




**Supplementary ecological survey**

**Nelson Bay Road upgrade, Stage 3**

**November 2013**

## DOCUMENT CONTROL

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Front Cover Photograph: Blackbutt Forest within the proposed Nelson Bay Road upgrade development footprint

## EXECUTIVE SUMMARY

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Niche Environment and Heritage Pty Ltd was commissioned by the NSW Roads and Maritime Services to conduct a supplementary ecological assessment for the Nelson Bay Road upgrade, Bobs Farm to Anna Bay Stage 3. Further impact assessments for eight groups of species listed under the *NSW Threatened Species Conservation Act 1995* and/or the *Commonwealth Environmental Protection and Biodiversity Conservation Act 1999* were requested by RMS.

Targeted field surveys for this supplementary ecological assessment occurred throughout the impact area of the Project as well at control sites scattered through the rest of the Tomaree Peninsula (the study area, Figure 2). In order to target the Koala (and other threatened arboreal marsupials including the Squirrel Glider and Brush-tailed Phascogale), 15- 300 metre spotlighting transects were established throughout the study area. These consisted of 13 reference sites and two impact sites, located within the project area. These were traversed at a speed of approximately 1kilometre per hectare, on two separate nights. At each spotlighting transect, call playback for the Koala was also conducted through a 10 watt megaphone for 5 minutes.

Koala Spot Assessment Technique (SAT) plots were also completed at the same sites as the spotlighting transects, with additional SAT plots being completed within the project area. This produced a total of 16 SAT plots, which equated to > 20 hours of survey effort.

In order to further inform the likelihood of occurrence of the Spotted-tail Quoll, motion sensor camera surveys were also undertaken. At 20 sites throughout the study area, a single Scoutguard motion sensor camera was baited with fresh chicken pieces (frames, legs and wings) for seven consecutive nights. Each site was at least 500 metres apart in order to maximise the sampling area, which allowed for most large bushland remnants within the study area to be surveyed. This produced a combined survey effort of 140 camera trap nights.

Koalas were recorded at four out of 15 transects via spotlighting and six out of 16 sites where SAT plots were completed. However no evidence of Koalas was recorded within the clearing footprint for the Nelson Bay Road Upgrade stage 3.

Other threatened species recorded during the spotlighting survey included the Powerful Owl (one site), Masked Owl (one site) and Squirrel Glider (two sites). However, no evidence of Powerful Owl, Masked Owl or Squirrel Glider was recorded within the clearing footprint for the Nelson Bay Road upgrade stage 3.

Seven Part Tests of Significance were completed for the Squirrel Glider, Brush-tailed Phascogale, Spotted-tail Quoll, threatened owls (Powerful, Masked and Barking), threatened diurnal raptors (Little Eagle, Square-tail Kite, Eastern Osprey), waterbirds (Black Bittern and Australasian Bittern), Wallum Froglet and Sand Doubletail Orchid (*Diuris arenaria*). The project includes two fauna underpasses and one rope ladder, nesting boxes and continued ecological monitoring in the local area. On that basis, no significant impact on these species is expected to occur, and therefore a species impact statement is not required.

Assessments of Significance under the EPBC Act were undertaken for the Koala, Newcastle Doubletail Orchid, Grey-headed Flying Fox, New Holland Mouse and Spotted-tail Quoll. The Assessments of Significance concluded that a significant impact is not expected to occur for the aforementioned species, provided that the proposed mitigation measures are installed.

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## 1 INTRODUCTION

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### 1.1 Background

Niche Environment and Heritage Pty Ltd (Niche) was commissioned by the NSW Roads and Maritime Services to conduct a supplementary ecological assessment for the Nelson Bay Road upgrade, Stage 3 (Project). RMS requested further impact assessments not completed in the original ecological assessment for a range of species known or highly likely to occur along the Project route that are listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act) and/or the Commonwealth *Environmental Protection Biodiversity and Conservation Act 1999* (EPBC Act).

Ecological assessments undertaken for the REF concluded that (Lesryk 2012):

*“no important populations are considered to rely upon the habitat present within the study area. Similarly, the study area is not considered to contain any areas of critical habitat for this species. In addition, it is not considered that the amount of habitat to be affected as a result of the proposed upgrading is essential to the dispersal of Koalas between those forest or woodland habitats present within the Port Stephens LGA. As such, no further assessment in regards to the Koala or its habitat is considered necessary.”*

The Review of Environmental Factors (REF) for the project was determined on 13 November 2012 and the construction contract was awarded in July 2013.

In August 2013, an injured Koala was found along Nelson Bay Road near the study area. Koalas are listed as vulnerable under both State and Commonwealth legislation, and as RMS has an ongoing obligation under Part 5 to fully consider its impacts on the environment, there is a need for reassessment of the Project under both State and Commonwealth legislation.

### 1.2 The Proposal and the study area

The Project consists of the widening of the existing Nelson Bay Road between Bobs Farm and Anna Bay (a distance of approximately 4 kilometres) to divided, dual carriageway. The project is Stage 3 of the Nelson Bay Road upgrade, with the previous two stages having been completed to the southwest of the Project. A regional study for the Koala and Spotted-tailed Quoll was undertaken across 15 spotlighting sites, 16 Koala SAT plots and 20 remote camera sites (Figure 2; hereafter referred to as the ‘study area’). These sites were located in a range of public lands including Worimi National Park, Tomaree National Park, Tilligerry Nature Reserve and a number of Port Stephens Council managed reserves, in addition to the immediate subject site.

### 1.3 Definitions

The following definitions are taken from the Department of Environment, Climate Change and Water (DECCW) *Threatened Species Assessment Guidelines: The Assessment of Significance* (DECC 2007) and have been adopted for this assessment.

**Subject site:** the area to be directly affected by the proposal.

**Study area:** the subject site and any additional areas which may potentially be affected by the proposal either directly or indirectly.

**Direct impacts:** those that directly affect the habitat and/or individual plants and animals and cannot be avoided or mitigated.

**Indirect impacts:** those that affect species, populations or ecological communities in a manner other than through direct loss or disturbance. These can usually be avoided or mitigated.

**Local population:** the population of a particular species that occurs in the study area.

**Locality:** the area within 10 km of the study area.

**Local occurrence:** refers to the distribution of an ecological community within the study area.

## 1.4 Scope

This study aimed to provide collect information on the distribution and abundance of threatened species within the proposal area and the study area. This information was used to complete relevant impact assessments. The specific scope of this study is to:

- Undertake targeted flora surveys within the proposal area for the threatened Newcastle Doubletail Orchid (*Diuris praecox*);
- Undertake remote camera trap surveys across 20 spatially independent sites within the study area, targeting the Spotted-tail Quoll;
- Undertake spotlighting and call playback surveys across 13 spatially independent sites within the study area, targeting the Koala;
- Complete Koala Spot Assessment Technique (SAT) plots, to search for Koala scats to determine the level of Koala activity at each site;
- Undertake a review from the peer-reviewed literature and previous ecological reports completed for the proposal and adjacent projects;
- Review previous records for threatened fauna within the study area and analyse potential fragmentation effects on these species from the proposal;
- Undertake habitat assessments within the proposal area for other species not specifically targeted during field surveys for use in impact assessments;
- Complete Seven Part Tests of Significance for species not previously assessed;
- Provide Assessments of Significance under the EPBC Act for the Spotted-tail Quoll , Koala, Newcastle Doubletail Orchid, Grey-headed Flying Fox and New Holland Mouse; and
- Provide supporting mapping for the above components.

## 2 METHODS

### 2.1 Literature and Database Review

#### 2.1.1 Review of literature

A brief, yet comprehensive review of the peer reviewed literature on the ecology of the Koala occurred via the online database ‘Scopus’. The review used the key words of ‘Koala’, ‘Koala’ AND ‘Port Stephens’ and ‘Koala’ AND ‘roads’. The results of this literature review are included in Table 3. Due to the absence of published studies on the effectiveness of road mitigation on Koalas, a Google search was also completed for unpublished studies on Koala and road mitigation.

#### 2.1.2 Review of previous ecological studies from the proposal and adjacent projects

The previous ecological assessment for Stage 3 of the Nelson Bay Road upgrade (Lesryk 2012) was reviewed, along with a Species Impact Statement completed by Cumberland Ecology (2003) for a parcel of land on the northern side of Nelson Bay Road.

#### 2.1.3 Likelihood of occurrence for EPBC listed species

New threatened species likelihood of occurrence tables were completed via the Protected Matters Search Tool. From this report, threatened species likelihood of occurrence was determined based on known records within the study area, presence of important habitat features and field survey results. Five categories for ‘likelihood of occurrence’ (Table 1 and Table 2 below) were attributed to species. This process was completed on an individual species basis.

**Table 1: Likelihood of Occurrence Criteria - Threatened Flora**

Likelihood rating	Criteria
Known	The species was observed within the study area
High	Preferred habitat for the species occurs within the study area and is in good condition. It is therefore considered likely that a species inhabits or utilises habitat within the study area. There are numerous previous known records of the species in the locality.
Moderate	Potential habitat for a species occurs within the study area, though habitats are in a poor or modified condition. There are few known records for the species in the locality. Adequate targeted field survey would determine if there is a ‘high’ or ‘low’ likelihood of occurrence for the species within the study area
Low	It is unlikely that the species inhabits the study area, as preferred habitat for the species is not present. The species has not been previously recorded in the locality.
None	The habitat within the study area is unsuitable for the species



**Table 2: Likelihood of Occurrence Criteria - Threatened Fauna**

Likelihood rating	Criteria
Known	The species was observed within the study area
High	It is likely that a species inhabits or utilises habitat within the study area
Moderate	Potential habitat for a species occurs on the site and the species may occasionally utilise that habitat. Species unlikely to be wholly dependent on the habitat present within the study area
Low	It is unlikely that the species inhabits the study area. If present at the site the species would likely be a transient visitor. The site contains only very common habitat for this species which the species would not rely on for its on-going local existence.
None	The habitat within the study area is unsuitable for the species

## 2.2 Field survey

### 2.2.1 Remote camera deployment

Remote, motion activated cameras (Scoutguard 8MP) were deployed across 20 sites within the study area. Each site was located at least 800 metres apart, to ensure for spatial independence and maximise the likelihood of detecting the Spotted-tail Quoll. The location of the remote camera sites is shown on Figure 2. Cameras were baited with a mixture of fresh chicken frames, chicken wings and chicken legs, along with meat flavoured dry dog food. Where possible, the baits were held in place by logs and rocks to maximise their longevity. Cameras were installed on 2<sup>nd</sup> October 2013 and retrieved on 9<sup>th</sup> October 2013, resulting in seven continuous nights of use at each site. This translated to a combined survey effort of 144 camera nights.

### 2.2.2 Spotlighting and call playback

Spotlighting occurred across 15 sites within the study area. At each site, a 300 metre spotlighting transect was established, which was traversed by a fauna ecologist highly experienced in detecting arboreal and nocturnal fauna (Drs Chris Mclean and Rod Kavanagh) walking at a speed of approximately 1 kilometre per hour. At the end of the transect, call playback through a 10 watt megaphone was undertaken for the Koala, for 3 minutes, before spotlighting occurred on the return transect, at a speed of approximately 2 kilometres per hour. The location of any threatened fauna were recorded via GPS, while the count for any non threatened fauna represented the maximum known to be alive on the site, i.e. the maximum number of animals observed from either the first or return pass of the transect.

### 2.2.3 Koala Spot Assessment Technique (SAT) plots

Koala Spot Assessment Technique (SAT) plots (after Phillips and Callaghan 2011) were undertaken at 16 sites throughout the study area, including four plots directly within the

subject site (Figure 2). At each location, the ground beneath 30 trees with a diameter of at least 10 cm was searched for two minutes. This was to determine either the presence (or absence) of Koala from that particular area and also to determine the relative level of Koala activity within each SAT site.

#### **2.2.4 Targeted orchid surveys**

Two ecologists traversed the entire proposal area over a six hour period, in search of any Newcastle Doubletail and Sand Doubletail Orchids. These species of orchids have a restricted flowering period (August and early to mid September), thus the survey was opportunistic and the presence of these species within the proposal area could not be discounted even with a null result. A reference location for the Newcastle Doubletail Orchid within Tomaree National Park was visited, where a yellow *Diuris* sp. was found to have just finished flowering.

#### **2.2.5 Habitat assessment within the proposal area**

A habitat assessment occurred within the proposal area. This included an assessment as to whether the habitat within the proposal area was suitable for a range of threatened species. In particular, in conjunction with the orchid survey, any trees that may have served as potential breeding trees for threatened owls were targeted for specific survey.

### **2.3 Limitations**

While a relatively high level of survey effort occurred via the aforementioned survey techniques for their targeted species, at times when species are at a low density, false absences still may occur. To counteract this, the Spotted-tail Quoll and Koala are assumed to be present within the study area, based on previous NSW Atlas of Wildlife records.

As the targeted orchid surveys were undertaken 2-3 weeks after the flowering period of the target species, it cannot be assumed that both species are absent from the study area. Hence, both orchid species are assumed to be present within the Project Area.

## 3 RESULTS

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### 3.1 Results of peer review literature study with regard to Koalas

Nine publications and/ or unpublished technical reports were reviewed (see below), to determine the ecology of Koalas in the Port Stephens area, the general ecology of Koalas and the effectiveness of road mitigation for Koalas.

Fauna fencing, in particular ‘floppy top’ wire fencing was reported to be extremely useful in reducing the rate of road kill for larger species (eg wallabies, Koalas), sometimes up to 100%, depending on the extent and style of the fencing.

In general it was reported that Koalas utilised fauna underpasses, including box culvert style underpasses 2.4 m wide x 1.2 m high or larger. A limiting factor to the effectiveness of underpasses for Koalas is considered to be the length of the underpass, with the reviewed studies not demonstrating that Koalas would use longer (60-100m) underpasses.

In the Port Stephens area, four peer reviewed papers were found during the database search. They found that Koalas utilised a wide range of leaves in their diet, being 19 species of *Eucalyptus* and 12 non *Eucalyptus* species. The primary habitat for the Koala in the Port Stephens area has been found to be ‘swamp forests’, where Swamp Mahogany (*Eucalyptus robusta*), Broad-leaf Paperbark (*Melaleuca quinquinervia*) and Forest Red Gum (*Eucalyptus tereticornis*) occur. These areas were most likely to contain breeding Koalas and Koalas were recorded at higher densities than other vegetation types.

**Table 3. Results of review of published literature and unpublished technical reports on Koala ecology**

AMBS 2011	Road ecology	<p>Studies were conducted before, during and after the highway upgrades had been completed and before-after the mitigation structures had been constructed. Between 2000-2010, 47 koalas were captured at Bonville and 38 of these were radio-collared and tracked. Between 1999-2001, 15 koalas were captured and radio-tracked at Yelgun-Chinderah.</p> <p>In addition, three fauna movement structures within the Bonville study area were monitored using remote cameras:</p> <ul style="list-style-type: none"> <li>• Raleigh underpass: 3 x 3 m box culvert, 100 m long</li> <li>• Natural gully underpass: 35 m wide x 4.5 m high, 30 m long</li> <li>• Land bridge overpass: 44 m wide, 80 m long</li> </ul> <p>An underpass on the old highway: 3 x 3 m box culvert, 30 m wide, was also assessed using sand traps.</p> <p>From 2008-2011, four complete crossings by koalas were recorded at the Raleigh underpass (plus a number of incomplete crossings), and five complete crossings at the natural gully underpass (plus a number of incomplete crossings). No crossings were recorded at the land bridge overpass, although some koala pellets were observed there after the completion of the study. The old highway underpass was used on at least three occasions by Koalas during 1999. The length of the Raleigh underpass (100 m) was considered to be a factor discouraging further use of this structure.</p> <p>Fauna movement structures were used mostly during September and October, corresponding to the breeding and dispersal seasons. Roadside Koalas appear to recognise the highway as a boundary feature, but at least some were able to cross it successfully. The 12 crossings recorded were likely adequate to prevent genetic isolation of the population on both sides of the highway.</p> <p>At Yelgun-Chinderah, apparently 13 crossings were recorded in 2003, but the report focuses mainly on the Bonville study.</p> <p>Mortalities: there were 65 koalas killed on the highway near Bonville between 2000 and 2010, most during the months of August to October. Only one animal was killed directly by heavy machinery during the construction phase of the highway; this was attributed to the protocols established. Five koalas were killed in 2004 on the completed highway at Yelgun-Chinderah (most July-September).</p> <p>Exclusion fences: the “floppy top” fences were effective in reducing the number of road-killed koalas, but gaps and other weaknesses (including side-roads without gates) had to be eliminated, and fences had to extend beyond the forest edge or be turned back into the forest.</p> <p>Sand plots and koala faecal pellet surveys were inefficient or ineffective methods for assessing koala movements and ecology in the context of highway upgrades.</p> <p>The report cites three other AMBS studies that recorded 8 koalas “using” highway underpasses.</p>
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<p>Bond and Jones 2008</p> <p>Road ecology.</p> <p>Results of the upgrading of a major arterial road in Brisbane and the use of two underpasses and one overpass by wildlife (the koala was not present).</p>	<p>Monitoring of road-kill was undertaken for 4 months before construction and after the completion of construction of 2 additional lanes making a 4 lane road. Assessment of the use of two underpasses and a large overpass ('land-bridge') started 6 months after construction using sand tracking in underpasses and scat sampling on the land-bridge.</p> <p>On average, 1-5 tracks per day (all species combined, but excluding the koala which was not present in this study) were detected in the underpasses at the start of the survey (August 2005), increasing steadily to ~42 tracks per day by February 2006. Thereafter, monthly surveys (June 2006-June 2007) showed regular use of the underpasses by a wide range of species and species-groups, the most abundant being 'rodents', most likely <i>Rattus</i> species, but also frequently bandicoots (mainly <i>Isoodon macrourus</i>), possums (mainly <i>Trichosurus vulpecula</i>), dogs and cats. The land-bridge was also used continuously by three species of macropod (<i>Macropus rufogriseus</i>, <i>Wallabia bicolor</i> and <i>Macropus giganteus</i>) with brown hare (<i>Lepus capensis</i>) becoming increasingly common in summer 2006. Full crossings of the road through the underpasses were highly variable among the taxa and between surveys.</p> <p>The exclusion fencing was extremely effective in preventing most road-kill, at least of larger species, except following human-related breaches in the fence.</p>
<hr/> <p>Goosem 2012</p> <p>Road ecology</p> <p>A review of the ecological impacts and measures to mitigate adverse effects of roads on fauna. Emphasis on roads and fauna in North Queensland rainforests.</p>	<p>Australian mitigation measures concentrate on two important impacts: road mortality and terrestrial habitat fragmentation. Other important ecological impacts of roads are seldom addressed, including edge effects, traffic disturbance, exotic invasions and fragmentation of stream habitats. In North Queensland, faunal underpasses and canopy bridges across rainforest roads have been monitored over long periods. These structures are used frequently by multiple individuals of various species, implying effectiveness for movements and dispersal of many generalist and specialised rainforest animals. However, without addressing population and genetic implications, assessment of effectiveness of these connectivity structures is not holistic and requires long-term funding to allow systematic monitoring before and after construction. More holistic approaches to mitigation of road impacts would routinely examine population and genetic connectivity.</p>

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- Lunney *et al.* Koala ecology in the Port Stephens area. 1998
- Development of a koala habitat map to assist local land use planning in the Port Stephens Shire.
- The aim of this study was to define, rank and map the distribution of koala habitat in Port Stephens Shire, New South Wales. The procedure was to merge the results of two independent survey techniques (faecal pellet searches and a letter-box questionnaire), each of which was interpreted using a vegetation map specifically prepared for this study. A field survey used a plot-based sampling protocol to determine tree species preferences based on the presence/absence of koala faecal pellets. Data were obtained on 8,764 trees comprising 19 eucalypt and 12 non-eucalypt species. A high-profile community survey obtained 2,756 koala records. Koala habitat maps from both survey methods were examined as overlapping GIS layers. Combined koala habitat categories were then devised, ranked and mapped across the Shire.
- Primary koala habitat was identified as vegetation associations dominated by *E. robusta* and/or *E. parramattensis* and/or *E. tereticornis*. Preferred koala habitat comprised 7,367 ha, or 18.4% of total koala habitat, corresponding to 9.0% of the Shire. Supplementary koala habitat was 9,778 ha, or 24.4% of total koala habitat, corresponding to 11.9% of the Shire.
- Some of the identified habitat no longer supports extant koala populations. This is most notable in the western and northern parts of the Shire where evidence suggests a widely dispersed, low density population, possibly comprising transient individuals, rather than established, sedentary, breeding populations. Breeding koala populations are largely focused on discrete areas of preferred and supplementary habitat on the Tilligerry Peninsula and the Tomago Sandbeds in the eastern part of the Shire.
- The remaining areas of preferred habitat should be afforded the highest level of environmental protection available. Supplementary habitat is widespread but also requires protection, with possibly less development constraints as for preferred habitat.
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- Lunney *et al.* Koala ecology in the Port Stephens area. 2007
- A desktop exercise (population viability analysis) in which koala population parameters and the impacts of fire and dog predation on koala survival are estimated over varying time intervals.
- The Port Stephens koala *Phascolarctos cinereus* population has been regarded as one of the strongholds for koalas in New South Wales. This study applied population viability analysis to investigate the impact of fire and predation by dogs on the viability of the local population. The rapid decline of the modelled koala population under basic assumptions (i.e. the status quo) throws the assumed security of such large populations into question. In all the modelled management scenarios, reducing mortality had more influence than any other factor in maintaining the size of the koala population. Reducing the severity and frequency of large catastrophic fires improved the probability of survival for the population, though the modelled population size still declined sharply. Any management action to improve koala survival must be accompanied by a reduction in mortality from dog attacks. Fires and dogs will have an ever greater impact on koala populations as coastal forests become more fragmented and isolated by urban development, and their combined control will be needed to complement land-use planning measures to address habitat loss and fragmentation.

