

## Appendix P: Compensatory habitat policies

Compensatory habitat can be loosely defined as an area of habitat that is acquired or otherwise protected in order to compensate for or replace habitat that has been removed as a result of development. Several state government agencies in NSW have developed policies concerning compensatory habitat, including the NSW Roads and Traffic Authority, NSW Fisheries and the Department of Infrastructure, Planning and Natural Resources. Policy development in the other states and Commonwealth government agencies varies considerably.

The Draft Roads and Traffic Authority policy *Road Development and Impacts and Amelioration Measures – Compensatory habitat* (Draft 6, 12 November 1998) is most relevant to the current proposal. The policy considers compensatory habitat to be one of a range of mitigation measures, being appropriate only when there has been a loss of key habitat after route selection, road design and other mitigation measures have been employed. Key habitat areas are those that support flora and fauna species, populations or ecological communities considered to be of significance because they are listed on any or all of the following:

- Schedules 1 or 2 of the NSW Threatened Species Conservation Act 1995
- register for critical habitat held by the Minister of the Environment
- planning instrument under the NSW Environmental Planning and Assessment Act 1979
- the Register of the National Estate under the Australian Heritage Commission Act 1975
- conservation reserve under the NSW National Parks and Wildlife Act 1979 or the Forestry Act 1916
- area of high conservation value under the Native Vegetation Management Act 1997
- area identified under any other conservation agreement
- area of particular significance to NSW Department of Environment and Conservation, NSW Fisheries, NSW Department of Lands, State Forests NSW or any other agency.

According to the draft NSW Roads and Traffic Authority policy, wherever possible compensatory habitat should be:

- at least equal in area to the key habitat lost
- close to the affected key habitat
- similar to or better than affected key habitat.

The Roads and Traffic Authority considers that where compensatory habitat is already established, it should replace key habitat lost at a ratio of 1:1. In response to National Parks and Wildlife Service (now Department of Environment and Conservation) concerns about mitigating edge effects associated with new roads, the Roads and Traffic Authority commissioned a study that investigated compensation for edge effects (Bali 2000). The resulting discussion paper outlined guidelines based on ecological principles derived from the literature and data analysis for Pacific Highway upgrades. As a result, it was recommended that an additional 30 metre strip is included for compensation purposes along newly-created corridors.

In cases where there is no existing habitat available, compensatory habitat may be established using part or full restoration. In the latter cases, the Roads and Traffic Authority may consider providing an area of compensatory habitat that is greater than the amount of key habitat lost. In the case of wetland creation, a 2:1 ratio is generally accepted as a means of accounting for the uncertainties of establishing a functional wetland (Bali 2000). This is the ratio specified in the NSW Fisheries policy (NSW Fisheries 1999). For wetlands considered to be of state significance (*State Environmental Planning Policy Number 14*), a maximum ratio of 10:1 has been specified in the the Department of Infrastructure, Planning and Natural Resources draft policy (G. Yeates, *pers. comm.*).

The Roads and Traffic Authority considers that wherever possible, compensatory habitat should be located close to the affected key habitat where it is more likely to reinforce other mitigation measures and to be similar in type and condition to key habitat lost. Although the policy recommends that the location of compensatory habitat is determined on a project-by-project basis, it recognises that where major road developments have regional impacts such as the Pacific Highway upgrade, the ultimate size and location of compensatory habitat may be determined on a regional basis.

Main Roads currently has no policy on compensatory habitat. However, a draft issues paper has been prepared on this topic and is awaiting internal review (A. Howard, Environmental Officer Main Roads, *pers. comm.*). Although there are several examples of projects in Queensland where compensatory habitat has been acquired, there has been no systematic approach to this process.

The Commonwealth government has no policy on compensatory habitat. However, it adopts similar and/or consistent approaches to each state.

