
Brown Honeyeater	<i>Lichmera indistincta</i>	10
Variegated Fairy-wren	<i>Malurus lamberti</i>	10
Red-browed Finch	<i>Neochmia temporalis</i>	9
Grey Fantail	<i>Rhipidura fuliginosa</i>	8
Rose Robin	<i>Petroica rosea</i>	7
Weebill	<i>Smicrornis brevirostris</i>	6

Fauna listed in the tables above, indicating the species richness of the Ingleside area, use the reserves around Ingleside as habitat, as do many other native species not listed. Ingleside Chase Reserve for example: “is one of the best remaining examples of high quality urban bushland remnants in Sydney” (Sullivan, 2010) The native species using these reserves and other bushland remnants in the area need connectivity by way of corridors and road crossings to facilitate movement across the landscape.

5. Corridors and crossings

Corridors and crossing structures must suit the needs of the fauna using the Ingleside precinct and surrounding bushland. They must also be the result of a co-operative effort by all stakeholders which matches the crossing structure to the location of the corridor and the species for which it is intended.

5.1 Optimum crossing structures for species groups

The barrier to fauna movement caused by roads can be overcome by construction of suitable fauna crossings designed to give safe passage to targeted species. They must be designed specifically for the purpose, as opposed to drainage culverts and pipes which may only be used opportunistically by a few species.

A range of crossing designs are available to suit the needs of fauna found in Ingleside. Table 5 shows the optimum crossing structure for each species.

Table 5. Suitability of different types of fauna structures for a selection of commonly addressed species or groups of species

	Land bridge	Canopy bridge	Poles	Underpass Culvert	Underpass Tunnel
Frogs	√√	-	-	√	√
Mammals: macropods	√√	-	√√	√	-
Mammals: arboreal species	√√	√√	√√	√	√
Mammals: bats/flying foxes	√√	-	-	-	-
Mammals: small size	√√	-	√	√√	√√
Birds: flying, over 30 grams	N/A	-	-	-	-
Birds: flying, under 30 grams	√√	-	-	-	-
Birds: brush turkey, lyre bird	√√	-	-	?	-
Reptiles: snakes and lizards	√√	-	-	√	√
Reptiles: turtles	√√	-	-	√√	√√
Monotremes: Echidna	√√	-	-	√√	√√
Invertebrates: insect and spiders	√√	-	-	√√	√√

(Table adapted from Qld Dept. of Transport and Main Roads 2010)

√√ = optimal solution

√ = can be used with some adaptations

- = unsuitable

? = unknown

5.1.1 Vegetated fauna overpass

Table 5 shows clearly that the land bridge, or vegetated overpass is the optimal road crossing structure for the widest range of species. This finding is supported by many researchers into fauna road crossings, for example, Jones (2015), Glista et al, (2009), Hayes and Goldingay, (2009).

5.1.2 Canopy bridge

As shown in Table 5, canopy bridges (usually rope constructions suspended above the roadway) are targeted at arboreal species so are best used as an adjunct to other crossing structures.

Research by The Australian Research Centre for Urban Ecology shows that a variety of arboreal species including ringtail and brushtail possums and some climbing species use canopy bridges (Soanes, 2013).

5.1.3 Glider poles

Glider poles (vertical poles placed to enable species to cross roads by providing them with multiple launch and landing points) are also targeted at a small number of species, those that glide between vegetation, sugar gliders for example.

5.1.4 Underpass

Fauna underpasses can be suitable for many terrestrial species, however as shown in table 5 are not suitable for birds and flying foxes. They must be purpose built for the target species as their success as a crossing structure depends on the design (Qld Dept. of Transport and Main Roads, 2010, p 42). This would indicate that a number of specifically designed underpasses would be required to facilitate movement by the widest range of species. Jones (2015) says that “the evidence is clear that having multiple [fauna crossing] options is extremely important in maintaining ongoing movements”.