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- Matthews *et al.* Koala ecology in the Port Stephens area. 2007
- Fifty-five koalas were monitored regularly by radio-tracking for up to 35 months between March 1994 and February 1997, shortly after the extensive wildfire of January 1994. Half of the animals tracked were released from captivity where they had received treatment for burns or other injuries, with the remainder wild-caught individuals.
- Tree species selected by 55 radio-collared koalas following wildfires in 1994.
- Regeneration of the forest began immediately following the fires and within three months koalas were seen among the epicormic growth. From a total 4631 trees used by koalas, 3247 (70%) were burnt. Observations of koalas feeding included 53% in burnt trees. Koalas changed trees frequently, with individuals rarely recorded in the same tree on more than two occasions.
- Swamp mahogany (*Eucalyptus robusta*) was the tree species most frequently used by koalas, particularly at night and by breeding females. Another commonly-used tree species was *Angophora costata*. Females were more frequently sighted in *E. robusta*, *M. quinquenervia*, *E. parramattensis* and eucalypt complexes, while males were more frequently sighted in *C. gummifera*, *E. signata* and its hybrid *E. haemostoma/E. signata*, and *E. pilularis*. Of the two preferred food tree species recognised by Phillips *et al.* (2000) for koalas in Port Stephens, *E. parramattensis* was used by 11 females and 11 males, and *E. robusta* was used by 26 females and 21 males. Breeding females used *E. robusta*, *E. pilularis* and *M. quinquenervia* more than other members of the population.
- Koalas used a wide range of tree sizes, from less than 10 cm DBH to greater than 90 cm DBH, but preferred trees of larger diameter (>30 cm). They used significantly taller trees during summer. The study showed that resource depletion from intense wildfire is short-term for koalas because they utilise burnt trees within months of the fire for both food and shelter.
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- Phillips *et al.* Koala ecology in the Port Stephens area. 2000
- Koala pellets were located within 41 of 58 pellet search plots during November 1994 - March 1996. In total, 3847 trees were assessed, collectively comprising 15 *Eucalyptus* species and 17 species of non-eucalypt. Koala faecal pellets were recorded from beneath 10 *Eucalyptus* species and 9 species of non-eucalypt.
- Koala tree species preferences as determined using faecal pellet searches around the base of trees in 58 0.16 ha plots
- Two tree species were most preferred: swamp mahogany (*E. robusta*) and drooping red gum (*E. parramattensis*). Increases in the levels of use of other tree species were positively associated with the presence of *E. robusta* and/or *E. parramattensis*.

<p>Taylor and Goldingay 2003</p> <p>Road ecology.</p> <p>Reports wildlife usage of nine underpasses constructed on the Pacific Highway near Brunswick Heads, NSW.</p>	<p>Culverts have been used for a number of decades in North America and Europe to reduce wildlife road kills, but only recently have they been employed in Australia. Sand-strip surveys were used to investigate wildlife usage at nine purpose-built culverts along a 1.4 km section of the Pacific Highway. Culverts were reinforced concrete 2.4 m wide x 1.2 m high, and 18 m long.</p> <p>Surveys during two eight-day periods in spring and summer 2000 recorded 1202 traverses by wildlife through the culverts. Frequent culvert users were bandicoots (25% of traverses), rats (25%), wallabies (13%) and cane toads (14%). The koala was recorded crossing once through two different culverts. Surveys for road-kills on this road section suggest that the exclusion fence bordering the highway prevented mammal road-kills and channelled mammals to the culverts. Culverts and exclusion fencing facilitate safe passage across a road for a range of wildlife species, and this management response to reducing wildlife mortality on roads should be adopted more widely.</p> <p>Some culverts were prone to flooding and could not be surveyed. These culverts may be unsuitable as fauna crossings during periods of inundation.</p>
<p>Taylor and Goldingay 2010</p> <p>Road ecology.</p> <p>Reviewed 244 published studies from the previous decade on road and vehicle impacts on wildlife worldwide.</p> <p>76% of these studies were conducted in North America and Europe, with only 17% in Australia.</p>	<p>Roads disrupt population processes of vertebrate wildlife species through habitat fragmentation and vehicle collision. Despite a prevalence of studies on wildlife road mortality (34%), population impacts are poorly described, although negative impacts are implicated for many species. Barrier effects of roads were examined in 44 studies, with behavioural aversion leading to adverse genetic consequences identified for some species.</p> <p>The installation of road-crossing structures for wildlife has become commonplace worldwide, but has largely outpaced an understanding of any population benefits. Road underpasses appear to be an important generic mitigation tool because a wide range of taxa use them. A national strategy to mitigate the impacts of roads on wildlife populations is long overdue and requires research funding to investigate key issues.</p> <p>Taylor and Goldingay reported only 5 studies that investigated wildlife road-crossing structures in Australia (total sample size: adapted culverts [14], underpasses [4], overpass [1], and canopy rope bridges [2]).</p>
<p>Griffith University 2012</p> <p>Monitor before-and-after movement patterns of koalas in the immediate vicinity of each selected study site, and assess whether retrofitted structures and wildlife-proof fencing influence koala movements over time.</p>	<p>Fitted GPS radio collars to 36 Koalas over a 2 year period. Found that Koalas readily moved through retrofitted culverts. The fauna fencing virtually eliminated collisions with Koalas.</p>



### 3.2 Review of previous ecological studies from within and adjacent to the subject site

The original ecological assessment for the proposal was completed by Lesryk (2012). Lesryk (2012) undertook limited spotlighting within the subject site on three nights, where it is stated that spotlighting sessions lasted for between 15-30 minutes. Ultrasonic bat recording occurred at four sites for one night each. Lesryk (2012) recorded three Newcastle Doubletail Orchids (*Diuris praecox*) in the 2011 flowering season (listed as vulnerable under both the TSC and EPBC Acts) adjacent to the Anna Bay cemetery. However in the 2012 flowering season, these individuals could not be found by ecologists from Lesryk, potentially due to the construction of a service station on private land.

Three species of microbat, each listed as vulnerable under the TSC Act, were recorded within the subject site during the ultrasonic bat detection, being the Greater Broad-nosed Bat (*Scoteanax rueppellii*), Little Bent Wing Bat (*Miniopterus australis*) and the Eastern Bent Wing Bat (*Miniopterus schreibersii*), with the Greater Broad-nosed Bat being a hollow-dependent species, while the two latter species are cave dwelling species.

Lesryk (2012) recorded five vegetation communities within the subject site, two of which are commensurate with Endangered Ecological Communities (EECs) under the TSC Act, being Swamp Mahogany-Flooded Gum-Paperbark Open Forest, which is commensurate with Swamp Sclerophyll Forest on the NSW North Coast Bioregion (of which approximately 0.7 hectares will be removed by the proposal) and Swamp Oak Woodland, which is commensurate with Swamp Oak Forest on the NSW North Coast Bioregion (of which approximately 0.06 hectares will be removed by the proposal). At least 79 hollow-bearing trees were recorded as requiring removal (Lesryk 2012).

Seven Part Tests of Significance were completed by Lesryk (2012) for two EECs, cave and hollow-dependent microbat species, Grey-headed Flying Fox, threatened parrots and the Varied Sittella.

Located immediately to the north of the study area on Nelson Bay Road at Lot 2, DP 747399 Anna Bay, a Species Impact Statement (SIS) was prepared for a proposed luxury resort development by Cumberland Ecology (2007). That particular site is low lying and subsequently contains vegetation communities that, in general, are different to the proposal area for the Nelson Bay Road upgrade, Stage 3. Cumberland Ecology (2007) and other consultants beforehand undertook extensive field surveys on the site between 2003 and 2007 including arboreal and terrestrial trapping, nocturnal call playback for threatened owls and arboreal marsupials, spotlighting, diurnal searches, ultrasonic bat recording and vegetation survey and mapping. Cumberland Ecology (2007) recorded the following threatened species within the above site:

- Wallum Froglet;
- Squirrel Glider;
- Koala;
- Australasian Bittern;
- Black Bittern;
- Grey-headed Flying Fox;

- Yellow-bellied Sheathtail Bat;
- Eastern Freetail Bat;
- Little Bent Wing Bat;
- Greater Broad Nosed Bat;
- Eastern Cave Bat.

No threatened flora species were recorded within the study area.

### 3.3 Updated Database Search results

The following species were considered as having a moderate or greater likelihood of occurrence during a review of the NSW Bionet database records:

- Squirrel Glider;
- Brush-tailed Phascogale;
- Square-tailed Kite;
- Little Eagle;
- Eastern Osprey;
- Black Bittern;
- Australasian Bittern;
- Wallum Froglet;
- Sand Doubletail Orchid.

### 3.4 Roadkill Records

The Hunter Koala Preservation Society was contacted to discuss the level of roadkill impacts on Koalas along Nelson Bay Road. Over the past three months three Koalas have been hit by vehicles and historically the area often has Koala impacts. A summary of the number of Koalas impacted by vehicles at Bobs Farm from Hunter Koala Preservation Society records has been attached as Appendix C. In summary, 18 Koalas have been impacted within or adjacent to the subject site. The majority of these collisions have occurred within the vicinity of Trotter Road and Hellenvale Lane. Subsequently the two fauna underpasses are proposed to be established in the vicinity of these collisions at both Trotter Road and Hellenvale Lane.

### 3.5 Spotlighting and call playback surveys

Koalas were recorded at four out of 15 spotlighting transects, being located in Tilligerry Nature Reserve (3 out of 3 sites contained Koalas) and Fenninghams Island (1 out of 3 sites contained Koalas). Spotlighting also recorded one Masked Owl at Tilligerry Nature Reserve and one Powerful Owl at Worimi National Park. Squirrel Gliders were recorded at one site at Fenninghams Island and also on one occasion within the subject site.

The density and diversity of arboreal marsupials was relatively low, considering the availability of hollows and the general high quality of the habitat. The only other arboreal marsupials recorded during spotlighting were the Common Ringtail Possum and the Common Brushtail Possum. For a summary of the results of the spotlighting surveys, see Table 4.

### 3.6 Koala spot assessment technique (SAT) plot surveys

Evidence of Koala activity in the form of faecal pellets (scats) were recorded at six out of 16 SAT plots. No evidence of Koala activity was recorded from any of the four plots completed within the proposal area. The results of the SAT plots are included in Table 5.

### 3.7 Motion camera surveys

A total of 14 fauna species were recorded during the motion camera survey which included birds, reptiles and mammals. No Spotted-tail Quolls were recorded during the surveys. The results of the motion camera surveys are included in Table 6. Some of the photos recorded during the camera surveys are included below.



**Plate 1: Typical camera trap setup showing baits pegged to the soil to maximise their longevity.**



**Plates 2 and 3: Long-nosed Bandicoot and Short-beaked Echidna**

**Table 4: Results of spotlighting surveys for nocturnal species from transects (after two visits).**

Site name	Koala	Squirrel Glider	Common Ringtail Possum	Common Brushtail Possum	Tawny Frogmouth	Powerful Owl	Masked Owl	Southern Boobook	Australian Owlet Nightjar
Fenninghams 1	X	X						X	
Fenninghams 2				X				X	X
Fenninghams 3				X				X	X
Tilligerry 1	X			X					
Tilligerry 2	X			X					
Tilligerry 3	X						X	X	
Worimi 1			X						
Worimi 2			X		X				X
Worimi 3			X	X					
Worimi 4						X			X
Impact 1		X		X	X				
Impact 2									X
Boat Harbour 1			X						
Boat Harbour 2									
Tomaree 1									

**Table 5: Results of Koala Spot Assessment Technique (SAT) plots from this study.**

Note dominant tree species include Coastal Blackbutt (*Eucalyptus pilularis*), Old Man Banksia (*Banksia serrata*), Mahogany (*Eucalyptus umbra*), Red Bloodwood (*Corymbia gummifera*), Smooth-barked Apple (*Angophora costata*), Broad-leaved Paperbark (*Melaleuca quinquinervia*), Flooded Gum (*Eucalyptus grandis*), Swamp Mahogany (*Eucalyptus robusta*), Forest Oak (*Allocasuarina torulosa*) and Swamp Oak (*Casuarina glauca*). Percentages in brackets indicate the relative frequency of each tree species within the stand.

Site name	Dominant canopy tree species	Number of Koala scats present from 30 trees	Other scats present	Habitat Critical to the Survival of the Species (DSEWPaC 2012)
Impact 1	<i>E. pilularis</i> (80%)/ <i>A. costata</i> (20%)	Nil	Squirrel Glider	No
Impact 2	<i>E. pilularis</i> (80%)/ <i>A. costata</i> (20%)	Nil	Common Brushtail Possum	No
Impact 3	<i>E. pilularis</i> (80%)/ <i>A. costata</i> (20%)	Nil	Common Brushtail Possum	No
Impact 4	<i>E. grandis</i> (50%)/ <i>E. robusta</i> (50%)	Nil	Common Ringtail Possum	Yes
Fenninghams 1	<i>E. pilularis</i> (40%)/ <i>C. gummifera</i> (20%) / <i>E. umbra</i> (20%) / <i>A. costata</i> (20%)	3/30	Nil	No
Fenninghams 2	<i>E. pilularis</i> (50%)/ <i>A. costata</i> (20%)/ <i>E. umbra</i> (20%)/ <i>B. serrata</i> (10%)	Nil	Common Brushtail Possum	No
Tilligerry 1	<i>E. pilularis</i> (60%)/ <i>A. costata</i> (30%) / <i>C. gummifera</i> (10%)	Nil	Common Brushtail Possum	No
Tilligerry 2	<i>E. robusta</i> (40%)/ <i>E. pilularis</i> (30%)/ <i>M. quinquinervia</i> (20%)/ <i>A. costata</i> (10%)	8/30	Nil	Yes
Tilligerry 3	<i>M. quinquinervia</i> (30%)/ <i>E. robusta</i> (30%) / <i>A. costata</i> (20%)/ <i>A. torulosa</i> (20%)	13/ 30	Nil	Yes
Tomaree 1	<i>M. quinquinervia</i> (50%)/ <i>E. pilularis</i> (40%)/ <i>A. costata</i> (10%)	Nil	Nil	Yes
Boat Harbour 1	<i>E. pilularis</i> (80%)/ <i>A. costata</i> (20%)	2/30	Nil	No
Boat Harbour 2	<i>E. robusta</i> (50%)/ <i>C. glauca</i> (30%)/ <i>M. quinquinervia</i> (20%)	5/30	Nil	Yes
Worimi 1	<i>E. robusta</i> (30%)/ <i>B. serrata</i> (20%)/ <i>M. quinquinervia</i> (30%)/ <i>E. pilularis</i> (20%)	1/30	Nil	Yes
Worimi 2	<i>E. pilularis</i> (70%) / <i>A. costata</i> (20%) / <i>B. serrata</i> (10%)	Nil	Swamp Wallaby	No
Worimi 3	<i>E. pilularis</i> (70%)/ <i>B. serrata</i> (20%) / <i>A. costata</i> (10%)	Nil	Common Brushtail Possum	No
Worimi 4	<i>E. pilularis</i> (60%)/ <i>A. costata</i> (20%)/ <i>B. serrata</i> (20%)	Nil	Nil	Yes

**Table 6: Results of observed fauna from the remote camera sites**

Site	Rodent	Lace monitor	Square Tail Kite/ Whistling Kite	Australian Raven	Swamp wallaby	Brown Antechinus	Common Brush- tail Possum	Red Fox	Northern Brown Bandicoot	Echidna	Long Nosed Bandicoot	Kookaburra	Magpie	Eastern Osprey
5	1	1												
8		1	1	1	1	1								
9	1	1					1							
7		1	1		1			1						
1			1	1	1	1								1
12		1	1		1		1		1					
13	1	1	1		1					1				
11		1						1			1			
17		1		1			1							
16					1									
18		1					1	1				1		
15														
14														
6														
4					1		1							
2		1			1		1							
3		1	1											
19		1			1	1	1							
20		1		1						1			1	
10		1						1		1				

## 4 FINDINGS AND RECOMMENDATIONS

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### 4.1 Findings

Koalas were recorded within the study area, although at a relatively low density at most sites, and no koalas were recorded within the subject area. However, from the Koala SAT plots, it is known that Koalas occur on both sides of Nelson Bay Road and widening of the road will increase fragmentation, thus it is recommended that the proposal provide effective movement corridors to allow for the movement of Koalas across the road corridor.

Spotted-tail Quolls were not recorded on the remote cameras, although due to their large home range, numerous previous records within 10 kilometres (however the most recent records are from 2008) and elusive nature, this species may still be present within the study area.

The Squirrel Glider was recorded within the subject site, thus appropriate mitigation measures should be installed for this species.

No terrestrial orchids were recorded within the proposal area, however due to the survey being several weeks after the peak flowering period for the threatened Newcastle Doubletail and Sand Doubletail Orchids, their occurrence within the proposal area cannot be discounted.

With the implementation of the recommendations outlined below, no significant impact is expected to occur on any species listed under the TSC Act, therefore a Species Impact Statement (SIS) is not required under the TSC Act.

With regard to species listed under the EPBC Act, a significant impact is unlikely for the Spotted-tailed Quoll, New Holland Mouse and Newcastle Doubletail Orchid. However, due to the removal of 0.7 hectares of habitat considered critical to the survival of the Koala (in accordance to assessment using EPBC Significant Impact Guidelines for the Koala), the number of roadkill records of the Koala along the present road, and the potential fragmentation of an important Koala population, a significant impact on the Koala is considered likely, unless adequate mitigation measures are employed.

### 4.2 Recommendations

#### 4.2.1 Mitigation

It is recommended that the following mitigation measures are implemented to minimise the effect of the road project on the ecology of the area.