Compensatory habitat should not be confused with 'no net loss' and 'net gain' policies. 'No net loss' requires that new habitat is created through revegetation of cleared or otherwise highly disturbed areas. The concept of 'net gain' has most recently been formalised in Victoria's Draft Native Vegetation Management Framework. A net gain is where 'losses of native vegetation and habitat, as measured by a combined quality-quantity measure (habitat-hectare), are reduced, minimised and more than offset by commensurate gains'. These are measured at a catchment scale.



# Description and Preliminary Assessment of the Compensatory Habitat Package Proposed for the Tugun Bypass



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## Tugun Bypass Alliance

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## Executive Summary

The purpose of this report is to describe and broadly assess the compensatory habitat package proposed for the Tugun Bypass. The package has been developed using guidelines set out in the draft NSW Roads and Traffic Authority policy *Compensatory Habitat Policy and Guidelines – Providing Compensatory Habitat as Amelioration for Impacts on Habitat Resulting from Road Development*. The policy specifies that compensation is one of a range of mitigation measures applied to residual impacts associated with road development. Despite a route selection study and proposed mitigation measures, residual impacts along the Tugun Bypass would be associated with habitat loss and fragmentation.

The proposed package looks at the total impact of the Tugun Bypass, in both NSW (NSW) and Queensland. It should be noted that the Roads and Traffic Authority Policy is only applicable to land within NSW. In addition, all land proposed to be offered as compensation is located solely within NSW.

The proposed package described in this report represents an initial approach to compensate for some of these residual impacts. Finalisation of the compensatory habitat package would only occur after negotiations between the Queensland Department of Main Roads and relevant government agencies (including the Department of Infrastructure, Planning and Natural Resources and National Parks and Wildlife Service) and landowners are complete.

The proposed compensatory habitat package comprises land purchase and compensatory measures. The latter are aimed at conserving a population of Long-nosed Potoroos although they would benefit other ground-dwelling species as well. Measures include Fox control and predator control fencing in various areas. Compensation for a SEPP 14 wetland that would be affected by the proposal are also briefly considered. Sites forming the land package were assessed on the basis of field work undertaken as part of the Tugun Bypass Environmental Impact Statement and on a desktop review of available information.

The draft NSW Roads and Traffic Authority policy states that, wherever possible, compensatory habitat should be equal or greater in area to the key habitat lost, however, this is not a legal requirement. Key habitat areas are those that support flora and fauna species of legislative and/or conservation significance. The Tugun land package has also taken into consideration the compensation of edge effects as required in the draft policy. This amounts to an additional 30 metre strip being added along newly-created corridors. A total of 66.4 hectares of key habitat would be lost (39.4 hectares) or edge-affected (27 hectares) by the proposal.

The proposed sites forming the compensatory habitat land package are described as Block A (Koala Block), Block C (Tweed Canal Estate) and Block E (Ganter Block). Together these blocks total 75.8 hectares and are located within a kilometre from the proposal. The total land package is therefore larger (9 hectares) than key habitat to be removed or edge-affected.

The compensatory land package is of a similar habitat quality and type to key habitat that would be removed as a result of the proposal. This is in accordance with the draft policy. It shares at least eight (26 percent) vegetation communities in common with the Tugun study area. As a result of the compensatory habitat package, there would be a net gain in the amounts of 11 vegetation communities managed for conservation. Notably, it would result in the conservation of 12.9 hectares of Swamp Oak Forest, a vegetation community considered to be of state significance in NSW and Queensland.



Similarly, the compensatory land package shares at least 25 (33 percent) legislatively significant flora and fauna species in common with the Tugun study area. The inclusion of Block A (Koala Block) as part of the package provides an opportunity to preserve local and regional biodiversity. It contains a remnant population of Koalas and mature hollow-bearing trees. Koalas were not recorded within the Tugun study area despite targeted surveys. Hollow-bearing trees are considered to be a limiting resource within the Tugun study area as they were only recorded in one area of Scribbly Gum Woodland located to the west of the proposal.