A critical element in the design of an underpass crossing is appropriate vegetative cover at the entrances (Qld Dept. of transport and Main Roads, 2010). This does not seem to have been taken into account in the location of the single underpass planned for Mona Vale Road East as the plan accompanying RMS’ July 2015 information brochure appears to show the western entrance opening onto cleared private property.

The most effective solution to connectivity for Mona Vale Road East is in our opinion a vegetated overpass in association with an array of other crossing structures, including a number of canopy bridges and multiple fauna underpasses.

5.2 Fauna corridors

The bushland reserves in the Ingleside area that will be most affected by the upgrade of Mona Vale Road East are Katandra Bushland Sanctuary, Ingleside Chase Reserve and Warriewood Wetland. While a number of fauna crossing structures on Mona Vale Road East are needed to provide connectivity between these bushland fragments and Ku-ring-gai Chase National Park, connectivity also depends on matching the location of the crossing structures with fauna corridors through the Ingleside precinct.

The Department of Planning and Environment and its planning partners have produced a publically available document outlining the network fauna corridors through the Ingleside precinct: The Ingleside Precinct Draft Structure Plan (DP&E 2014). This plan shows a number of green spaces and corridors. However, it appears to us that a number of them don’t act as effective fauna corridors due to insufficient width, lack of fauna road crossings and poor siting in relation to providing connectivity to affected bushland reserves.

We propose that the existing green spaces and corridors be enhanced to ensure that there are two core vegetated fauna corridors of sufficient width which, along with a number of supplementary corridors and carefully located fauna crossings will provide effective connectivity through the Ingleside precinct.

5.2.1 Location of corridors

The fauna corridors through Ingleside must link up with fauna crossings on Mona Vale Road. Locations, therefore should be negotiated between the stakeholders.

5.2.2 Width of corridors

Research on width of fauna corridors indicates that the wider the corridor, the more effective it will be in allowing movement and dispersal of a wide range of species. Narrow corridors are subject to edge effects which degrade their effectiveness (Smith and Smith 2010), and Ives (2011) recommends that to accommodate a wide range of species corridors should be between 127 and 289 metres wide. We reiterate our opinion put in a previous submission that “the most significant corridor in the Ingleside precinct is the north – south corridor between Cicada Glen Road and Lane Cove Road, joining the endangered ecological community at the head of Narrabeen Creek to a tributary of Cicada Glen Creek. We feel that this could be considered a sub-regional corridor. We suggest a minimum width of 127 metres.” (Marlow and Palmer, 2015)

5.2.3 Fauna corridor vegetation

Vegetation in fauna corridors, on overpasses and around underpasses must be of a type and quality that supports and protects populations of target species. McGregor et al (2015), in a study of herpetofauna using the Compton Road overpass in S.E. Queensland found that “... persistent occupation by species on the overpass throughout the six years suggests permanent colonisation of the vegetated structure as an extension of the natural forest habitat”. The Compton Road overpass is vegetated with the same native plant species as the adjacent bushland remnants.

Corridors consisting of largely open green space do not act as habitat for most native fauna species as they don't provide sufficient refuge against predators and contain few food plants and nesting spaces. Swamp wallabies will move onto grassed areas at night, but retreat to shelter during the day.

6. Conclusion

Ingleside is a challenging locality for urban development and provision of major infrastructure. Fragmentation of bushland remnants already exists, but some measure of fauna connectivity through the precinct and across roads remains.

Both Roads and Maritime Services and Department of Planning and Environment acknowledge the need to avoid further impacts on biodiversity and where this is not possible to mitigate those impacts. In this submission we have argued that by improving fauna connectivity, impacts on biodiversity will be mitigated.

We also contend that the challenge of Ingleside will not be met by organisations working alone. A holistic, landscape scale response is needed to meet the challenge. This response should be started by a commitment from Roads and Maritime Services, Department of Planning and Environment Pittwater Council and Office of Environment and Heritage to work together with other stakeholders such as the Rural Fire Service, electricity and other service providers to develop a fauna connectivity strategy taking in the points made in this submission.



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