##### 4.2.1.1 Preparation and implementation of Koala Plan of Management

Due to the presence of candidate Core Koala Habitat (after Port Stephens Council and Australian Koala Foundation 2002) within the proposal area (i.e. an area dominated by Swamp Mahogany) and the known occurrence of Koalas within the proposal area, it is recommended that a Koala Plan of Management be prepared, specifically dealing with



potential impacts and appropriate mitigation measures for the subject site. The Koala Plan of Management should consider monitoring and mitigation measures pre construction, during construction and post construction, in order to minimise any potential impacts of the proposal on the local Koala population. The Koala Plan of Management should be peer reviewed by a recognised expert in Koala ecology prior to its implementation.

#### **4.2.1.2 Implementation of ecological monitoring of the Koala within the local landscape**

This survey conducted field surveys that can serve as a baseline for ecological monitoring of the Koala within the local landscape. It is recommended that one additional survey period occurs prior to the commencement of construction, one survey immediately following the clearing, followed by annual surveys for two years after the completion of the project, during the Spring Koala breeding season (August-November).

These surveys will consist of the 15 spotlighting transects, while it is also proposed that 30 permanent Koala SAT plots be established (i.e. an additional 14 plots), some of which should be located closer to the proposal area to monitor for Koala activity. Liaison with private landholders may be required to access such sites. The purpose of the monitoring is to determine if long-term change in the occupancy of habitat at varying distances from the road project occurs. While cause and effect may not be able to be inferred from this particular approach, when combined with the use of other methods (eg consideration of Koala roadkill records from the Hunter Koala Preservation Society), some level of inference of impact is possible.

Satellite tracking via GPS collars of at least four Koalas is recommended prior to construction. The Koalas should be located within 4km of the study area and ideally individuals should be located from both the north and south of Nelson Bay Road, however due to the low density of animals within the Worimi Conservation Lands, this may be difficult to achieve. Tracking should commence in Spring 2013, with a preference given to the installation of collars to subadult animals as they are the individuals most likely to undertake migrations. However difficulties may occur in obtaining collars that allow for 'growth' thus advice from collar manufacturers suggest that it may be better to use fully grown adult Koalas (Pers Comm, Chris Muller, Sirtrack, October 2013).

#### **4.2.1.3 Implementation of ecological monitoring of the Spotted-tail Quoll within the local landscape**

The occurrence/ and or density of Spotted-tail Quoll within the landscape is currently poorly understood. The continued use of the same 20 sites used for the survey completed for this study for a further two survey periods (one survey period being pre-construction and one survey period during clearing) are considered adequate for determining if sufficient densities of Spotted-tail Quolls occur within the landscape, to allow for long term monitoring, however the continued use of the remote cameras should be reviewed at the conclusion of the post clearing monitoring. If Quolls are detected in certain areas, then this may warrant additional survey effort or alternative methods (eg GPS collars) to gain useful information of their occurrence and habitat use within the Tomaree Peninsula.

#### **4.2.1.4 Pre clearance surveys**

Due to the known presence of the Squirrel Glider in the study area and the likely occurrence of the Brush-tailed Phascogale and Koala within the study area, pre clearance surveys must be implemented. These surveys must be coordinated and completed by a suitably qualified wildlife ecologist who holds appropriate licences and approvals.

Specifically the pre clearance surveys must employ a thermal camera before dawn (i.e. before 5am) to ensure no Koalas are present within any of the trees earmarked for clearance that day. Where Koalas are present, they must be lured down from the tree using an appropriate method accepted for the humane relocation of Koalas and again be supervised by a suitably qualified wildlife ecologist or veterinarian. Any Koalas recorded within the clearance area should be fitted with a GPS collar and its movements monitored for six months.

It is likely that a number of the tree hollows within the project area are utilised by hollow-dependent fauna (eg Squirrel Glider). Whenever practical, a thermal camera or endoscope should be used to conduct the pre-clearance surveys for the use of hollow-bearing trees by fauna. The impact to these animals must be minimised in accordance with Pre-clearing Process in RMS Biodiversity Guidelines (RTA 2010).

#### **4.2.1.5 Nesting box installation and monitoring**

Nesting boxes should be installed adjacent to the impact area in order to offset the loss of hollow-bearing trees within the project area. Specifically the nesting boxes should target the threatened hollow-dependent fauna known or considered as having the potential to use the area. These include the Squirrel Glider, Brush-tailed Phascogale and threatened hollow-dependent microbats. At least 70% of the proposed Nesting boxes should be installed at least one month prior to the removal of hollow-bearing trees and should be monitored for the first year to determine their usage and to complete any required maintenance. Due to the high density of hollows adjacent to the proposal area, nesting boxes should be grouped in areas where lower densities of hollow-bearing trees occur. A nest box plan should also be prepared, which should identify GPS locations of each nesting box and identify the proposed methodology for the ecological monitoring and maintenance of the boxes.

#### **4.2.1.6 Installation of rope ladder crossing**

In order to facilitate the movement of the Brush-tailed Phascogale and Squirrel Glider across Nelson Bay Road, a rope ladder would be installed in the vicinity of Helensvale Road. While the effectiveness of rope ladders in mitigating impacts on the Brush-tailed Phascogale and Squirrel Gliders is known from other projects (eg Hume Highway, Pacific Highway), monitoring will occur on the rope ladder consisting of the installation of a series of cameras in place along rope ladder to determine the frequency and use of the ladder and if partial or complete crossings are occurring.

#### **4.2.1.7 Installation of fauna underpasses**

Two fauna underpasses, each consisting of a 2.4m wide x 1.2 m high pre-cast concrete box culvert would be installed adjacent to Trotter Road and adjacent to Helensvale Lane to

allow for the passage of Koalas, Spotted-tail Quoll and terrestrial fauna (eg Swamp Wallabies) from the Worimi Conservation Lands in the south, to other vegetated areas in the north. Each underpass should be monitored with a remote motion activated camera, for a three month period, twice annually for two years post construction to determine their usage.

#### **4.2.1.8 Installation of ‘floppy top’ fauna fencing**

‘Floppy top’ fauna fencing should be installed along the frontage of the Worimi Conservation Lands within the project area (a distance of approximately 2.5km). Furthermore, as far as is possible, fencing should also be installed on the northern side of Nelson Bay Road in the vicinity of the fauna underpasses at Trotter Road and Hellenvale Lane to maximise the effectiveness of the fauna underpasses at those locations. Where practical, any other areas of native vegetation adjacent to the proposal area should have fauna fencing installed. The fauna fencing should be monitored in perpetuity for any breaches and repairs made as required.

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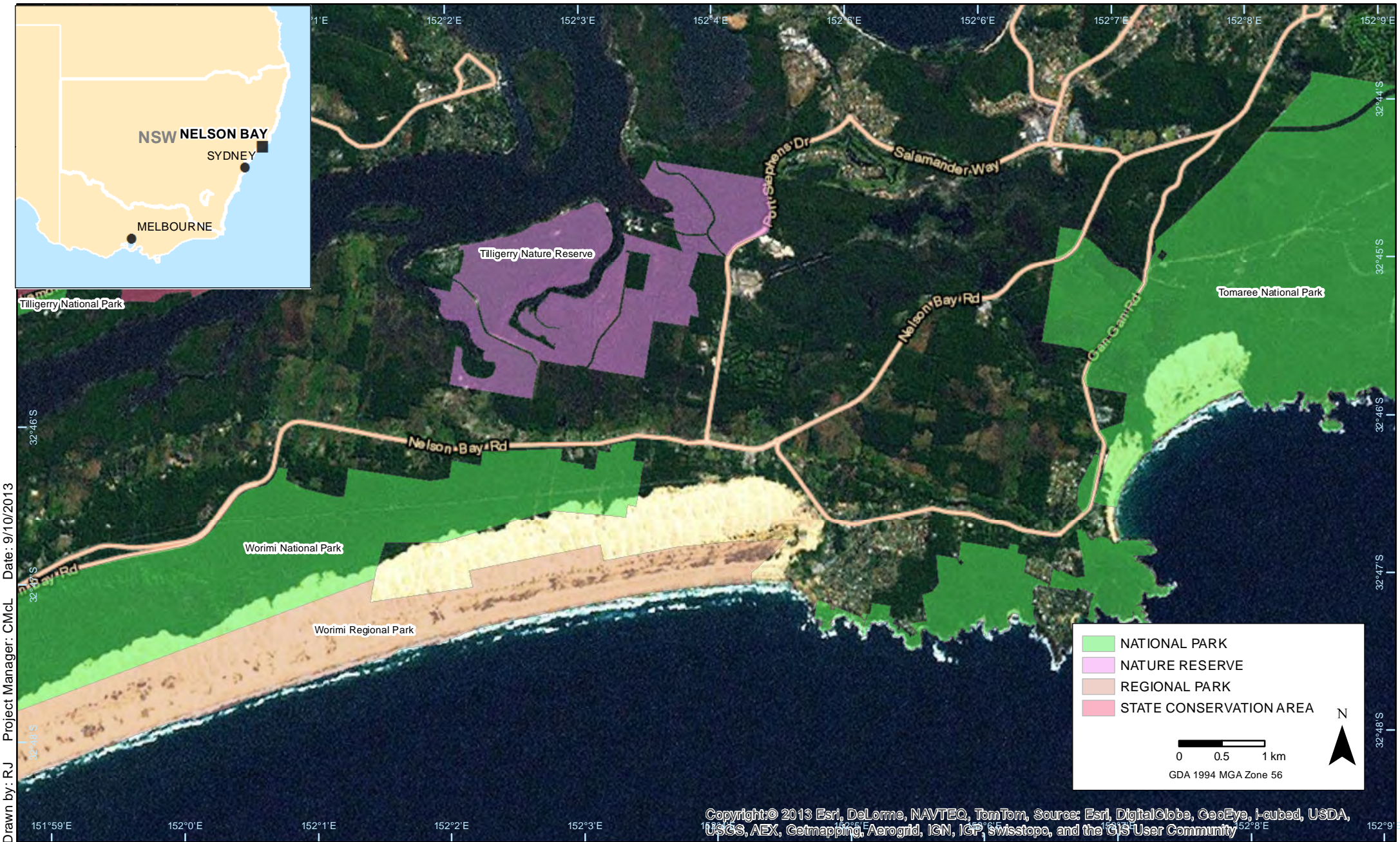
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## APPENDICES

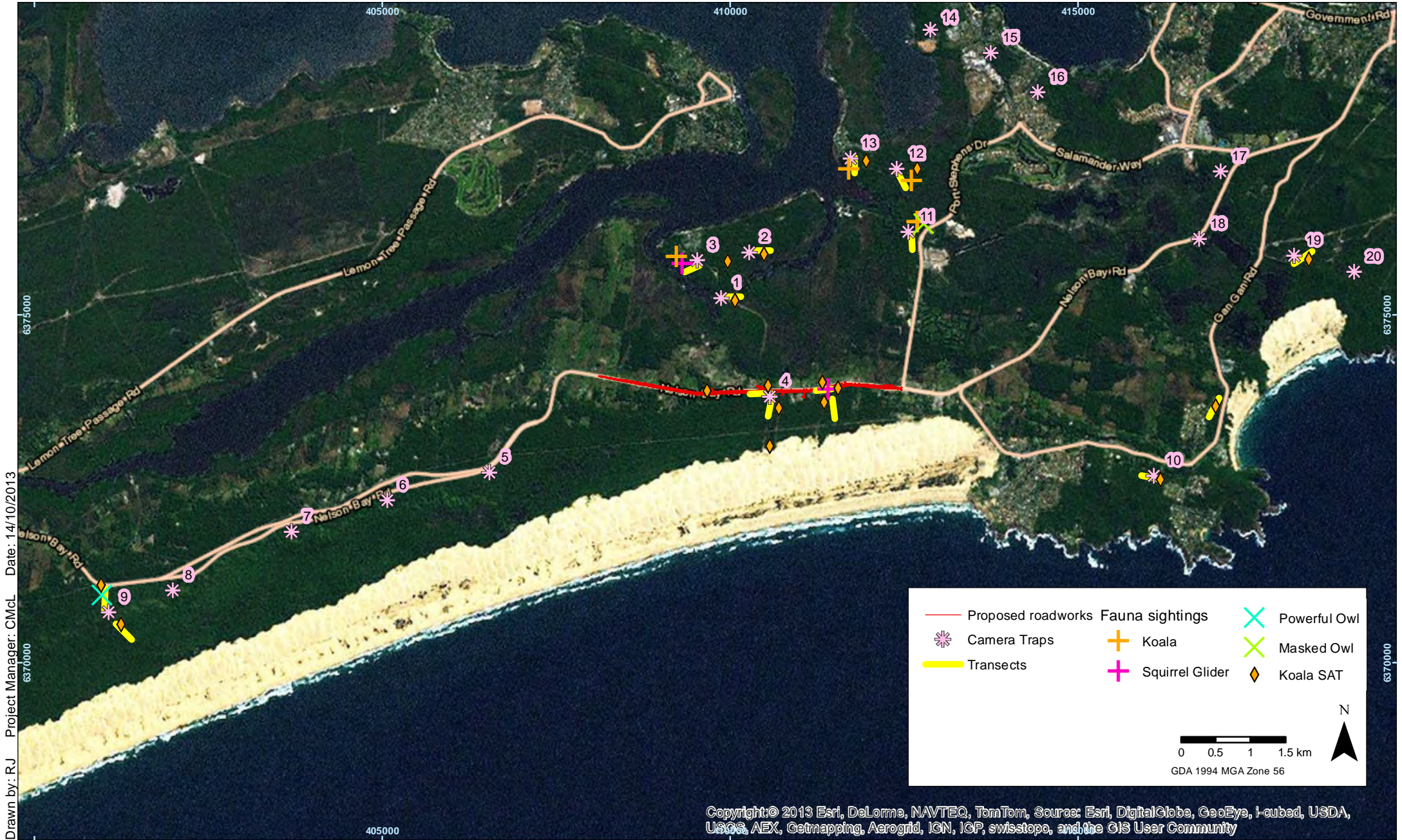
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## Appendix A- Figures



Regional Project Location  
 Nelson Bay Road EPBC Referral Supplementary Information

**FIGURE 1**



Survey Effort  
 Nelson Bay Road EPBC Referral Supplementary Information

**FIGURE 2**





EPBC-listed Fauna  
Nelson Bay Road EPBC Referral Supplementary Information

\*See Figures 5 and 6 for Koala records

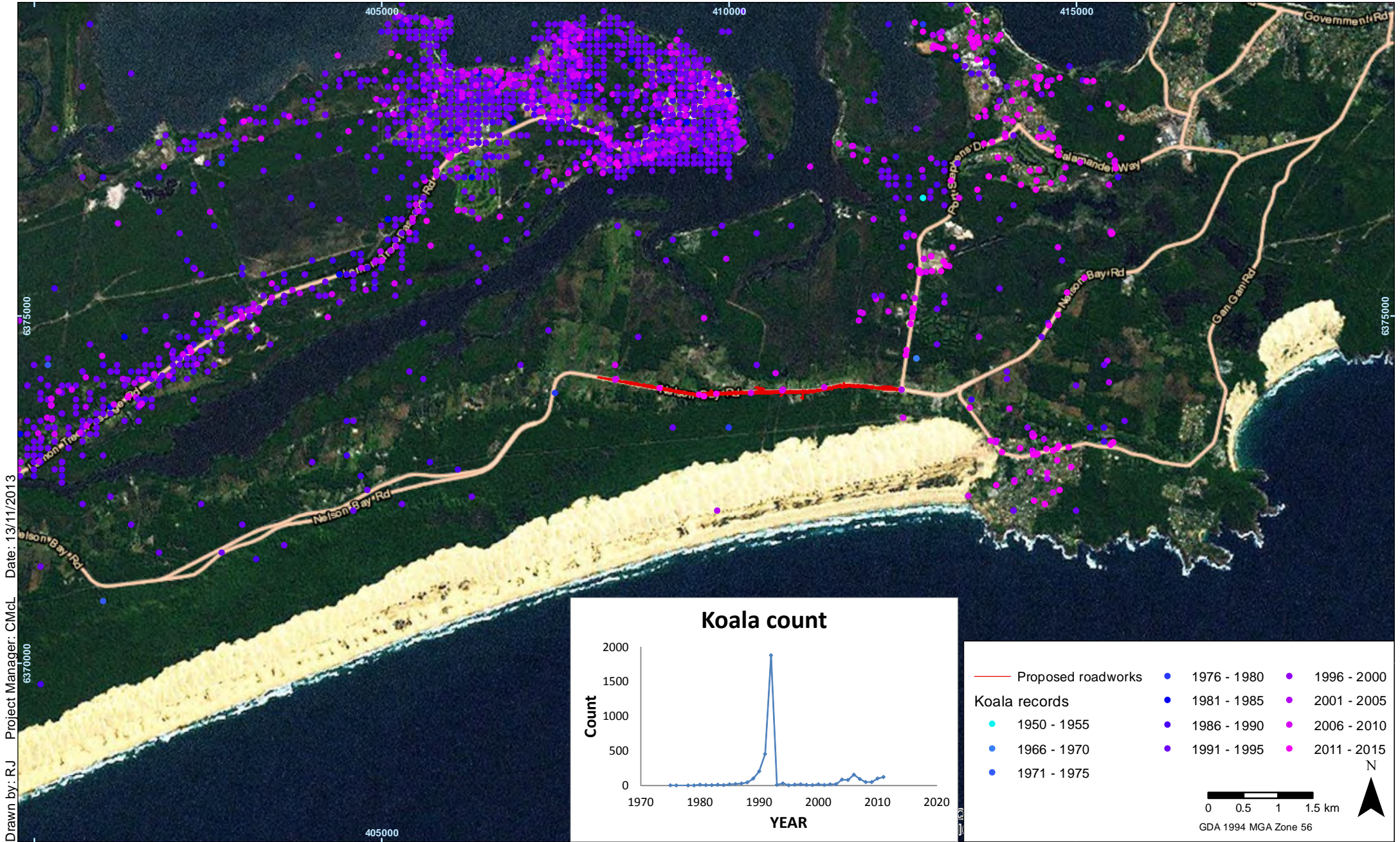
**FIGURE 3**



TSC-listed Fauna  
 Nelson Bay Road EPBC Referral Supplementary Information

\*See Figures 5 and 6 for Koala records

**FIGURE 4**



Drawn by: RJ Project Manager: CMcL Date: 13/11/2013

Koala Temporal Records  
 Nelson Bay Road EPBC Referral Supplementary Information