The population of Long-nosed Potoroos recorded adjacent to the proposal is currently under threat from cumulative impacts associated with adjacent developments including the Cobaki Lakes development and associated access track along Boyd Street. Compensatory measures are aimed at minimising predation by feral and domestic predators.

An additional investigation undertaken in April 2004 by Dr Glen Ingram determined that portions of Block C (Tweed Canal Estate) contained approximately one hectare of Wallum regrowth (as part of Paperbark Forest). This habitat was determined to be a candidate for the building of artificial ponds to encourage the breeding of the Wallum Sedge Frog.

The compensatory habitat package needs to be considered within the context of local and regional environmental protection. Block A (Koala Block), combined with Block E (Ganter Block), forms a strategically located link connecting habitat areas. Together with Block C and adjacent vacant NSW Crown land, the Gold Coast Airport's environmental precinct, areas of open space within the Cobaki Lakes development and other environmentally protected areas in Tweed Shire, they provide a continuous area of land of approximately 595 hectares having varying degrees of regional biological significance and environmental protection. Towards this aim, environmental planning around the Cobaki Broadwater should focus on appropriate management of these areas to maintain their integrity and connectivity. Furthermore, the potential also exists to incorporate large parts of these lands under a single management structure with the aim of enhancing biological values.

# 1. Introduction and Methodology

The purpose of this report is to describe and broadly assess the compensatory habitat package proposed for the Tugun Bypass. Compensatory habitat can be loosely defined as an area of habitat that is acquired or otherwise protected in order to compensate for or replace habitat that has been removed as a result of development. Several state government agencies in NSW have developed policies concerning compensatory habitat, including the Roads and Traffic Authority, NSW Fisheries and the Department of Infrastructure, Planning and Natural Resources. There is no legal requirements in QUEENSLAND compensate key habitat areas lost as part of development.

The compensatory package described in this report has been developed using guidelines set out in the Draft Roads and Traffic Authority policy *Compensatory Habitat Policy and Guidelines – Providing Compensatory Habitat as Amelioration for Impacts on Habitat Resulting from Road Development* (Draft 7, 5 March 2001).

The proposed package looks at the total impact of the Tugun Bypass, in both NSW and Queensland. It should be noted that the Roads and Traffic Authority Policy is only applicable to land within NSW. In addition, all land proposed to be offered as compensation is located solely within NSW.

Potential candidate sites were initially identified along the proposed alignment from property ownership and zoning maps and their suitability assessed on the basis of:

- locality;
- key habitat;
- location;
- ownership;
- zoning;
- approximate size;
- positive and negative environmental features; and
- options for conservation (i.e. purchase, conservation agreement).

In particular, Tweed Shire Council identified Lot 3 on DP837715 (referred to hereafter as Block A – Koala Block) as an area worthy of conservation for its known flora and fauna values. Graham Judge and Clive Easton from Tweed Shire Council provided information regarding environmental values of this site. In addition, Steve Phillips was also contacted regarding the Koala population known to occur on the site.

The sites forming the proposed land package are assessed based on survey work undertaken as part of the Tugun Bypass Environmental Impact Statement (EIS) and on a desktop review of available information. A number of studies have been undertaken on Block A including mapping of vegetation communities within this site by Warren (1997). During the present study, mapping was verified and adjusted to reflect the most recent aerial photos. Communities were then renamed for consistency with the Tugun Bypass EIS.

## 1.1 Background to the Draft Roads and Traffic Authority Policy

The draft Roads and Traffic Authority policy emphasises that, with respect to impacts associated with road construction, the Roads and Traffic Authority should aim to:

- avoid;
- minimise; and
- mitigate.

The draft policy considers compensatory habitat to be one of a range of mitigation measures, being appropriate only when there has been a loss of key habitat after route selection, road design and other mitigation measures have been employed. Key habitat areas are those that support flora and fauna species, populations or ecological communities considered to be of significance because they are listed in relevant legislation, on international agreements or because they are considered to be of particular significance by relevant government agencies.