**FIGURE 5**



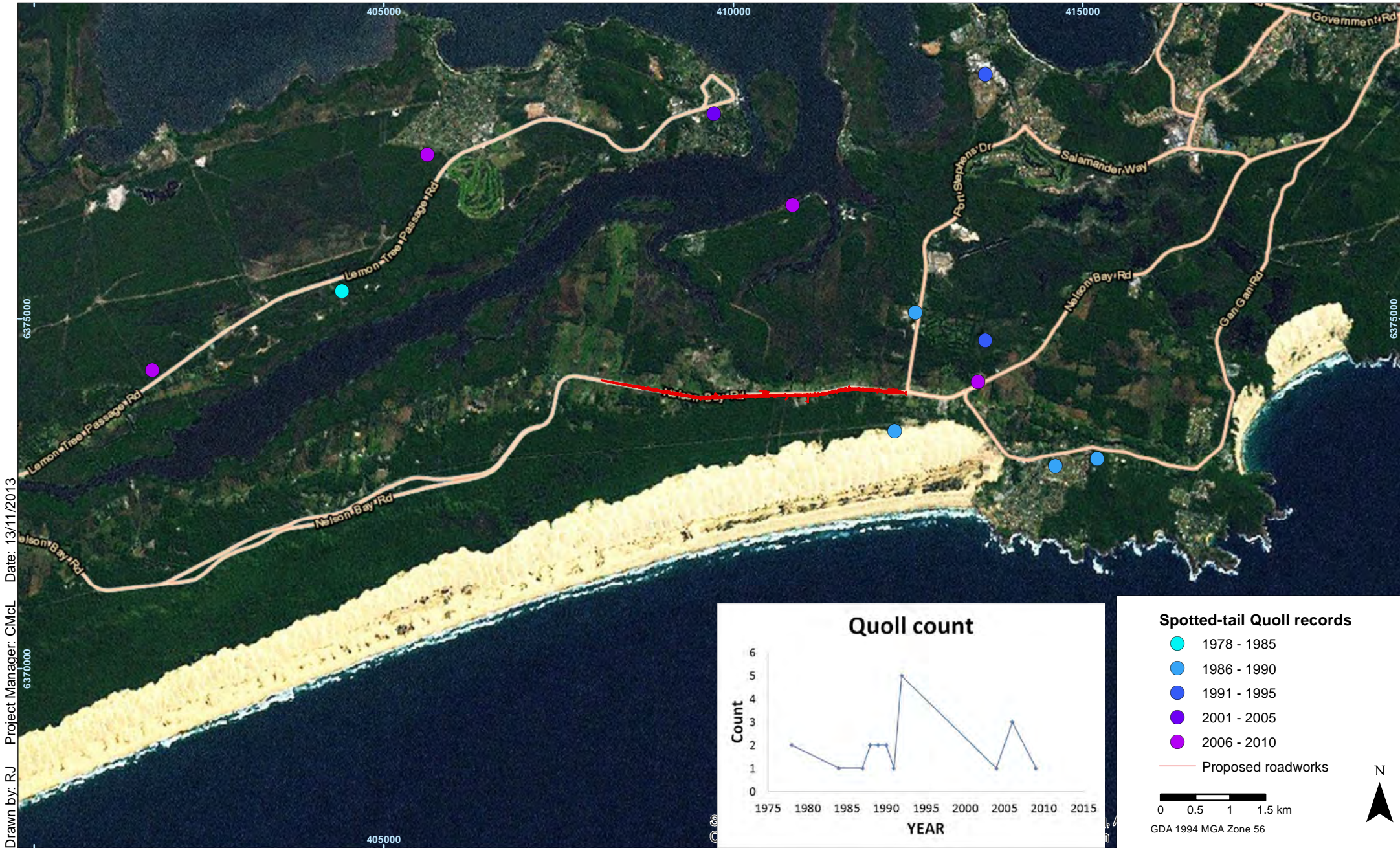
Koala Traffic Incidents  
Nelson Bay Road EPBC Referral Supplementary Information

**FIGURE 6**



Koala on-road incidents 2008 - 2013  
 Nelson Bay Road EPBC Referral Supplementary Information

**FIGURE 7**  
 Imagery: (c) RMS



Drawn by: RJ Project Manager: CMcL Date: 13/11/2013

Spotted-tail Quoll Temporal Records  
Nelson Bay Road EPBC Referral Supplementary Information

**FIGURE 8**



Location of fauna fencing and fauna crossing points  
Nelson Bay Road EPBC Referral Supplementary Information

**FIGURE 9**

## Appendix B.1: Likelihood of occurrence tables from Department of the Environment Protected Matters Search Tool

### Fauna

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat	Likelihood of Occurrence
<i>Litoria aurea</i>	Green and Golden Bell Frog	E	V	Inhabits a very wide range of water bodies including marshes, dams and streams, particularly those containing emergent vegetation such as bullrushes or spikerushes. It also inhabits numerous types of man-made water bodies including quarries and sand extraction sites. Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow, have a grassy area nearby and diurnal sheltering sites available.	Low; there is an absence of suitable habitat (wetlands with emergent plants) within the proposal area.
<i>Mixophyes balbus</i>	Stuttering Frog	E	V	Associated with streams in dry sclerophyll and wet sclerophyll forests and rainforests of more upland areas of the Great Dividing Range of NSW and down into Victoria. Breeding occurs along forest streams with permanent water where eggs are deposited within nests excavated in riffle zones by the females and the tadpoles swim free into the stream when large enough to do so. Outside of breeding, individuals range widely across the forest floor and can be found hundreds of metres from water	None, no suitable rainforest stream habitat occurs
<i>Mixophyes iteratus</i>	Giant Barred Frog	E	E	This species is found along larger streams of the coast and adjacent ranges of NSW and SE QLD. It inhabits rainforest and wet sclerophyll forest, but is also found within cleared farmland where fringing vegetation is retained, including lantana beds. Many sites where the Giant Barred Frog is known to occur are the lower reaches of streams which have been affected by major disturbances such as clearing, timber harvesting and urban development in their headwaters.	None, no suitable rainforest stream habitat occurs
<i>Anthochaera phrygia</i>	Regent Honeyeater	E	E,M	The Regent Honeyeater mainly inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. Birds are also found in drier coastal woodlands and forests in some years. This species has contracted dramatically in the last 30 years to between north-eastern Victoria and south-eastern	Low-Moderate; may feed in Swamp Mahogany during the winter flowering period.



Scientific Name	Common Name	TSC Act	EPBC Act	Habitat	Likelihood of Occurrence
				Queensland. There are only three known key breeding regions remaining: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley and the Bundarra-Barraba region. In NSW the distribution is very patchy and mainly confined to the two main breeding areas and surrounding fragmented woodlands. In some years flocks converge on flowering coastal woodlands and forests.	
<i>Lathamus discolor</i>	Swift Parrot	E	E	The Swift Parrot occurs in woodlands and forests of NSW from May to August, where it feeds on eucalypt nectar, pollen and associated insects. The Swift Parrot is dependent on flowering resources across a wide range of habitats in its wintering grounds in NSW. This species is migratory, breeding in Tasmania and also nomadic, moving about in response to changing food availability.	Moderate; may forage within the Swamp Mahogany within the proposal area during flowering.
<i>Rostratula australis</i>	Australian Painted Snipe	E	E, M	In NSW, this species has been recorded at the Paroo wetlands, Lake Cowell, Macquarie Marshes and Hexham Swamp. Most common in the Murray-Darling Basin. Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds.	Low, due to the absence of suitable wetlands (rather than swamp forest) within the proposal area.
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V	-	Spotted-tailed Quoll are found on the east coast of NSW, Tasmania, eastern Victoria and north-eastern Queensland. Only in Tasmania is it still considered common. Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline.	Moderate, suitable habitat occurs.
<i>Pseudomys novaehollandiae</i>	New Holland Mouse	-	V	The New Holland Mouse currently has a disjunct, fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. Across the species' range the New Holland Mouse is known to inhabit open heathlands, open woodlands with a heathland understorey, and vegetated sand dunes.	Moderate, suitable habitat occurs.
<i>Phascolarctos cinereus</i>	Koala	V	V	Inhabits eucalypt forests and woodlands. The suitability of these forests for habitation depends on the size and species of trees present, soil nutrients, climate and rainfall.	Known/recorded

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat	Likelihood of Occurrence
<i>Potorous tridactylus</i>	Long-nosed Potoroo	V	-	Inhabits coastal heath and wet and dry sclerophyll forests. Generally found in areas with rainfall greater than 760 mm. Requires relatively thick ground cover where the soil is light and sandy.	Low, while suitable habitat occurs, no local records occur.
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	V	This species is a canopy-feeding frugivore and nectarivore of rainforests, open forests, woodlands, melaleuca swamps and banksia woodlands. Bats commute daily to foraging areas, usually within 15 km of the day roost although some individuals may travel up to 70 km.	Known, previously recorded within the proposal area by Lesryk (2012).
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	Located in a variety of drier habitats, including the dry sclerophyll forests and woodlands to the east and west of the Great Dividing Range. Can also be found on the edges of rainforests and in wet sclerophyll forests. This species roosts in caves and mines in groups of between 3 and 37 individuals.	Low, prefers drier, less coastal habitat.

## Flora

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat	Likelihood of Occurrence
<i>Allocasuarina defungens</i>	Dwarf Heath Casuarina	E	E	Found only in NSW from the Nابیac area, north-west of Forster, to Byron Bay on the NSW north coast. Grows mainly in tall heath on sand, but can also occur on clay soils and sandstone. The species also extends onto exposed nearby-coastal hills or headlands adjacent to sandplains.	Low, no suitable habitat occurs
<i>Prostanthera densa</i>		V	V	Villous Mintbush is generally grows in sclerophyll forest and shrubland on coastal headlands and near coastal ranges, chiefly on sandstone, and rocky slopes near the sea.	Low, no suitable habitat occurs.
<i>Streblus pendulinus</i>	Siah's Backbone	-	E	Siah's Backbone is a tree or large shrub that grows to 6 m in height. Found in warmer rainforests, chiefly along watercourses.	Low, no suitable habitat occurs
<i>Eucalyptus camfieldii</i>		V	V	Restricted distribution in a narrow band with the most northerly records in the Raymond Terrace Area south to Waterfall. Localised and scattered distribution	Low, no suitable habitat occurs.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat	Likelihood of Occurrence
				includes sites at Norah Head (Tuggerah Lakes), Peats Ridge, Mt Colah, Elvina Bay Trail (West Head), Terrey Hills, Killara, North Head, Menai, Wattamolla and a few other sites in Royal National Park. Poor coastal country in shallow sandy soils overlying Hawkesbury sandstone. Coastal heath mostly on exposed sandy ridges. Occurs mostly in small scattered stands near the boundary of tall coastal heaths and low open woodland of the slightly more fertile inland areas.	
<i>Eucalyptus parramattensis</i> <i>subsp. decadens</i>		V	V	Generally occupies deep, low-nutrient sands, often those subject to periodic inundation or where water tables are relatively high. It occurs in dry sclerophyll woodland with dry heath understorey. It also occurs as an emergent in dry or wet heathland. Often where this species occurs, it is a community dominant.	Low-moderate, potential habitat occurs, however despite targeted searches no individuals have been recorded.
<i>Melaleuca biconvexa</i>		V	V	Grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects. Scattered and dispersed populations found in the Jervis Bay area in the south and the Gosford-Wyong area in the north.	Low, no local records occur.
<i>Cryptostylis hunteriana</i>	Leafless Tongue-orchid	V	V	Grows in swamp-heath on sandy soils, chiefly in coastal districts, south from the Gibraltar Range.	Low, the habitat is not damp enough for this species.
<i>Diuris praecox</i>		V	V	Occurs between Ourimbah and Nelson Bay. Grows on hills and slopes of near-coastal districts in open forests which have a grassy to fairly dense understorey. Exists as subterranean tubers most of the year. It produces leaves and flowering stems in winter.	Known
<i>Phaius australis</i>	Southern Swamp Orchid	E	E	Swampy grassland or swampy forest including rainforest, eucalypt or paperbark forest, mostly in coastal areas.	Low, no suitable habitat occurs
<i>Tetratheca juncea</i>		V	V	Confined to the northern portion of the Sydney Basin bioregion and the southern portion of the North Coast bioregion in the local government areas of Wyong, Lake Macquarie, Newcastle, Port Stephens, Great Lakes and Cessnock. It is usually found in low open forest-woodland with a mixed shrub understorey and grassy	Low, no suitable habitat occurs.

<b>Scientific Name</b>	<b>Common Name</b>	<b>TSC Act</b>	<b>EPBC Act</b>	<b>Habitat</b>	<b>Likelihood of Occurrence</b>
				groundcover. The majority of populations occur on low nutrient soils associated with the Awaba Soil Landscape. Cryptic species that requires survey in September-October.	

Key: 1) Listed on the TSC Act as Endangered (E), Vulnerable (V), Endangered Population (EP), Preliminary Determination (PD) 2) Listed on the EPBC Act as Endangered (E) or Vulnerable (V). Habitat descriptions taken from the relevant profiles on the DECCW Threatened Species web-site unless otherwise stated.

## Appendix B.2: Likelihood of occurrence for species listed under the Threatened Species Conservation Act 1995

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat	Likelihood of occurrence within subject site
<i>Crinia tinnula</i>	Wallum Froglet	V	-	Wallum Froglets are found in acid paperbark swamps and sedge swamps of the coastal 'wallum' country. Their tadpoles are adapted to acid conditions and may be outcompeted by the Common Froglet. Males call from the base of vegetation in and around the breeding site and are almost impossible to locate. Calling occurs from Autumn to Spring, being most strongly associated with flooding following rainfall. Its range extends from SE QLD to the Kurnell Peninsular of Sydney.	Moderate; suitable habitat occurs
<i>Pandion haliaetus</i>	Osprey	V	-	Ospreys are found right around the Australian coast line, except for Victoria and Tasmania. They are common around the northern coast, especially on rocky shorelines, islands and reefs. The species is uncommon to rare or absent from closely settled parts of south-eastern Australia. Favour coastal areas, especially the mouths of large rivers, lagoons and lakes. Feed on fish over clear, open water.	Moderate; potential roosting habitat occurs
<i>Burhinus grallarius</i>	Bush Stone-curlew	E	-	The Bush Stone-curlew is found throughout Australia except for the central southern coast and inland, the far south-east corner, and Tasmania. Only in northern Australia is it still common however and in the south-east it is either rare or extinct throughout its former range. Inhabits open forests and woodlands with a sparse grassy groundlayer and fallen timber. Largely nocturnal, being especially active on moonlit nights.	Low; suitable habitat (open grassy forests) are absent from the subject site.
<i>Calyptorhynchus lathamii</i>	Glossy Black-Cockatoo	V	-	Inhabits forest with low nutrients, characteristically with key Allocasuarina spp. Tends to prefer drier forest types with a middle stratum of Allocasuarina below Eucalyptus or Angophora. Often	Low; the preferred foraging

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat	Likelihood of occurrence within subject site
				confined to remnant patches in hills and gullies. Breed in hollows stumps or limbs, either living or dead. Endangered population in the Riverina.	resource ( <i>Allocasuarina</i> fruit) is absent from the subject site.
<i>Dromaius novaehollandiae</i>	Emu population in the New South Wales North Coast Bioregion and Port Stephens local government area	EP	-	The species was formerly widespread in north-eastern NSW, but that population is now isolated and largely restricted to coastal and near-coastal areas between Ballina - Evans Head and Red Rock, extending west to the Bungawalbin area. There have also been recent records from the Port Stephens area. On the NSW north coast, Emus occur in a range of predominantly open lowland habitats, including grasslands, heathland, shrubland, open and shrubby woodlands, forest, and swamp and sedgeland communities, as well as the ecotones between these habitats.	Low; suitable open plains habitat is generally absent from the subject site.
<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork	E	-	Mainly found on shallow, permanent, freshwater terrestrial wetlands, and surrounding marginal vegetation, including swamps, floodplains, watercourses and billabongs, freshwater meadows, wet heathland, farm dams and shallow floodwaters, as well as extending into adjacent grasslands, paddocks and open savannah woodlands. They also forage within or around estuaries and along intertidal shorelines, such as saltmarshes, mudflats and sandflats, and mangrove vegetation.	Low; suitable large wetlands with standing water absent from the subject site.
<i>Daphoenositta chrysoptera</i>	Varied Sittella	V	-	Inhabits wide variety of dry eucalypt forests and woodlands, usually with either shrubby under storey or grassy ground cover or both, in all climatic zones of Australia. Usually in areas with rough-	Known; recorded within the

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat	Likelihood of occurrence within subject site
				barked trees, such as stringybarks or ironbarks, but also in paperbarks or mature Eucalypts with hollows.	subject site by LesyK (2012)
<i>Glossopsitta pusilla</i>	Little Lorikeet	V	-	Distributed in forests and woodlands from the coast to the western slopes of the Great Dividing Range in NSW, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri. Mostly occur in dry, open eucalypt forests and woodlands. They feed primarily on nectar and pollen in the tree canopy. Nest hollows are located at heights of between 2 m and 15 m, mostly in living, smooth-barked eucalypts. Most breeding records come from the western slopes.	High; suitable foraging habitat occurs
<i>Lathamus discolor</i>	Swift Parrot	E	E	The Swift Parrot occurs in woodlands and forests of NSW from May to August, where it feeds on eucalypt nectar, pollen and associated insects. The Swift Parrot is dependent on flowering resources across a wide range of habitats in its wintering grounds in NSW. This species is migratory, breeding in Tasmania and also nomadic, moving about in response to changing food availability.	Low-moderate; suitable winter flowering habitat (Swamp Mahogany) occurs, however the patch is small and isolated.
<i>Ninox connivens</i>	Barking Owl	V	-	Generally found in open forests, woodlands, swamp woodlands and dense scrub. Can also be found in the foothills and timber along watercourses in otherwise open country.	High; suitable habitat occurs
<i>Tyto capensis</i>	Grass Owl	V	-	Found in areas of tall grass, including grass tussocks, in swampy	Low; suitable

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat	Likelihood of occurrence within subject site
				areas, grassy plains, swampy heath, and in cane grass or sedges on flood plains.	wetland habitat does not occur within the subject site
<i>Tyto novaehollandiae</i>	Masked Owl	V	-	Inhabits a diverse range of wooded habitat that provide tall or dense mature trees with hollows suitable for nesting and roosting. Mostly recorded in open forest and woodlands adjacent to cleared lands. Nest in hollows, in trunks and in near vertical spouts or large trees, usually living but sometimes dead. Nest hollows are usually located within dense forests or woodlands. Masked owls prey upon hollow-dependent arboreal marsupials, but terrestrial mammals make up the largest proportion of the diet.	High; suitable habitat occurs throughout the subject site.
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V	-	Spotted-tailed Quoll are found on the east coast of NSW, Tasmania, eastern Victoria and north-eastern Queensland. Only in Tasmania is it still considered common. Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline.	Moderate; suitable habitat occurs within the subject site.
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	V	-	The Brush-tailed Phascogale has a patchy distribution around the coast of Australia. In NSW it is mainly found east of the Great Dividing Range although there are occasional records west of the divide. Prefer dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. Also inhabit heath, swamps, rainforest and wet sclerophyll forest.	High; suitable habitat occurs within the subject site.
<i>Saccolaimus</i>	Yellow-bellied	V	-	Roosts singly or in groups of up to six, in tree hollows and	High;



Scientific Name	Common Name	TSC Act	EPBC Act	Habitat	Likelihood of occurrence within subject site
<i>flaviventris</i>	Sheath-tail-bat			buildings; in treeless areas they are known to utilise mammal burrows. When foraging for insects, flies high and fast over the forest canopy, but lower in more open country. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory.	potential habitat occurs within the subject site
<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	V	-	Most records are from dry eucalypt forests and woodlands to the east of the Great Dividing Range. Appears to roost in trees, but little is known of this species' habits.	High; potential habitat occurs within the subject site.
<i>Petaurus norfolcensis</i>	Squirrel Glider	V	-	Generally occurs in dry sclerophyll forests and woodlands but is absent from dense coastal ranges in the southern part of its range . Requires abundant hollow bearing trees and a mix of eucalypts, banksias and acacias . There is only limited information available on den tree use by Squirrel gliders, but it has been observed using both living and dead trees as well as hollow stumps. Within a suitable vegetation community at least one species should flower heavily in winter and one species of eucalypt should be smooth barked. Endangered population in the Wagga Wagga LGA.	Known; recorded within the subject site.
<i>Phascolarctos cinereus</i>	Koala	V	V	Inhabits eucalypt forests and woodlands. The suitability of these forests for habitation depends on the size and species of trees present, soil nutrients, climate and rainfall .	Known; numerous records of roadkills occur within the subject site.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat	Likelihood of occurrence within subject site
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	V	This species is a canopy-feeding frugivore and nectarivore of rainforests, open forests, woodlands, melaleuca swamps and banksia woodlands. Bats commute daily to foraging areas, usually within 15 km of the day roost although some individuals may travel up to 70 km.	High; foraging habitat occurs throughout the subject site.
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V	-	Inhabit sclerophyll forests, preferring wet habitats where trees are more than 20 m high. Two observations have been made of roosts in stem holes of living eucalypts. There is debate about whether or not this species moves to lower altitudes during winter, or whether they remain sedentary but enter torpor. This species also appears to be highly mobile and records showing movements of up to 12 km between roosting and foraging sites.	High; potential habitat occurs within the subject site.
<i>Miniopterus australis</i>	Little Bentwing-bat	V	-	Coastal north-eastern NSW and eastern Queensland. Little Bentwing Bat is an insectivorous bat that roost in caves, in old mines, in tunnels, under bridges, or in similar structures. They breed in large aggregations in a small number of known caves and may travel 100s km from feeding home ranges to breeding sites. Little Bentwing Bat has a preference for moist eucalypt forest, rainforest or dense coastal banksia scrub where it forages below the canopy for insects.	Known; previously recorded within the subject site by Lesryk (2012)
<i>Myotis macropus</i>	Southern Myotis	V	-	The Large-footed Myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage.	Moderate; a small area of potential habitat (open water) occurs within the

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat	Likelihood of occurrence within subject site
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V	-	Prefer moist gullies in mature coastal forests and rainforests, between the Great Dividing Range and the coast. They are only found at low altitudes below 500 m. In dense environments they utilise natural and human-made opening in the forest for flight paths. Creeks and small rivers are favoured foraging habitat. This species roosts in hollow tree trunks and branches.	Known; recorded from the subject site by Lesryk (2012)
<i>Vespadelus trougtoni</i>	Eastern Cave Bat	V	-	The Eastern Cave Bat is found in a broad band on both sides of the Great Dividing Range from Cape York to Kempsey, with records from the New England Tablelands and the upper north coast of NSW. The western limit appears to be the Warrumbungle Range, and there is a single record from southern NSW, east of the ACT.	Low; due to the absence of sandstone soil substrates, it is considered unlikely to occur.
<i>Callistemon linearifolius</i>		V	-	Recorded from the Georges River to Hawkesbury River in the Sydney area, and north to the Nelson Bay area of NSW. Recorded in 2000 at Coalcliff in the northern Illawarra. For the Sydney area, recent records are limited to the Hornsby Plateau area near the Hawkesbury River. Grows in dry sclerophyll forest on the coast and adjacent ranges.	Low; suitable habitat (dry sclerophyll forests on sandstone) do not occur within the subject site.
<i>Corybas dowlingii</i>		E	-	Sheltered areas such as gullies and southerly slopes in tall open forest on well-drained gravelly soil at elevations of 10-200 m.	Low; suitable known habitat (eg

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat	Likelihood of occurrence within subject site
					from Stony Ridge Reserve, Soldiers Point) does not occur within the subject site.
<i>Cryptostylis hunteriana</i>	Leafless Tongue-orchid	V	V	Grows in swamp-heath on sandy soils, chiefly in coastal districts, south from the Gibraltar Range.	Low; suitable damp heath style vegetation does not occur within the subject site.
<i>Diuris arenaria</i>	Sand Doubletail	E	-	Known from the Tomaree Peninsula near Newcastle. This species occurs in coastal heath and dry grassy eucalypt forest on sandy flats. Grows in gently undulating country in eucalypt forest with a grassy understorey on clay soil.	High; potential habitat occurs within the subject site.
<i>Diuris praecox</i>		V	V	Occurs between Ourimbah and Nelson Bay. Grows on hills and slopes of near-coastal districts in open forests which have a grassy to fairly dense understorey. Exists as subterranean tubers most of the year. It produces leaves and flowering stems in winter.	Known; previously recorded on the subject site by Lesryk

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat	Likelihood of occurrence within subject site (2012).
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## Appendix C: Seven Part Tests of Significance for species not already assessed

Threatened Raptors (Little Eagle, Eastern Osprey, Square-tailed Kite)	
Assessment of Significance criteria (Seven Part Test)	Address of criteria
Background	<p>The Little Eagle is listed as vulnerable under the TSC Act and is a medium-sized bird of prey. It is found throughout most of Australia and relies on habitat that supports a relatively high density of terrestrial mammals or small birds. It nests in tall trees, where it constructs a stick nest. The species occurs throughout the the woodlands to the west of the divide and formerly relied heavily on rabbits in its diet, however with the introduction of calicivirus in the mid 1990s, rabbit numbers have declined, thus having an effect on the abundance of the Little Eagle. However the main threat to the Little Eagle is the clearing and degradation of foraging and breeding habitat, with declines of up to 40% being observed over three generations, resulting in this species being recently listed as Vulnerable under the TSC Act.</p> <p>The Square-tailed Kite typically inhabits coastal forested and wooded lands of tropical and temperate Australia. In NSW it is often associated with ridge and gully forests dominated by <i>Eucalyptus longifolia</i>, <i>Corymbia maculata</i>, <i>Eucalyptus elata</i> or <i>E. smithii</i>. Individuals appear to occupy large hunting ranges of more than 100km<sup>2</sup>. They require large living trees for breeding, particularly near water with surrounding woodland -forest close by for foraging habitat. Nest sites are generally located along or near watercourses, in a tree fork or on large horizontal limbs.</p> <p>Ospreys are found right around the Australian coast line, except for Victoria and Tasmania. They are common around the northern coast, especially on rocky shorelines, islands and reefs. The species is uncommon to rare or absent from closely settled parts of south-eastern Australia. Favour coastal areas, especially the mouths of large rivers, lagoons and lakes. Feed on fish over clear, open water. Ospreys will also roost within forested habitat up to 2km from water courses.</p> <p>The Square-tail Kite and Eastern Osprey were recorded on the baited cameras at Fenningham's Island within dry sclerophyll forest.</p>
a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	The proposal will result in the removal approximately 5 hectares of potential foraging habitat for these species. Several thousand hectares of foraging habitat occur either immediately adjacent to, or within 3km of the proposal area, thus the removal of 5ha of habitat for a species that has a home range of many thousand hectares is considered to be minimal. It is therefore concluded that the proposal is unlikely to result in an adverse effect on the life cycle of the Little Eagle, Square-tail Kite and Eastern Osprey, such that, a viable local population of the species is likely to be placed at risk of extinction.
b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction	N/A
c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed: i. Is likely to have an adverse effect on the extent of the	N/A

Threatened Raptors (Little Eagle, Eastern Osprey, Square-tailed Kite)	
Assessment of Significance criteria (Seven Part Test)	Address of criteria
<p>ecological community such that its local occurrence is likely to be placed at risk of extinction, or</p> <p>ii. Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction</p>	
<p>d) In relation to the habitat of a threatened species, population or ecological community:</p> <p>i. The extent to which habitat is likely to be removed or modified as a result of the action proposed, and</p> <p>ii. Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and</p> <p>iii. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.</p>	<p>Approximately 5 ha of habitat is proposed to be removed as a result of the Upgrade. The habitat will be completely removed for the construction of a dual carriageway of Nelson Bay Road.</p> <p>While the proposal will result in fragmentation of habitat to the north and to the south of Nelson Bay Road, due to being highly mobile species that can fly over cleared areas, the level of fragmentation is considered to be non significant.</p> <p>The habitat proposed for removal is not considered to be important for the long term survival of the Little Eagle, Eastern Osprey or Square-tailed Kite due to being commensurate with a large proportion of the Port Stephens landscape. No breeding trees were observed within the study area.</p>
<p>e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)</p>	<p>Under the TSC Act, the Director-General maintains a Register of critical habitat. To date, no critical habitat has been declared for the Little Eagle, Square-tailed Kite and Eastern Osprey.</p>
<p>f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or TAP</p>	<p>As of 13 October 2013, no recovery plan has been prepared for the Little Eagle, Square-tailed Kite or Eastern Osprey. The following priority action statements have been identified for these species:</p> <ul style="list-style-type: none"> <li>• Protect nest sites (usually large dead trees) and surrounding vegetation using appropriate buffer zones (suggest 100 metres). Preservation of the existing nest and structure is a priority and relocation should only be considered a last resort.</li> <li>• Work with managers of infrastructure to manage or translocate nests if site selection puts Osprey at risk.</li> <li>• Identify and protect regular feeding areas, perch (feeding) trees and nest material collection sites, particularly vegetation surrounding nest tree.</li> <li>• Consider direct and indirect impacts on the species and its habitat in planning processes including adequate field survey to identify nest tree, buffer protection zone, perch trees and feeding areas. Nesting season is from June to October.</li> <li>• Continue programs monitoring the breeding status of the species in NSW incorporating surveys of the number of active nest trees, breeding success at nests and protection of buffer zones and roost trees.</li> <li>• Undertake community awareness initiatives such as media campaigns, brochures and interpretive signs. These should cover issues such as the threat of discarding fish with fishing tackle attached, protection of potential and future nest trees.</li> <li>• Investigate the effectiveness of ameliorative management actions on the species including effectiveness of artificial nest structures.</li> <li>• Continue ecological research to determine whether availability of potential nest trees and/or food resources are limiting to the species as well as potential impacts of pesticides and pollutants on species breeding success.</li> <li>• Continue to consult with Aboriginal communities to determine cultural significance of the osprey.</li> <li>• Ensure implementation of management strategies that reduce disturbance of riparian areas.</li> </ul>



Threatened Raptors (Little Eagle, Eastern Osprey, Square-tailed Kite)	
Assessment of Significance criteria (Seven Part Test)	Address of criteria
	<ul style="list-style-type: none"> <li>Identify and protect nest trees, and monitor reproduction.</li> <li>Liaise with local field ornithologist to obtain data on the Square-tailed Kite in the area.</li> <li>Raise awareness non-target poisoning from baits.</li> <li>Liaise with planning authorities to minimise the loss of habitat by clearing and fragmentation associated with urban and rural development.</li> <li>Raise awareness of loss of habitat through population pressure.</li> <li>Raise awareness about microhabitats used by Little Eagle. Encourage habitat retention through PVP process.</li> </ul> <p>However none of the above threatened species recovery actions relate directly to this proposal.</p>
g) Whether the action proposed constitutes or is part of a KTP or is likely to result in the operation of, or increase the impact of, a KTP	<p>There are 37 terrestrial KTPs currently listed.</p> <p>The proposal may potentially constitute or promote the following listed KTP under the NSW TSC Act, relevant to the species being assessed:</p> <ul style="list-style-type: none"> <li>Clearing of native vegetation</li> <li>Low of hollow-bearing trees</li> </ul>
<p><b>Conclusion:</b> The proposed action is unlikely to have a significant impact on the Little Eagle, Eastern Osprey or Square-tail Kite due to the removal of a minimal amount (5hectares) of potential foraging habitat..</p>	

Barking Owl	
Assessment of Significance criteria (Seven Part Test)	Address of criteria
Background	<p>The Barking Owl is listed as vulnerable under the TSC Act and is found throughout the majority of Australia and also parts of Papua New Guinea. In New South Wales, the core populations occur in woodlands to the west of the Great Divide, where its predominant prey includes small birds, Sugar Glider and other mammals. In the Hunter Region a small population of Barking Owl is thought to occur, predominantly in the forests and woodlands of Port Stephens, including along the Tomaree Peninsula within dry Blackbutt forests and woodlands.</p> <p>The Barking Owl was not recorded during the field surveys.</p>
a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	<p>The proposal will result in the removal of less than 5 ha of potential foraging habitat for this species and potentially den sites (i.e. dense vegetation and/ or hollow bearing trees). Several thousand hectares of suitable foraging habitat occurs adjacent to the site within the Worimi Conservation Lands. It is therefore concluded that the proposal is unlikely to result in an adverse effect on the life cycle of the Barking Owl, such that, a viable local population of the species is likely to be placed at risk of extinction.</p>

Barking Owl	
Assessment of Significance criteria (Seven Part Test)	Address of criteria
b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction	N/A
c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed: <ul style="list-style-type: none"> <li>i. Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or</li> <li>ii. Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction</li> </ul>	N/A
d) In relation to the habitat of a threatened species, population or ecological community: <ul style="list-style-type: none"> <li>i. The extent to which habitat is likely to be removed or modified as a result of the action proposed, and</li> <li>ii. Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and</li> <li>iii. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.</li> </ul>	<p>Approximately 5 ha of habitat is proposed to be removed as a result of this proposal. The habitat will be completely removed for the widening of Nelson Bay Road. A targeted search along the alignment found no hollows considered as being optimal for breeding for this species.</p> <p>While the subject site has the potential to act as a wildlife corridor between area of habitat to the north and adjoining habitat to the south, due to existing previous development consent for the habitat to the north, which will result in a high level of habitat removal and modification, the subject site is no longer considered to function as a wildlife corridor, thus no habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposal. The habitat proposed for removal is not considered to be important for the long term survival of the Barking Owl due to the disturbed nature of the understorey and future level of fragmentation (once approved developments to the north of the subject site are cleared).</p>
e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)	Under the TSC Act, the Director-General maintains a Register of critical habitat. To date, no critical habitat has been declared for the Barking Owl.
f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or TAP	<p>A draft recovery plan (DEC 2008) has been prepared for the Barking Owl. The following actions are included in the plan:</p> <ul style="list-style-type: none"> <li>• Increase understanding of the biology, ecology and management of the Barking Owl</li> <li>• Increase education and awareness of and involvement in the conservation of the Barking Owl and its habitat in NSW</li> <li>• Undertake threat abatement and mitigation</li> <li>• Gain efficiencies through links with other conservation plans and conservation groups</li> <li>• Provide organisational support</li> </ul> <p>However none of these actions relate to this proposal.</p>
g) Whether the action proposed constitutes or is part of a KTP or is likely to result in the operation of, or increase the impact of, a KTP	<p>There are 37 terrestrial KTPs currently listed.</p> <p>The proposal may potentially constitute or promote the following listed KTPs under the NSW TSC Act relevant to the Barking Owl:</p> <ul style="list-style-type: none"> <li>• Clearing of native vegetation</li> </ul>

Barking Owl	
Assessment of Significance criteria (Seven Part Test)	Address of criteria
	<ul style="list-style-type: none"> <li>• Competition from feral honeybees <i>Apis mellifera</i></li> <li>• Loss of hollow-bearing trees</li> <li>• Removal of dead wood and dead trees.</li> </ul>
<p><b>Conclusion:</b> The proposed action is unlikely to have a significant impact on the Barking Owl, due to the removal of a minimal amount (5hectares) of potential foraging habitat.</p>	

Large Forest Owls (Powerful Owl and Masked Owl)	
Assessment of Significance criteria (Seven Part Test)	Address of criteria
Background	<p>Powerful Owls <i>Ninox strenua</i> are listed as vulnerable under the TSC Act and are the largest of Australia's owls and, accordingly, require a large amount of land for foraging. As stated in the recovery plan for large forest owls, the home range of this species can be from 300 to 1500 hectares. The size of the range is likely to be dependent on prey density. The most common food source is arboreal mammals; however the prey may depend on local availability and the preferences of a particular pair of owls.</p> <p>The proposed development would result in the removal or modification of up to 5 hectares of potential foraging habitat for this species. This equates to between 0.3% and 5% of the home range requirements. Removal or modification of habitat at this scale is unlikely to disrupt the foraging aspects of this species life cycle.</p> <p>The breeding roost, essentially several different trees, is used for many months of the year. Before nesting, a pair may be seen on one of their roost sites between 10-20m apart from one another, the female will then move into the nesting hollow alone and the male take up roost nearby (generally within a 50m radius of the nest but can be much more).</p> <p>Masked Owl inhabits a diverse range of dry eucalypt forest and woodland, especially adjacent to grassland or clearings. Typical home range has been estimated at 1122 to 1178 hectares. Key roosting and nesting habitat must contain tall or dense mature trees with suitable hollows. Favoured nesting hollows are near-vertical spouts or large hollows in trunks of large eucalypts. They forage mainly upon terrestrial prey in adjoining open habitat, occasionally preying upon arboreal or scansorial mammals. Rats form a large part of their diet.</p> <p>Estimating the local population of Masked Owl is problematic. The population sizes of threatened bird species can vary significantly in relation to several extrinsic factors, including altitude, biogeographical region inhabited, threats faced, and habitat used. Given that, to date, no genetic information has been collected on the population in the Hunter Valley region, the limits of the local population is considered here to be at least the individuals recorded east to Newcastle as far west as Rutherford, north to Karuah and south to the Awaba. An individual Masked Owl requires three essential elements during its life cycle: roosting and den trees, foraging habitats, and accessibility to mating partners.</p> <p>A Powerful Owl was recorded within the Worimi Conservation Lands (approximately 5km to the southwest of the subject site) and a Masked Owl was recorded within the Tilligerry Nature Reserve (approximately 5km to the north of the subject site).</p>
a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be	<p>The proposal will result in the removal of less than 5 ha of potential foraging habitat for these species. Several thousand hectares of suitable foraging habitat occurs adjacent to the site within the Worimi Conservation Lands. It is therefore concluded that the proposal is unlikely to result in an adverse effect on the life cycle of the Powerful and Masked Owls, such that, a viable local population is likely to</p>

Large Forest Owls (Powerful Owl and Masked Owl)	
Assessment of Significance criteria (Seven Part Test)	Address of criteria
placed at risk of extinction	be placed at risk of extinction.
b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction	N/A
c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed: <ul style="list-style-type: none"> <li>i. Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or</li> <li>ii. Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction</li> </ul>	N/A
d) In relation to the habitat of a threatened species, population or ecological community: <ul style="list-style-type: none"> <li>i. The extent to which habitat is likely to be removed or modified as a result of the action proposed, and</li> <li>ii. Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and</li> <li>iii. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.</li> </ul>	<p>Approximately 5 ha of habitat is proposed to be removed as a result of this proposal. The habitat will be completely removed for the widening of Nelson Bay Road.</p> <p>While the proposal will increase the level of fragmentation between the Worimi Conservation Lands to the southwest of the site and other vegetated lands to the northeast of the site (i.e increase the hostile barrier from 20-30m to approximately 50-60m), the level of fragmentation is unlikely to significant affect the movement of large forest owls within the landscape.</p> <p>The habitat proposed for removal is not considered to be important for the long term survival of the Powerful Owl or Masked Owl, as approximately 4000 ha of commensurate habitat occurs within and adjacent to the Worimi Conservation Lands, immediately adjacent to the study area.</p>
e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)	Under the TSC Act, the Director-General maintains a Register of critical habitat. To date, no critical habitat has been declared for the Powerful Owl.
f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or TAP	<p>A recovery plan for large forest owls has been prepared by DEC (2006). This plan refers to the three species Powerful Owl, Masked Owl and Sooty Owl. The specific objectives of this plan are:</p> <p>Assess the distribution and amount of high quality habitat for each owl species across public and private lands to get an estimate of the number and proportion of each species that are, and are not, protected</p> <p>To monitor trends in population parameters (numbers, distribution, territory fidelity and breeding success) across the range of the three species and across different land tenures and disturbance histories</p> <p>To assess the implementation and effectiveness of forest management prescriptions designed to mitigate the impact of timber-harvesting operations on the three owl species and, (if necessary), to use this information to refine the prescriptions so that forestry activities on state forests are not resulting in adverse changes in species abundance and breeding success</p> <p>Ensure the impacts on large forest owls and their habitats are adequately assessed during planning and environmental assessment</p>