According to the draft Roads and Traffic Authority policy, wherever possible compensatory habitat should be:

- at least equal or greater in area to the key habitat lost;
- close to the affected key habitat; and
- of similar to or better type and quality than affected key habitat.

The Roads and Traffic Authority considers that where compensatory habitat is already established, it should replace key habitat lost at a ratio of 1:1.

## 1.2 Calculating Key Habitat Loss

For the purposes of this report, the study area for the proposed Tugun Bypass has been defined as that area between Stewart Road, Currumbin to the north and Kennedy Drive, Tweed Heads to the south. It is approximately seven kilometres long and extends one kilometre either side of the proposed alignment. The study area spans NSW, Queensland and Commonwealth land. The study site measures approximately 1,215 hectares although only about 500 hectares is vegetated. The study area and footprint (area that would be directly affected by road development) for the proposed Tugun Bypass alignment is shown on Figure 1.1.

Potential environmental impacts associated with the proposed Tugun Bypass were avoided and/or minimised through a route selection study and subsequent refinements of the alignment. A number of measures would be implemented in order to mitigate impacts related to water flow and quality, potential acid sulphate soils, barriers, fragmentation, edge effects and disturbance. However, residual impacts would still be associated with habitat loss and fragmentation.

In addition, the population of Long-nosed Potoroos (*Potorous tridactylus*) has been recorded adjacent to the proposed Tugun Bypass in the vicinity of Boyd Street is currently under threat from cumulative impacts associated with adjacent developments including the Cobaki Lakes development and associated access track off Boyd Street. It is likely that mortality due to road strike and predation will increase in the future.

In addition, cumulative impacts resulting from habitat loss and fragmentation associated with the proposed Tugun Bypass may increase the susceptibility of this regionally significant population to extinction. For these reasons, the proposed compensatory habitat package comprises land purchase as well as compensatory measures aimed at conserving potoroos.

The final land package has taken into consideration both key habitat lost as specified in the draft NSW Roads and Traffic Authority policy and edge-affected habitat as discussed by Bali (2000). A habitat edge is a transition zone between two distinct vegetation types, representing different communities, successional stages and/or land uses (Yahner 1988). Edge effects are the result of the interactions between the two habitats separated by such an edge (Murcia 1995). Edge effects associated with roads may include: changes in microclimate, hydrology and floristics; alterations to the pattern and frequency of fire; invasion by exotic plants and animal pests; increase in sedimentation; increase in tree death through windthrow or dieback; increase in pollution; and improved access for predators.

The discussion paper prepared by Bali (2000) was commissioned by the Roads and Traffic Authority in response to National Parks and Wildlife Service (NPWS) concerns about mitigating edge effects associated with new roads. Its guidelines are based on ecological principles derived from the literature and tested on several recent Pacific Highway upgrade projects. The report recommends that an additional 30 metre strip be calculated to compensate for edge effects along newly-created corridors. Although the study area for the Tugun Bypass is already substantially disturbed and edge-affected, it comprises a high diversity of vegetation communities providing habitat for numerous threatened species. It was therefore considered appropriate to include this additional area as compensatory habitat.

In addition the DMR plan to collect seed from native plants growing within the proposed bypass footprint prior to clearing of the site. This seed will be used to revegetate areas disturbed during construction and possibly to rehabilitate other degraded areas within and adjacent to the bypass. This will help minimise edge effects as well as providing additional habitat areas.

Key habitat lost or edge-affected as a result of the proposal is shown in Figure 1.2 and listed in Table 1.1.