Large Forest Owls (Powerful Owl and Masked Owl)	
Assessment of Significance criteria (Seven Part Test)	Address of criteria
	<p>processes</p> <p>Minimise further loss and fragmentation of habitat by protection and more informed management of significant owl habitat (including protection of individual nest sites)</p> <p>To improve the recovery and management of the three large forest owls based on an improved understanding of key areas of their biology and ecology</p> <p>To raise awareness of the conservation requirements of the three large forest owls amongst the broader community, to involve the community in owl conservation efforts and in doing so increase the information base about owl habitats and biology</p> <p>To coordinate the implementation of this recovery plan and continually seek to integrate actions in this plan with actions in other recovery plans or conservation initiatives.</p> <p>Objective 4 and 5 are considered relevant to this proposal. The action proposed does not involve any removal of known nesting or roosting habitat for the large forest owls, this is consistent with Objective 5. The impacts of the proposal are being adequately assessed, which is consistent with objective 4.</p>
g) Whether the action proposed constitutes or is part of a KTP or is likely to result in the operation of, or increase the impact of, a KTP	<p>To date, 37 Key Threatening Processes have been declared under the TSC Act. The proposal may potentially constitute or promote the following listed KTP under the NSW TSC Act.</p> <ul style="list-style-type: none"> <li>• Clearing of native vegetation</li> <li>• Competition from feral honeybees <i>Apis mellifera</i></li> <li>• Loss of hollow-bearing trees</li> <li>• Removal of dead wood and dead trees</li> </ul> <p>Other threats to this species include:</p> <ul style="list-style-type: none"> <li>• Historical loss and fragmentation of suitable forest and woodland habitat from land clearing for residential and agricultural development. This loss also affects the populations of arboreal prey species, particularly the Greater Glider which reduces food availability for the Powerful Owl</li> <li>• Inappropriate forest harvesting practices that have changed forest structure and removed old growth hollow-bearing trees. Loss of hollow-bearing trees reduces the availability of suitable nest sites and prey habitat</li> <li>• Can be extremely sensitive to disturbance around the nest site, particularly during pre-laying, laying and downy chick stages. Disturbance during the breeding period may affect breeding success.</li> <li>• High frequency hazard reduction burning may also reduce the longevity of individuals by affecting prey availability.</li> <li>• Road Kills</li> <li>• Secondary poisoning</li> <li>• Predation of fledglings by foxes, dogs and cats (DECCW undated).</li> </ul> <p>The proposed development is unlikely to significantly contribute to any of these processes.</p>
<p><b>Conclusion:</b> The proposed action is unlikely to have a significant impact on the Powerful Owl and Masked Owl due to the removal of a minimal amount (5hectares) of potential foraging habitat..</p>	

Spotted-tailed Quoll

Assessment of Significance criteria (Seven Part Test)	Address of criteria
Background	<p>The Spotted-tailed Quoll is listed as vulnerable under the TSC Act and is about the size of a domestic cat, from which it differs most obviously in its shorter legs and pointed face. The average weight of an adult male is about 3500 grams and an adult female about 2000 grams. It has rich-rust to dark-brown fur above, with irregular white spots on the back and tail, and a pale belly. The spotted tail distinguishes it from all other Australian mammals, including other quoll species. However, the spots may be indistinct on juvenile animals. The Spotted-tailed Quoll has been recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline.</p> <p>The range of the Spotted-tailed Quoll has contracted considerably since European settlement. It is now found on the east coast of NSW, Tasmania, eastern Victoria and north-eastern Queensland. Only in Tasmania is it still considered common. Individual animals use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites. Females occupy home ranges up to about 750 hectares and males up to 3500 hectares. They usually traverse their ranges along densely vegetated creeklines.</p> <p>The subject site provides suitable foraging habitat for this species, but was not recorded during field surveys.</p>
a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	The proposal will result in the removal of less than 5 ha of potential foraging (and possible denning) habitat for this species. Several thousand hectares of suitable foraging habitat occurs adjacent to the site within the Worimi Conservation Lands. It is therefore concluded that the proposal is unlikely to result in an adverse effect on the life cycle of the Spotted-tail Quoll, such that, a viable local population is likely to be placed at risk of extinction.
b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction	N/A
c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed: <ul style="list-style-type: none"> <li>i. Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or</li> <li>ii. Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction</li> </ul>	N/A
d) In relation to the habitat of a threatened species, population or ecological community: <ul style="list-style-type: none"> <li>i. The extent to which habitat is likely to be removed or modified as a result of the action proposed, and</li> <li>ii. Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and</li> </ul>	<p>Approximately 5 ha of habitat is proposed to be removed as a result of this proposal.</p> <p>The proposal is likely to contribute to the fragmentation of habitat for this species to the north and south of Nelson Bay Road. Without adequate mitigation, as described in the main body of the report, this may represent a significant impact. However through fauna fencing, fauna underpasses and continued monitoring at 20 sites throughout the local area (to gain an understanding of the distribution of the species in the locality), a significant impact on this species is not predicted to occur. However no records of this species occur for their use of 1.2x 2.4m culverts, however they have been known to use smaller culverts and pipes in other states (Pers Comm, Nick Mooney, Tasmanian Quoll expert, November 2013, Dean Heinze, Tasmanian Quoll Expert, November 2013). The habitat proposed for</p>

Spotted-tailed Quoll	
Assessment of Significance criteria (Seven Part Test)	Address of criteria
iii. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.	removal is not considered to be important for the long term survival of the Spotted-tail Quoll due to several thousand hectares of commensurate habitat being located elsewhere within the Port Stephens area.
e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)	Under the TSC Act, the Director-General maintains a Register of critical habitat. As at 10 October 2013, no critical habitat has been declared for any of the Spotted-tailed Quoll.
f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or TAP	<p>No recovery plan has been prepared the Spotted-tailed Quoll. However 35 action priority statements have been identified being::</p> <ul style="list-style-type: none"> <li>• Establish and maintain regional working groups in southeast and northeast NSW to coordinate research and management.</li> <li>• Research disturbance thresholds and adequacy of existing prescriptions for retention of habitat of breeding females in timber production forests.</li> <li>• Renegotiate habitat retention prescriptions in IFOAs if they are found to be inadequate following research into disturbance thresholds and habitat requirements of breeding females.</li> <li>• Research to investigate interactions between native and exotic predators and their prey to better understand the consequences of 1080 baiting at an ecosystem level.</li> <li>• Based on research, develop and implement a protocol for use of poison baits that further reduces impacts on individual Spotted-tailed Quolls.</li> <li>• Investigate the demographics of Spotted-tailed Quoll populations and use results to develop viability models for quoll populations.</li> <li>• Investigate the impact of fox and wild dog baiting on Spotted-tailed Quoll populations.</li> <li>• Assess potential risk Cane Toads pose to populations of quolls.</li> <li>• Monitor survival of Spotted-tailed Quoll populations in habitat newly colonised by cane toads.</li> <li>• The threat of cane toads to be assessed as part of the DEC Cane Toad Action Plan.</li> <li>• Seminar on quoll biology and conservation.</li> <li>• Review survey methods and assess effectiveness of different techniques to identify an optimal survey protocol. Undertake research into new methods, if necessary.</li> <li>• Conduct field and community surveys for the Spotted-tailed Quoll in areas where its distribution is poorly known. Areas identified for large-scale urban development (i.e. Far north coast, Hunter) and coastal reserves should be the highest priority.</li> <li>• Map Spotted-tailed Quoll distribution and update as additional data becomes available.</li> <li>• Identify study sites across the NSW range and within different habitat types at which long-term population monitoring can be undertaken.</li> <li>• Conduct systematic monitoring at key sites. Monitoring sites will be distributed across the NSW range of the Spotted-tailed Quoll and within different habitat types such as Kosciusko NP, Limeburner's Creek NR, northern tablelands and the Blue Mountains.</li> <li>• Develop a database and update it regularly to track population trends at monitoring sites, particularly with respect to density and survival of breeding females.</li> <li>• Develop standard data collection protocol to maximise information obtained from field surveys. Include procedure for</li> </ul>

Spotted-tailed Quoll	
Assessment of Significance criteria (Seven Part Test)	Address of criteria
	<p>monitoring disease status of wild animals and collecting and storing genetic samples.</p> <ul style="list-style-type: none"> <li>• Collect genetic samples from all Spotted-tailed Quoll populations during field surveys and regular monitoring activities.</li> <li>• Continue to undertake research on genetic diversity of populations to guide identification of appropriate genetic management units throughout range.</li> <li>• Conduct and publish ecological research on relationship between prey density, den availability and density of females in different habitat types to determine measures of habitat quality.</li> <li>• Liaise with key aboriginal groups and document understanding of Spotted-tailed Quoll's local distribution, abundance, ecology and threats.</li> <li>• Develop a licence agreement with managers of captive Spotted-tailed Quoll populations to enable recruitment to captive populations from wild populations.</li> <li>• Develop agreement with captive management institutions to facilitate use of captive animals for research when required.</li> <li>• Develop a communication strategy to raise public awareness of the Spotted-tailed Quoll, compile education resources and distribute to identified target audiences. Support community participation in survey and monitoring programs.</li> <li>• Consult with Aboriginal land managers regarding intended conservation management efforts for Spotted-tailed Quolls on lands of interest to them.</li> <li>• Erect signs in areas where road kills are common to alert drivers to the presence of Spotted-tailed Quolls.</li> <li>• Identify sections of roads where Spotted-tailed Quolls are frequently killed on roads. Conduct a media campaign to ask for public records of road kills and use data held by the relevant government agencies.</li> <li>• At sections of roads where Spotted-tailed Quolls are frequently killed, incorporate methods to reduce the numbers of animals killed. Assess the effectiveness of different mitigation methods.</li> <li>• Prepare brochure detailing designs of 'quoll-proof' poultry runs and aviaries and distribute within relevant locations.</li> <li>• Seek funding or sponsorship to subsidise landholder costs of modifying poultry runs and aviaries.</li> <li>• Habitat requirements of Spotted-tailed Quolls to be adequately conserved within environmental planning instruments and through other legislative protection mechanisms, including property vegetation plans.</li> <li>• Develop environmental impact assessment guidelines for the Spotted-tailed Quoll, which includes information on adequate survey methods, survey effort, inappropriate development proposals and impact mitigation measures.</li> <li>• Reserve Fire management Strategy(s) include operational guidelines that protect rocky outcrops and riparian zones within areas of known habitat.</li> <li>• Research and publish findings to determine impact of wildfires and prescription burns on populations, with emphasis on prey resources, refugia, impacts of foxes, cats and wild dogs/dingoes.</li> </ul> <p>Of the above criteria, the proposal conducted targeted surveys with baited cameras in the Hunter region, which is identified as an area where further surveys are required thus assisting in that action and also to assess the effectiveness of different mitigation measures. However the proposal does not relate to any of the other actions.</p>
g) Whether the action proposed constitutes or is part of a KTP or is likely to result in the operation of, or increase the impact of, a KTP	The proposal may potentially constitute or promote a number of KTPs under the NSW TSC Act, as listed below. However, each of these processes are already in operation within the subject site and the proposal includes measures to reduce additional impacts from the proposal.



Spotted-tailed Quoll	
Assessment of Significance criteria (Seven Part Test)	Address of criteria
	<ul style="list-style-type: none"> <li>• Clearing of native vegetation</li> <li>• Removal of dead wood and dead trees</li> <li>• Invasion and establishment of exotic vines and scramblers</li> <li>• Invasion of native plant communities by exotic perennial grasses.</li> </ul> <p>None of the processes mentioned above are likely to impact the population of the species within the subject site.</p>
<p><b>Conclusion:</b> The proposed action is unlikely to have a significant impact on the Spotted-tailed Quoll due to only a small area of habitat being proposed for removal (5ha) and due to the implementation of appropriate mitigation measures (fencing and underpasses).</p>	

Squirrel Glider	
Assessment of Significance criteria (Seven Part Test)	Address of criteria
Background	<p>Squirrel Gliders is listed as vulnerable under the TSC Act and inhabit mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. They prefer mixed species stands with a shrub or Acacia midstorey and they live in family groups of a single adult male one or more adult females and offspring. They require abundant tree hollows for refuge and nest sites.</p> <p>Diet varies seasonally and consists of Acacia gum, eucalypt sap, nectar, honeydew and manna, with invertebrates and pollen providing protein (DECCW undated).</p> <p>An individual Squirrel Glider requires three essential elements during its life cycle; roosting and den trees, foraging habitats (can include year round flowering resources), and accessibility to mating partners. A Squirrel Glider was observed within the subject site within Blackbutt forest while another animal was observed within a reference site (also within Blackbutt forest), approximately 3km to the north of the site.</p>
a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	The proposal will result in the removal of less than 5 ha of potential foraging and denning habitat for this species. Several thousand hectares of suitable foraging habitat occurs adjacent to the site within the Worimi Conservation Lands. It is therefore concluded that the proposal is unlikely to result in an adverse effect on the life cycle of the Squirrel Glider, such that, a viable local population is likely to be placed at risk of extinction.
b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction	N/A
c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed: <ul style="list-style-type: none"> <li>i. Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or</li> </ul>	N/A

Squirrel Glider	
Assessment of Significance criteria (Seven Part Test)	Address of criteria
ii. Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction	
d) In relation to the habitat of a threatened species, population or ecological community: <ul style="list-style-type: none"> <li>i. The extent to which habitat is likely to be removed or modified as a result of the action proposed, and</li> <li>ii. Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and</li> <li>iii. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.</li> </ul>	<p>Approximately 5 ha of habitat is proposed for to be removed as a result of this proposal. The habitat will be completely removed for the widening of Nelson Bay Road.</p> <p>The proposal will result in increased fragmentation between the north and south sides of Nelson Bay Road, which without appropriate mitigation may represent a significant impact on this species. However due to the establishment of a rope ladder across Nelson Bay Road which will allow for the passage of genetic material (i.e. individuals) it is not expected the proposal will represent a significant impact on this species. Similar rope ladders have been shown to be effective in the movement of Squirrel Gliders across the Hume Highway in southern New South Wales.</p> <p>The habitat proposed for removal is not considered to be important for the long term survival of the Squirrel Glider due being commensurate with a large proportion of the Port Stephens area, including the adjacent Tomaree National Park.</p>
e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)	Under the TSC Act, the Director-General maintains a Register of critical habitat. As at 18 April 2013, no critical habitat has been declared for any of the Squirrel Glider.
f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or TAP	<p>The following priority actions have been identified for the Squirrel Glider:</p> <ul style="list-style-type: none"> <li>• Conduct surveys on the Far South Coast, from Murramarong National Park south to Eden, to determine population size and extent and connectivity of populations (surveys should incorporate potential habitat on public as well as private land).</li> <li>• Model and predict the distribution of Squirrel Gliders across the south west slopes.</li> <li>• Delineate boundaries of population to identify the extent to which populations are interconnected (to determine propensity to move across cleared land).</li> <li>• Ensure the largest hollow bearing trees (including dead trees) are given highest priority for retention in PVP assessments and other environmental planning instruments, or other land assessment tools.</li> <li>• Control feral horses at relevant sites to promote retention and growth of mid-storey shrubs.</li> <li>• Prepare EIA guidelines which address the retention of hollow bearing trees maintaining diversity of age groups, species diversity. Give priority to largest hollow bearing trees.</li> <li>• Investigate the effectiveness of logging prescriptions.</li> <li>• Prepare a recovery plan for the Squirrel Glider.</li> <li>• Conduct surveys and assessments of less known sites to confirm presence of species and negotiate, develop and implement conservation management agreements for high priority sites.</li> </ul> <p>However none of these actions relate to the proposal.</p>
g) Whether the action proposed constitutes or is part of a KTP or is likely to result in the operation of, or increase the impact of, a KTP	The proposal may potentially constitute or promote a number of KTPs under the NSW TSC Act, as listed below. However, each of these processes are already in operation within the subject site and the proposal includes measures to reduce additional impacts from the proposal.

Squirrel Glider	
Assessment of Significance criteria (Seven Part Test)	Address of criteria
	<ul style="list-style-type: none"> <li>• Clearing of native vegetation</li> <li>• Competition from feral honeybees <i>Apis mellifera</i></li> <li>• Removal of dead wood and dead trees</li> <li>• Loss of tree hollows</li> </ul>
<p><b>Conclusion:</b> The proposed action is unlikely to have a significant impact on the Squirrel Glider due to the small extent of removal of suitable habitat (5ha), provided the recommended mitigation measures (eg rope crossing) are implemented.</p>	

Koala	
Assessment of Significance criteria (Seven Part Test)	Address of criteria
Background	<p>The Koala is listed as vulnerable under the TSC Act and is an arboreal marsupial with fur ranging from grey to brown above, and white below. It has large furry ears, a prominent black nose and no tail. It spends most of its time in trees and has long, sharp claws, adapted for climbing. Adult males weigh 6 - 12 kg and adult females weigh 5 - 8 kg. During breeding, males advertise with loud snarling coughs and bellows.</p> <p>The Koala has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. In NSW it mainly occurs on the central and north coasts with some populations in the western region. It was historically abundant on the south coast of NSW, but now occurs in sparse and possibly disjunct populations. Koalas are also known from several sites on the southern tablelands.</p> <p>Koalas inhabit eucalypt woodlands and forests where they feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. They are inactive for most of the day, feeding and moving mostly at night. They spend most of their time in trees, but will descend and traverse open ground to move between trees. Their home range size varies with quality of habitat, ranging from less than two ha to several hundred hectares in size.</p> <p>Koalas are generally solitary, but have complex social hierarchies based on a dominant male with a territory overlapping several females and sub-ordinate males on the periphery. Females breed at two years of age and produce one young per year.</p> <p>Koalas were recorded throughout the local landscape, however no Koalas were recorded within the subject site.</p>
a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	<p>The proposal will result in the removal of approximately 5 ha of Koala habitat, including 0.7ha of Swamp Mahogany dominated habitat which may constitute Core Koala Habitat as defined in the Port Stephens Comprehensive Koala Plan of Management (however this area was not mapped due to its small size). However several thousand hectares of commensurate habitat occurs within the locality. However the results from road collisions along this stretch of road suggest that Koala corridors occur at Trotter Road and Helenvale Lane, for individuals moving from breeding habitat on the northern side of Nelson Bay Road, into foraging habitat on the southern side of Nelson Bay Road. Currently the rate of road kill is at approximately 4-5 individuals per year, which may be unsustainable. The current proposal with underpasses at these locations, along with fauna fencing is likely to reduce the level of mortality. It is therefore concluded that the proposal is unlikely to result in an adverse effect on the life cycle of the Koala, such that, a viable local population is</p>

Koala	
Assessment of Significance criteria (Seven Part Test)	Address of criteria
	likely to be placed at risk of extinction.
b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction	N/A
c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed: <ul style="list-style-type: none"> <li>i. Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or</li> <li>ii. Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction</li> </ul>	N/A
d) In relation to the habitat of a threatened species, population or ecological community: <ul style="list-style-type: none"> <li>i. The extent to which habitat is likely to be removed or modified as a result of the action proposed, and</li> <li>ii. Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and</li> <li>iii. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.</li> </ul>	<p>Approximately 5 ha of habitat is proposed for to be removed as a result of this proposal. The habitat will be completely removed for the construction of stage 3 of the Nelson Bay Road upgrade.</p> <p>The area is a known crossing point for Koalas, with three reported road collisions occurring in the past few months. Subsequently without appropriate mitigation the action may constitute a significant impact on the local population of Koalas. However fauna fencing is proposed, along with two fauna underpasses and associated management plans and strategies. These mitigation measures will improve connectivity between the north and south of Nelson bay Road, and therefore, a significant impact on Koala movement is not expected to occur.</p> <p>The habitat proposed for removal is not considered to be important for the long term survival of the Koala with no Koalas being recorded during the field surveys (compared to other areas where Koalas were recorded) and because several thousand hectares of occupied habitat occurs adjacent to the proposal area.</p>
e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)	Under the TSC Act, the Director-General maintains a Register of critical habitat. As at 18 April 2013, no critical habitat has been declared for any of the Koala.
f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or TAP	<p>A NSW recovery plan (DECC 2008) has been prepared for this species and lists 7 objectives:</p> <ul style="list-style-type: none"> <li>To conserve koalas in their existing habitat</li> <li>To rehabilitate and restore koala habitat and populations</li> <li>To develop a better understanding of the conservation biology of koalas</li> <li>To ensure that the community has access to factual information about the distribution, conservation and management of koalas at a national, state and local scale</li> <li>To manage overbrowsing to prevent both koala starvation and ecosystem damage in discrete patches of habitat</li> <li>To coordinate, promote the implementation, and monitor the effectiveness of the NSW Koala Recovery Plan across NSW.</li> </ul>

Koala	
Assessment of Significance criteria (Seven Part Test)	Address of criteria
	The proposal will increase the level of understanding of the conservation biology of koalas, however will incrementally increase the level of habitat loss of Koalas. Thus the proposal is generally consistent with these objectives.
g) Whether the action proposed constitutes or is part of a KTP or is likely to result in the operation of, or increase the impact of, a KTP	The proposal may potentially constitute or promote a number of KTPs under the NSW TSC Act, as listed below. However, each of these processes are already in operation within the subject site and the proposal includes measures to reduce additional impacts from the proposal. <ul style="list-style-type: none"> <li>• Clearing of native vegetation</li> </ul>
<b>Conclusion:</b> The proposed action is unlikely to have a significant impact on the Koala provided the recommended mitigation measures (eg fauna fencing and fauna underpasses) are implemented.	

Brush-tailed Phascogale	
Assessment of Significance criteria (Seven Part Test)	Address of criteria
Background	The Brush-tailed Phascogale is listed as vulnerable under the TSC Act and is a scansorial marsupial carnivore, weighing up to 150 grams. In accordance with most Dasyurids (marsupial carnivores) the males die after only one year, leaving only females within the population. The Brush-tailed Phascogale is found in Victoria and southeastern New South Wales (south of Wollongong), north of the Hunter River to Newcastle and in the Northern Territory and in Western Australia. Genetic studies have shown that four genetically distinct 'units' occur. In the population north of the Hunter River, little is known as to their ecology. However a study in the State Forests of near Taree found that their home range was approximately 15 ha and that they had a relatively high density within Coastal Blackbutt forest.  This species was not recorded during the field surveys.
h) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	The proposal will result in the removal of less than 5 ha of potential foraging habitat for this species. Several thousand hectares of suitable foraging habitat occurs adjacent to the site within the Worimi Conservation Lands. It is therefore concluded that the proposal is unlikely to result in an adverse effect on the life cycle of the Brush-tailed Phascogale, such that, a viable local population is likely to be placed at risk of extinction.
i) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction	N/A
j) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed: iii. Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or iv. Is likely to substantially and adversely modify the	N/A

Brush-tailed Phascogale	
Assessment of Significance criteria (Seven Part Test)	Address of criteria
composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction	
<p>k) In relation to the habitat of a threatened species, population or ecological community:</p> <p>iv. The extent to which habitat is likely to be removed or modified as a result of the action proposed, and</p> <p>v. Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and</p> <p>vi. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.</p>	<p>Approximately 5 ha of habitat is proposed to be removed as a result of this proposal. The habitat will be completely removed for the widening of Nelson Bay Road.</p> <p>Due to increasing the level of fragmentation between the habitat on the north and south of Nelson Bay, two areas of habitat will become fragmented by this proposal. Without mitigation measures this may constitute a significant impact on the local population of Brush-tailed Phascogale. However due to the introduction of a rope ladder over the road, the flow of genetic diversity will occur, thus the population is considered unlikely to become significantly fragmented.</p> <p>The habitat proposed for removal is not considered to be important for the long term survival of the Brush-tailed Phascogale, as it is commensurate with several thousand hectares of other habitat within the locality.</p>
l) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)	<p>Under the TSC Act, the Director-General maintains a Register of critical habitat. As at 8 October 2013, no critical habitat has been declared for the Brush-tailed Phascogale.</p>
m) Whether the action proposed is consistent with the objectives or actions of a recovery plan or TAP	<p>No recovery plan has been prepared for this species. The following priority actions have been prepared:</p> <ul style="list-style-type: none"> <li>• Establish a long term monitoring program of Brush-tail Phascogales across at least 30 sites.</li> <li>• Undertake a targeted community education program that raises awareness of threats such as cats</li> <li>• Develop and provide environmental assessment guidelines for Local Councils and other consent or determining authorities to enable adequate consideration of the potential impacts of activities or actions on phascogales.</li> <li>• Monitor the effectiveness of forestry threatened species licence conditions and refine and negotiate changes if required.</li> <li>• Undertake research into the impact of hazard reduction burn practices.</li> <li>• Undertake fox and wild dog control at priority sites.</li> <li>• Design and implement an ecological burn (Dinner Creek) including habitat requirements of the species in Demon Nature Reserve.</li> </ul> <p>However none of these priority actions relate to the current proposal.</p>
n) Whether the action proposed constitutes or is part of a KTP or is likely to result in the operation of, or increase the impact of, a KTP	<p>The proposal may potentially constitute or promote a number of KTPs under the NSW TSC Act, as listed below. However, each of these processes are already in operation within the subject site and the proposal includes measures to reduce additional impacts from the proposal.</p> <ul style="list-style-type: none"> <li>• Clearing of native vegetation</li> <li>• Competition from feral honeybees <i>Apis mellifera</i></li> <li>• Removal of dead wood and dead trees</li> <li>• Loss of tree hollows</li> </ul>
<p><b>Conclusion:</b> The proposed action is unlikely to have a significant impact on the Brush-tailed Phascogale, due to the removal of a relatively small area of potential habitat (5ha) and the proposed mitigation measures (eg rope ladder)</p>	

Wallum Froglet	
Assessment of Significance criteria (Seven Part Test)	Address of criteria
Background	The Wallum Froglet is listed as vulnerable under the TSC Act and is a small amphibian found throughout coastal NSW and southern Queensland which occurs within semi acid swamp forests and associated wetlands.  This species was not recorded during field surveys, despite the occurrence of targeted field surveys.
o) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	The proposal will result in the removal of less than 0.7ha of marginal habitat for this species. Due to over 1000 ha of suitable habitat within the local area, it is expected that a significant impact will not occur on the Wallum Froglet, such that, a viable local population is placed at risk of extinction.
p) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction	N/A
q) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed: v. Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or vi. Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction	N/A
r) In relation to the habitat of a threatened species, population or ecological community: vii. The extent to which habitat is likely to be removed or modified as a result of the action proposed, and viii. Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and ix. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.	Approximately 0.7 ha of marginal habitat is proposed for removal as a result of this proposal. The habitat will be completely removed for the widening of Nelson Bay Road.  Due to all suitable habitat for the species occurring on the northern side of Nelson Bay Road, the proposal is considered unlikely to fragment areas of habitat for this species.  The habitat proposed for removal is not considered to be important for the long term survival of the Wallum Froglet, as it is commensurate with several thousand hectares of other habitat within the locality.
s) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)	Under the TSC Act, the Director-General maintains a Register of critical habitat. As at 8 October 2013, no critical habitat has been declared for any of the Wallum Froglet.
t) Whether the action proposed is consistent with the objectives or	No recovery plan has been prepared for this species. The following 29 priority actions have been prepared:

Wallum Froglet	
Assessment of Significance criteria (Seven Part Test)	Address of criteria
actions of a recovery plan or TAP	<ul style="list-style-type: none"> <li>• Finalise preparation of national Wallum-dependent frog species Recovery Plan.</li> <li>• Qld Environment Protection Agency, NSW Department of Environment &amp; Conservation and SE Qld Frog Recovery Team coordinate implementation of Recovery Plan.</li> <li>• Review status of species; determine whether Commonwealth listing on the EPBC Act is justified and prepare nomination if appropriate.</li> <li>• Manage cane toads in areas of known habitat.</li> <li>• Protect swamps from fire.</li> <li>• Map (and refine existing mapping of) potential habitat areas and group into habitat value categories.</li> <li>• Survey areas identified as potential habitat to determine presence/absence of target species, habitat condition, future management priorities and appropriate tenures.</li> <li>• Investigate, and where appropriate and landowners agree, implement relevant land protection and/or management mechanisms on freehold, leasehold and crown lands.</li> <li>• Rehabilitate or re-create former habitat degraded or destroyed by grazing, sand mining &amp; other activities.</li> <li>• Create habitat in corridors linking existing or rehabilitated habitat.</li> <li>• Control, and where practicable, eradicate the Plague Minnow in accordance with approved Threat Abatement Plan.</li> <li>• Ensure regional fire plans and hazard reduction guidelines include protocols for protection of <i>Crinia tinnula</i> habitat.</li> <li>• Control stormwater runoff, drainage, ground water extraction and associated changes in water chemistry, pH, quality and quantity that may adversely impact on habitats and/or species' populations.</li> <li>• Develop and implement measures to minimise the spread of the disease chytridiomycosis to and between habitats.</li> <li>• Control, and where practicable, eradicate feral pigs.</li> <li>• Monitor selected populations of the Wallum Froglet to determine population trends and species' responses to threatening processes.</li> <li>• Monitor populations and habitat of sites before and after development to determine impacts of the developments and effectiveness of ameliorator measures.</li> <li>• Improve knowledge and understanding of aspects of the species' biology and ecology (e.g. non-breeding habitat use and population dynamics), taxonomy and genetics that are related to /or are impacted by conservation and management, habitat fragmentation. <ul style="list-style-type: none"> <li>• Determine impacts of Plague Minnow the Wallum Froglet in accordance with the <i>Gambusia</i> Threat Abatement plan.</li> <li>• Determine impacts of pesticides and herbicides (from agriculture, weed and mosquito control, etc) on habitat and individual the Wallum Froglet.</li> </ul> </li> <li>• Investigate potential impacts of global climate change (particularly sea level rises) on habitat nature and extent.</li> <li>• Investigate impacts of current fire management practices on habitats and populations.</li> <li>• Investigate impacts of stormwater runoff, drainage, groundwater extraction and associated changes in water chemistry, pH, quantity and quality on species' habitats and/or populations.</li> <li>• Investigate the nature and potential degree of impacts of the disease chytridiomycosis on species' populations.</li> <li>• Determine most effective and cost-efficient monitoring and survey methods for the species for both recovery and proposed</li> </ul>



Wallum Froglet	
Assessment of Significance criteria (Seven Part Test)	Address of criteria
	<p>development impact assessment objectives.</p> <ul style="list-style-type: none"> <li>• Determine potential nature and extent of competition from other frog species following habitat modification or degradation.</li> <li>• Undertake ongoing assessment of effectiveness of current management strategies. Incorporate results of surveys, monitoring and research to develop more cost-efficient and effective management strategies.</li> <li>• Inform and involve the community, landholders and other stakeholders through the production and dissemination of fact sheets on acid frogs, habitat management &amp; protection, web page, survey/monitoring training workshops and display boards.</li> </ul> <p>However none of these priority actions relate to the current proposal.</p>
u) Whether the action proposed constitutes or is part of a KTP or is likely to result in the operation of, or increase the impact of, a KTP	<p>The proposal may potentially constitute or promote a number of KTPs under the NSW TSC Act, as listed below. However, each of these processes are already in operation within the subject site and the proposal includes measures to reduce additional impacts from the proposal.</p> <ul style="list-style-type: none"> <li>• Clearing of native vegetation</li> <li>• Infection of frogs by amphibian chytrid fungus causing the disease chytridiomycosis</li> </ul>
<p><b>Conclusion:</b> The proposed action is unlikely to have a significant impact on the Wallum Froglet due to the removal of only a small area of potential habitat (0.7ha)</p>	

Waterbirds (Australasian Bittern and Black Bittern)	
Assessment of Significance criteria (Seven Part Test)	Address of criteria
Background	<p>The Australasian Bittern and Black Bittern are listed as vulnerable under the TSC Act and are types of Heron that occur within dense vegetation. Potential marginal habitat occurs within the Swamp Sclerophyll Forest within the proposal area.</p> <p>These species were not recorded during field surveys.</p>
v) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	<p>The proposal will result in the removal of less than 0.7ha of potential marginal habitat for this species. Due to over 1000 ha of suitable habitat within the local area, it is expected that a significant impact will not occur on the Black Bittern and Australasian Bittern, such that, a viable local population is placed at risk of extinction.</p>
w) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction	N/A
x) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed: vii. Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely	N/A

Waterbirds (Australasian Bittern and Black Bittern)	
Assessment of Significance criteria (Seven Part Test)	Address of criteria
viii. to be placed at risk of extinction, or Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction	
y) In relation to the habitat of a threatened species, population or ecological community: x. The extent to which habitat is likely to be removed or modified as a result of the action proposed, and xi. Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and xii. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.	Approximately 0.7 ha of habitat is proposed for removal as a result of this proposal. The habitat will be completely removed for the widening of Nelson Bay Road. Due to all suitable habitat for the species occurring on the northern side of Nelson Bay Road, the proposal is considered unlikely to fragment areas of habitat for these species. The habitat proposed for removal is not considered to be important for the long term survival of the Black Bittern and Australasian Bittern, as it is commensurate with several thousand hectares of other habitat within the locality.
z) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)	Under the TSC Act, the Director-General maintains a Register of critical habitat. As at 8 October 2013, no critical habitat has been declared for any of the Black Bittern or the Australasian Bittern.
aa) Whether the action proposed is consistent with the objectives or actions of a recovery plan or TAP	No recovery plan has been prepared for these species. The following priority actions have been prepared: <ul style="list-style-type: none"> <li>• Enhance knowledge of the breeding locations of this species. Survey suitable habitat eg vegetated wetlands during the breeding season. Investigate habitat usage particularly in Swamp Oak Forest.</li> <li>• In areas of suitable breeding habitat, seek to retain and manage riparian vegetation.</li> <li>• Identify priority breeding wetlands and determine threatening processes at each site in order to target management actions. Initial emphasis should be targeted at Macquarie Marshes, Lowbidgee, Lachlan and Menindee Lakes.</li> <li>• Where known, protect and manage priority breeding sites using appropriate regulatory and community based mechanisms.</li> <li>• Rehabilitate former key breeding wetlands where known and practical, to enhance habitat availability.</li> <li>• Target research toward developing a method for both assessing and determining population trends in NSW.</li> <li>• As an adjunct to habitat protection, use fencing and/or signage to minimise damage to priority breeding sites (when known) from trampling by livestock, feral animals and/or human disturbance.</li> <li>• Develop and distribute environmental assessment guidelines to aid consent or determining authorities assess the potential impact to Australasian Bitterns from development and apply appropriate mitigation measures.</li> <li>• Assess the effectiveness of Property Vegetation Plans in providing for the conservation of this species.</li> <li>• Undertake targeted fox control at identified priority sites in accordance with the DEC Fox Threat Abatement Plan.</li> </ul> However none of these priority actions relate to the current proposal.
bb) Whether the action proposed constitutes or is part of a KTP or is likely to result in the operation of, or increase the impact of, a KTP	The proposal may potentially constitute or promote a number of KTPs under the NSW TSC Act, as listed below. However, each of these processes are already in operation within the subject site and the proposal includes measures to reduce additional impacts from the proposal.

Waterbirds (Australasian Bittern and Black Bittern)	
Assessment of Significance criteria (Seven Part Test)	Address of criteria
	<ul style="list-style-type: none"> <li>Clearing of native vegetation</li> </ul>
<b>Conclusion:</b> The proposed action is unlikely to have a significant impact on the Black Bittern and Australasian Bittern due to the removal of a small area (0.7ha) of potential marginal foraging habitat.	

Sand Doubletail Orchid	
Assessment of Significance criteria (Seven Part Test)	Address of criteria
Background	The Sand Doubletail Orchid is listed as vulnerable under the TSC Act and is found only from the Tomaree Peninsula in Port Stephens. It flowers in late August and early September and has light purple flowers. It occurs in sandy coastal heath and grassy Eucalypt forest on the coast.
cc) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	The proposal will result in the removal of less than 4ha of potential marginal habitat for this species. Due to over 4000 ha of suitable habitat within the local area, it is expected that a significant impact will not occur on the Sand Doubletail Orchid, such that, a viable local population is placed at risk of extinction.
dd) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction	N/A
ee) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed: <ul style="list-style-type: none"> <li>ix. Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or</li> <li>x. Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction</li> </ul>	N/A
ff) In relation to the habitat of a threatened species, population or ecological community: <ul style="list-style-type: none"> <li>xiii. The extent to which habitat is likely to be removed or modified as a result of the action proposed, and</li> <li>xiv. Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and</li> <li>xv. The importance of the habitat to be removed, modified,</li> </ul>	<p>Approximately 4 ha of habitat is proposed for removal as a result of this proposal. The habitat will be completely removed for the widening of Nelson Bay Road.</p> <p>Due to all suitable habitat for the species occurring on the southern side of Nelson Bay Road, the proposal is considered unlikely to fragment areas of habitat for this species.</p> <p>The habitat proposed for removal is not considered to be important for the long term survival of the Newcastle Doubletail, as it is commensurate with several thousand hectares of other habitat within the locality.</p>

Sand Doubletail Orchid	
Assessment of Significance criteria (Seven Part Test)	Address of criteria
fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.	
gg) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)	Under the TSC Act, the Director-General maintains a Register of critical habitat. As at 8 October 2013, no critical habitat has been declared for any of the Sand Doubletail Orchid.
hh) Whether the action proposed is consistent with the objectives or actions of a recovery plan or TAP	<p>No recovery plan has been prepared for this species. The following priority actions have been prepared:</p> <ul style="list-style-type: none"> <li>• Collect propagules for NSW Seedbank in collaboration with RBG&amp;DT. Identify single provenance seed from individual populations. Develop programs to strengthen individual populations.</li> <li>• Identify road/trackside populations and avoid during roadworks.</li> <li>• Minimise further loss of habitat from clearing and fragmentation associated with urban development.</li> <li>• Create a management plan to address threats including illegal dumping, recreational activities, slashing and spraying.</li> <li>• Improve awareness of the threat of illegal dumping and recreational activities to <i>Diuris arenaria</i> habitat through signage.</li> <li>• Implement appropriate fire management practices.</li> <li>• Control priority weeds.</li> </ul> <p>The proposal will create a loss of potential habitat for this species, although not through urban development. None of the other actions relate to this proposal</p>
ii) Whether the action proposed constitutes or is part of a KTP or is likely to result in the operation of, or increase the impact of, a KTP	<p>The proposal may potentially constitute or promote a number of KTPs under the NSW TSC Act, as listed below. However, each of these processes are already in operation within the subject site and the proposal includes measures to reduce additional impacts from the proposal.</p> <ul style="list-style-type: none"> <li>• Clearing of native vegetation</li> </ul>
<b>Conclusion: The proposed action is unlikely to have a significant impact on the Sand Doubletail Orchid due to the removal of only a small area (4ha) of suitable habitat.</b>	

## Appendix D: EPBC Assessments of Significance for species considered as having potential habitat within the project area