**Table 1.1: Area of Key Habitat to be Removed or Edge-affected by the Proposed Tugun Bypass**

Key Habitat Type	Area Removed By Bypass per Jurisdiction			Total Area Affected By Bypass (hectares)
	NSW (hectares)	Comm (hectares)	QLD (hectares)	
Dune Forest	0.2	0.7	0.5	1.4
Ridge Forest	0	0	8.5	8.5
Rainforest	0	0	0.85	0.85
Swamp Forest	7.3	2.6	1.7	11.5
Disturbed Swamp Forest	5.7	0	0	5.7
Mangrove Forest	0	0.05	0	0.05
Heathland	0	2.9	0	2.9

Key Habitat Type	Area Removed By Bypass per Jurisdiction			Total Area Affected By Bypass (hectares)
	NSW (hectares)	Comm (hectares)	QLD (hectares)	
Sedgeland	0.04	1.8	0	1.9
Saltmarsh	0	0.02	0	0.02
Disturbed Open Habitat	2.4	1.7	2.6	6.7
Plantings	0	0	0	0
Cleared Land	9.7	5.4	11.6	26.8
<b>TOTAL (key habitat lost)</b>	<b>15.6</b>	<b>9.7</b>	<b>14.1</b>	<b>39.4</b>
Edge Effected	<b>8.3</b>	<b>9.6</b>	<b>9.1</b>	<b>27.0</b>
<b>Total Area to be Compensated</b>	<b>23.9</b>	<b>19.3</b>	<b>23.2</b>	<b>66.4</b>

A total of 66.4 hectares of key habitat would be lost or edge-affected by the proposal from 28 native vegetation communities. This comprises 39.4 hectares to be lost and 27 hectares to be edge-affected. Although 23.9 of the 66.4 hectares of the total key habitat to be removed is within NSW, the entire 75.8 hectares compensatory package is located within NSW, which will represent a net gain of 51.8 hectares.