Koala		
Criteria (Vulnerable Species)	Address of Criteria	Likelihood
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:		
<ul style="list-style-type: none"> <li>lead to a long-term decrease in the size of an important population of a species</li> </ul>	The site contains habitat for the Koala and Koalas are known to utilise the site (eg NSW Atlas of Wildlife records occur from 2011, road kill records form HKPS). While the habitat linkages on the southwest and northeast side of Nelson Bay Road are fairly limited, the widening of Nelson Bay Road will further erode the level of habitat connectivity. Additionally, due to the increased width of the road, a greater likelihood of Koala road kill is predicted to occur. Mitigation is proposed through two fauna underpasses and the installation of fauna fencing (for the location of fauna fencing, see Figure 9). These measures are not expected to lead to a long-term decrease in the size of the Port Stephens important population of the Koala.	Low-moderate
<ul style="list-style-type: none"> <li>reduce the area of occupancy of an important population</li> </ul>	The project will remove an area of approximately 4 ha of supplementary Koala habitat, along with approximately 0.7 ha of habitat considered critical to the survival of the Koala (dominated by Swamp Mahogany; <i>Eucalyptus robusta</i> ). Thus the project will reduce the area of available habitat for an important Koala population, although considering several thousand hectares of suitable habitat occurs within the Port Stephens area, the impact is considered to incrementally contribute to the reduction of occupancy of an important population.	Low- moderate
<ul style="list-style-type: none"> <li>fragment an existing important population into two or more populations</li> </ul>	The Worimi Conservation Lands are mapped as Supplementary Koala Habitat under the Port Stephens Comprehensive Koala Plan of Management, while lands to the northeast and north of the project area are mapped as both Supplementary and Core Koala habitat under the same document. Migration is likely to occur across Nelson Bay Road at various locations, including potentially within the project area. These areas are not considered to represent habitat critical to the long-term survival of the Koala. Due to the potential impacts from the project from fragmentation, mitigation is proposed through two fauna underpasses and the installation of fauna fencing (see Figure 9). These measures will greatly reduce the impact of the proposal on the Koala. Due to the strategic location of the underpasses where over 90% of Koala collisions occur within this stretch of road, it is expected that the movement of Koalas will be maintained across Nelson Bay Road, however this will be monitored through the installation of GPS collars onto at least 4 individuals and the monitoring of the use of the culverts with remote cameras.	Low-moderate
<ul style="list-style-type: none"> <li>adversely affect habitat critical to the survival of a species</li> </ul>	In the Port Stephens area, Core Koala Habitat is considered as being habitat critical for the survival of the Koala (Port Stephens Council 2002). Core Koala Habitat is considered to be commensurate with habitat critical for the survival of the Koala. In the project area, approximately 0.7 ha of habitat where the dominant tree species is Swamp Mahogany will be removed. This habitat is considered important for the survival of this species, thus its removal will incrementally adversely affect habitat	Low-moderate

	critical to the survival of the Koala.	
<ul style="list-style-type: none"> <li>disrupt the breeding cycle of an important population</li> </ul>	The proposal is unlikely to disrupt the breeding cycle of the Koala, due to the mitigation measures proposed that will allow for the passage of Koalas from non-breeding to breeding habitats. Non breeding habitats are considered to occur in the Worimi Conservation Lands while breeding habitats occur in the north, for example within Tilligerry Nature Reserve. At present a high number of Koalas are killed on this stretch of road (averaging 4-5 individuals per year) and through locating the fauna underpasses at locations where the majority of Koala collisions occur, movement will be facilitated across the road project.	Unlikely
<ul style="list-style-type: none"> <li>modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</li> </ul>	The proposal will remove approximately 5 ha of suitable habitat for the Koala and 0.7hectares of habitat considered critical to the survival of the koala. The subject site potentially operates as a movement corridor within the landscape, rather than preferred foraging habitat. This corridor will be enhanced by the 'funnelling effect' of the fauna fencing and underpasses. As several thousand hectares of similar habitat occurs within the local area, it is unlikely that the species will decline as a direct result of the habitat removal.	Low
<ul style="list-style-type: none"> <li>result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat</li> </ul>	A vegetation management plan (VMP) will be developed for the project, where invasive weed species are actively managed throughout the life of the project. Therefore it is considered unlikely that any invasive species will become established within the habitat of the Koala.	Low
CONCLUSION	Due to the removal of only a small area (0.7ha) of habitat critical to the survival of the Koala in the Port Stephens area and the implementation of a range of mitigation measures (fauna fencing and underpasses), a significant impact on the Koala is not considered to be likely.	

New Holland Mouse		
Criteria (Vulnerable Species)	Address of Criteria	Likelihood
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:		
<ul style="list-style-type: none"> <li>lead to a long-term decrease in the size of an important population of a species</li> </ul>	The site contains habitat for the New Holland Mouse. The proposal will remove approximately 4 ha of habitat. However a further 4000 ha of suitable habitat occurs within the adjacent Worimi Conservation Lands, thus it is considered unlikely that the project will lead to the long term decrease of the New Holland Mouse in the Port Stephens area.	Unlikely
<ul style="list-style-type: none"> <li>reduce the area of occupancy of an important population</li> </ul>	The project will remove an area of approximately 4 ha of New Holland Mouse habitat, in an area that is potentially an important population due to the occurrence of a large tract of sand dune vegetation (i.e. preferred habitat). However in the context of >4000 ha of suitable habitat located immediately adjacent to the project, the reduction in the area of occupancy of the New Holland Mouse is considered to be non-significant.	Low

<ul style="list-style-type: none"> <li>fragment an existing important population into two or more populations</li> </ul>	The New Holland Mouse prefers drier sand plain vegetation, which is found on the southwestern side of the project area, while unflavoured moister swamp forest occurs on the north eastern side of the project area. Due to this, it is considered unlikely that the project will fragment two or more populations of the New Holland Mouse.	Unlikely
<ul style="list-style-type: none"> <li>adversely affect habitat critical to the survival of a species</li> </ul>	The site contains habitat that is commensurate with over 4000 ha of habitat within the Worimi Conservation Lands. Thus the habitat to be removed is not considered to be critical for the survival of the New Holland Mouse.	Unlikely
<ul style="list-style-type: none"> <li>disrupt the breeding cycle of an important population</li> </ul>	Due to the removal of only 4 ha of suitable habitat, the project is unlikely to disrupt the breeding cycle of the New Holland Mouse in the Port Stephens area.	Unlikely
<ul style="list-style-type: none"> <li>modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</li> </ul>	The project will result in the removal of 4 ha of suitable habitat for this species. Due to the presence of 4000 ha of suitable habitat located immediately adjacent to the project, the New Holland Mouse population in the Port Stephens area is considered unlikely to decline.	Low
<ul style="list-style-type: none"> <li>result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat</li> </ul>	A vegetation management plan (VMP) will be produced for the project, where invasive weed species are actively managed throughout the life of the project. Therefore it is considered unlikely that any invasive species will become established within the habitat of the New Holland Mouse.	Low
CONCLUSION	Due to the small scale of the proposed habitat removal (4ha) and the extent of adjoining habitat, the action is not likely to have a significant impact on the New Holland Mouse.	

Spotted-tail Quoll (Endangered Species)		
Criteria (Endangered Species)	Address of Criteria	Likelihood
An action is likely to have a significant impact on an endangered species if there is a real chance or possibility that it will:		
<ul style="list-style-type: none"> <li>lead to a long-term decrease in the size of a population of a species</li> </ul>	The site contains habitat for the Spotted-tail Quoll, surrounding the project site. The action will remove approximately 5 ha of foraging and potential denning habitat (i.e. within tree hollows and/ or logs) for the species. Where the home range of a female Quoll previously being estimated at between 180-600 ha, this level of habitat removal represents between 2.8-0.8% of the home range of one individual. However a greater impact may occur through potential road kill or amplification of the existing hostile barrier to movement. Mitigation measures in the form of two fauna underpasses and fauna fencing are proposed, which will greatly reduce any negative effects of the proposal on the Spotted-tail Quoll. While Quolls have not been previously recorded using 1.2x 2.4m culverts in New South Wales, research in Tasmania has shown that Quolls will use small structures, including 900mm pipes (Nick Mooney and Dean Heinze, Pers Comm, November 2013). This suggests that the 1.2x 2.4m culverts will potentially allow the movement of Quolls across Nelson Bay Road.	Low-moderate
<ul style="list-style-type: none"> <li>reduce the area of occupancy of a population</li> </ul>	The project will remove an area of approximately 5 ha of Spotted-tail Quoll habitat. However in the context of >4000 ha of suitable habitat located immediately adjacent to the project, the reduction in the area of occupancy of the Spotted-tail Quoll is considered to be non-significant.	Low

<ul style="list-style-type: none"> <li>fragment an existing population into two or more populations</li> </ul>	The proposal will result in the duplication of the Nelson Bay Road, resulting in the creation of a 40 m wide hostile barrier to fauna movement. However these impacts will be mitigated through the installation of fauna fencing and two fauna underpasses, which reduces the impact on the population	Low
<ul style="list-style-type: none"> <li>adversely affect habitat critical to the survival of a species</li> </ul>	The site contains habitat that is commensurate with over 4000 ha of other available habitat within the Worimi Conservation Lands. The habitat proposed for removal is representative of several thousand hectares of other habitat in the Port Stephens area, thus the habitat to be removed is not considered to be critical for the survival of the Spotted-tail Quoll.	Unlikely
<ul style="list-style-type: none"> <li>disrupt the breeding cycle of a population</li> </ul>	No Quolls are known to be breeding within the proposal area, however due to their cryptic nature, it cannot be assumed that the species is absent. However Quolls prefer to breed within rock outcrops, caves and deep gullies, none of which occur within the proposal area. The proposal will reduce the propensity for roadkill along Nelson Bay Road, due to the installation of fauna fencing and road underpasses, thus increase the ability of dispersing male Quolls to do so within the landscape.	Low
<ul style="list-style-type: none"> <li>modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</li> </ul>	The project will result in the removal of 5 ha of suitable habitat for this species. Due to the presence of 4000 ha of suitable habitat located immediately adjacent to the project, the Spotted-tail Quoll population in the Port Stephens area is considered unlikely to decline as a direct result of the proposed habitat removal.	Low
<ul style="list-style-type: none"> <li>result in invasive species that are harmful to an endangered species becoming established in the endangered species' habitat</li> </ul>	A vegetation management plan (VMP) will be produced for the project, where invasive weed species are actively managed throughout the life of the project. Therefore it is considered unlikely that any invasive species will become established within the habitat of the Spotted-tail Quoll.	Low
CONCLUSION	The removal of habitat for the Spotted-tail Quoll is considered unlikely to constitute a significant impact due to the provision of fauna fencing, underpasses and ongoing monitoring which targets the species in the local landscape.	

Grey-headed Flying Fox		
Criteria (Vulnerable Species)	Address of Criteria	Likelihood
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:		
<ul style="list-style-type: none"> <li>lead to a long-term decrease in the size of an important population of a species</li> </ul>	The site contains habitat for the Grey-headed Flying Fox, surrounding the project site. The project will remove approximately 5 ha of foraging habitat for the species. No Grey-headed Flying Fox camps are known from the proposal area or adjacent within the Worimi National Park. Due to the vegetation proposed for removal to be commensurate with the majority of vegetation within the Port Stephens area and the required foraging area for this species, a long term decrease in the Grey-headed Flying Fox is considered unlikely to occur.	Low



<ul style="list-style-type: none"> <li>reduce the area of occupancy of an important population</li> </ul>	The project will remove an area of approximately 5 ha of suitable Grey-headed Flying Fox habitat. However in the context of >4000 ha of suitable habitat located immediately adjacent to the project, the reduction in the area of occupancy of the Grey-headed Flying Fox is considered to be non-significant.	Low
<ul style="list-style-type: none"> <li>fragment an existing important population into two or more populations</li> </ul>	Due to the mobile nature of this species, the level of fragmentation proposed by the duplication of the Nelson Bay Road (i.e. 40m) will not result in a level of fragmentation that limits the dispersal of this species.	Low
<ul style="list-style-type: none"> <li>adversely affect habitat critical to the survival of a species</li> </ul>	The site contains habitat that is commensurate with over 4000 ha of habitat within the Worimi Conservation Lands. Thus the habitat to be removed is not considered to be critical for the survival of the Grey-headed Flying Fox.	Unlikely
<ul style="list-style-type: none"> <li>disrupt the breeding cycle of an important population</li> </ul>	No known Grey-headed Flying Fox camps occur within or adjacent to the proposal area. Subsequently it is considered unlikely that the breeding cycle of this species will be disrupted.	Unlikely
<ul style="list-style-type: none"> <li>modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</li> </ul>	The project will result in the removal of 5 ha of suitable habitat for this species. Due to the presence of 4000 ha of suitable habitat located immediately adjacent to the project, the Grey-headed Flying Fox population in the Port Stephens area is considered unlikely to decline as a direct result of the proposed habitat removal.	Low
<ul style="list-style-type: none"> <li>result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat</li> </ul>	A vegetation management plan (VMP) will be produced for the project, where invasive weed species are actively managed throughout the life of the project. Therefore it is considered unlikely that any invasive species will become established within the habitat of the Grey-headed Flying Fox	Low
CONCLUSION	Due to the small extent of vegetation removal and the absence of flying fox camps within 20 kms of the subject site or adjacent to the subject site, an impact on an important population of the Grey Headed Flying Fox is considered unlikely to occur.	

Newcastle Doubletail Orchid		
Criteria (Vulnerable Species)	Address of Criteria	Likelihood
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:		
<ul style="list-style-type: none"> <li>lead to a long-term decrease in the size of an important population of a species</li> </ul>	Three individual stems of this species were recorded during initial field surveys in 2011. Approximately 4ha of suitable habitat will be removed for the duplication of Nelson Bay Road. The removal of three stems and 4 ha of suitable habitat when 4000 ha of suitable habitat occurs in the locality is considered to have a low likelihood of resulting in a significant impact to an important population of the Newcastle Doubletail Orchid.	Low
<ul style="list-style-type: none"> <li>reduce the area of occupancy of an important population</li> </ul>	The project will remove an area of approximately 4ha of suitable habitat for this species. However as several thousand hectares occurs in the locality for this species, a significant impact is not expected	Low

	to occur.	
<ul style="list-style-type: none"> <li>fragment an existing important population into two or more populations</li> </ul>	Only marginal habitat occurs on the northern side of Nelson Bay Road, with all suitable occurring on the southern side of the road. Subsequently the proposal is unlikely to fragment the population of the Newcastle Doubletail Orchid.	Unlikely
<ul style="list-style-type: none"> <li>adversely affect habitat critical to the survival of a species</li> </ul>	The site contains habitat that is commensurate with over 4000 ha of suitable habitat within the Worimi Conservation Lands. Thus the habitat to be removed is not considered to be critical for the survival of the Newcastle Doubletail Orchid.	Unlikely
<ul style="list-style-type: none"> <li>disrupt the breeding cycle of an important population</li> </ul>	The removal of three stems of the Newcastle Doubletail Orchid is unlikely to disrupt the breeding cycle of the species. Within a nearby electricity easement (approximately 500m to the southeast), several hundred Newcastle Doubletail Orchids occur. Thus the removal of three stems of genetic material are unlikely to disrupt the breeding cycle of the species.	Unlikely
<ul style="list-style-type: none"> <li>modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</li> </ul>	The project will result in the removal of 5 ha of suitable habitat for this species. Due to the presence of 4000 ha of suitable habitat located immediately adjacent to the project, the Newcastle Doubletail population in the Port Stephens area is considered unlikely to decline as a direct result of the proposed habitat removal.	Low
<ul style="list-style-type: none"> <li>result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat</li> </ul>	A vegetation management plan (VMP) will be produced for the project, where invasive weed species are actively managed throughout the life of the project. Therefore it is considered unlikely that any invasive species will become established within the habitat of the Newcastle Doubletail Orchid.	Low
CONCLUSION	The proposal is unlikely to result in a significant impact to an important population of the Newcastle Doubletail Orchid.	

Appendix E: Hunter Koala Preservation Society records of rescues and deaths along Nelson Bay Road

# Koalas Rescued or Found Dead at Bob's Farm - from 1/1/2008 to 15/10/2013

## Within rectangle defined by -32.78713,152.003891 & -32.746858,152.065689

NAME	DATE	Type	PROBLEM	ADDRESS	RESCUE REASON	FATE DESC	LATITUDE	LONGITUDE
Unknown	17/01/2008	Found Dead	Mvehicle	NELSON BAY RD ( south side ) - 150m East Helenvale Ln		Found Dead	-32.76928	152.03815
Emily	6/11/2008	Live Rescue	Mvehicle	PORT STEPHENS DRIVE AND NELSON BAY ROAD		Found Dead	-32.76923	152.06494
Unknown	24/08/2009	Found Dead	Mvehicle	4011 NELSON BAY ROAD - 150m East Helenvale Rd		Found Dead	-32.76882	152.03819
Theo	8/09/2009	Live Rescue	Other	NELSON BAY ROAD & TROTTER ROAD		Released	-32.769	152.04502
Mitchell	20/09/2009	Found Dead	Mvehicle	NELSON BAY ROAD & TROTTER ROAD		Found Dead	-32.76886	152.04471
Unknown	8/12/2009	Found Dead	Mvehicle	NELSON BAY RD - 200m East Helenvale Ln		Found Dead	-32.76949	152.03825
Unknown	19/01/2010	Found Dead	Mvehicle	NELSON BAY ROAD 200 MTS SOUTH OF MARSH ROAD		Found Dead	-32.76932	152.01231
Theo Natf	26/02/2010	Transferred I	Mvehicle	Nelson Bay Rd - 200m West Trotter Rd		Released	-32.76931	152.04254
Unknown	13/09/2010	Call Out	Unsuitable Environment	Nelson Bay Road X Cromarty Ln	Koala sitting in middle of road.		-32.76739	152.02169
Max	13/09/2010	Live Rescue	Mvehicle	Cnr Nelson Bay Rd & Cromarty Lane	Hit by car	Released	-32.76739	152.02177
Margie	18/09/2010	Live Rescue	Mvehicle	Nelson Bay Rd - 1Km East Trotter Rd	Hit by car	Released	-32.76857	152.05387

# Koalas Rescued or Found Dead at Bob's Farm - from 1/1/2008 to 15/10/2013

## Within rectangle defined by -32.78713,152.003891 & -32.746858,152.065689

NAME	DATE	Type	PROBLEM	ADDRESS	RESCUE REASON	FATE DESC	LATITUDE	LONGITUDE
Max	12/12/2010	Found Dead	Mvehicle	Nelson Bay Rd - 200m East Trotter Rd	Hit by car in front of the same property he was released behind in Sept.	Found Dead	-32.76887	152.04743
Unknown	9/08/2011	Live Rescue	Mvehicle	Nelson Bay Rd - 200m West Helenvale Ln	Hit by car. Was alive when rescued. Died in basket when I got home	Died within 24 hour	-32.76943	152.03456
Unknown	16/09/2011	Found Dead	Mvehicle	Nelson Bay Rd - 500m East Cromarty Ln	Dead in middle of road. Weight approximate as entrails squashed on road.	Found Dead	-32.76853	152.02846
Unknown	11/10/2011	Found Dead	Mvehicle	Nelson Bay Rd - 100m West Helenvale Ln	Dead on road. Assumed hit by car	Found Dead	-32.76963	152.03535
Unknown	11/12/2011	Live Rescue	Mvehicle	Nelson Bay Rd - 300m East Helenvale Ln	Hit by car. Facial injuries, broken left hind leg. Difficult pole rescue	Died within 24 hour	-32.76928	152.03718
Mim	27/09/2012	Live Rescue	Unsuitable Environment	Approx 3km west of Birubi Point Surf Club on Stockton beach	Sunbathing on beach	Relocated	-32.78562	152.03885
Krystaley	27/10/2012	Live Rescue	Mvehicle	Nelson Bay Rd - 100m East Trotter Rd	Had been hit by two cars	Released	-32.76902	152.04628
Unknown	25/12/2012	Live Rescue	Mvehicle	Nelson Bay Rd - 500m East Trotter Rd	Hit by car and left on road. Picked up by passing motorist and delivered to carer	Died within 24 hour	-32.76899	152.04973
Honey Bunch	19/08/2013	Live Rescue	Mvehicle	Nelson Bay Rd & Helenvale Road	Hit by car. Bleeding from nose	In Care	-32.76922	152.03680
Unknown	27/08/2013	Live Sighting	Unsuitable Environment	Nelson Bay Rd - 100m East Helenvale Rd	1:10 pm koala seen running across busy Nelson Bay Road. All cars stopped. We were 2nd car.	Left and observed	-32.76928	152.03740