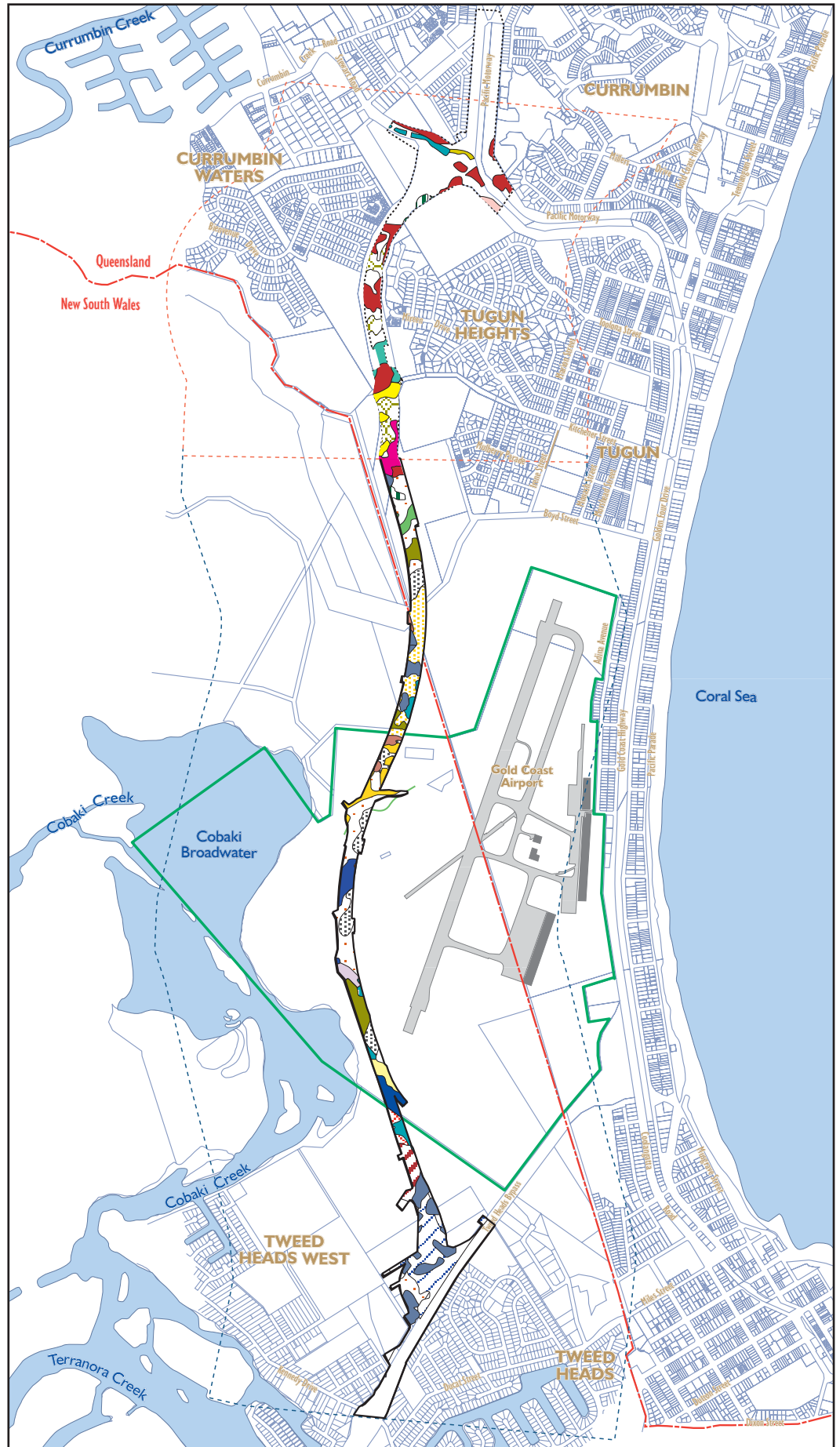


-  Tugun Bypass Footprint Stage 1
-  Tugun Bypass Footprint Stage 2
-  Stage 1 Study Area
-  Stage 2 Study Area
-  Gold Coast Airport Boundary
-  Queensland/NSW Border



Figure 1.1 Proposal Footprint





- Tugun Bypass Footprint Stage 1
- Tugun Bypass Footprint Stage 2
- Stage 1 Study Area
- Stage 2 Study Area
- Gold Coast Airport Boundary
- Queensland/NSW Border
- Cleared Land
- Blackbutt Woodland
- Regenerating Vine Forest
- Dry Blackbutt Forest
- Forest Red Gum Forest
- Ironbark/Mahogany Forest
- Mangrove Forest
- Mixed Swamp Forest
- Moist Blackbutt Forest
- Open Paperbark Woodland
- Paperbark Forest
- Paperbark Regrowth
- Phragmites Rushland
- Pine Forest
- Saltmarsh
- Scribbly Gum Forest
- Scribbly Gum Mallee Heathland
- Sedgeland
- Slashed Heathland
- Swamp Mahogany/Brushbox Forest
- Swamp Mahogany Forest
- Disturbed Saltmarsh/Sedgeland
- Swamp Mahogany/Scribbly Gum Forest
- Swamp Oak Forest
- Swamp Oak Woodland
- Regenerating Brushbox Forest
- Swamp Mahogany/Paperbark Forest
- Weedy Grassland
- Wet Heathland



Figure 1.2 Key Habitat Removed as a Result of the Proposal

### 1.3 Compensating for SEPP 14 Wetlands

State Environmental Planning Policy (SEPP) 14 Wetland Number 5a fringes the north-eastern shore of Cobaki Creek. Approximately 0.02 hectares of highly degraded Swamp Oak Woodland mapped as SEPP 14 habitat would be removed as a result of the proposal. More sensitive communities including mangroves and saltmarsh would not be directly affected by the proposal.

For wetlands considered to be of State significance (SEPP 14), a maximum ratio of 10:1 has been specified in the NSW Department of Infrastructure, Planning and Natural Resources proposed policy (G. Yeates, *pers. comm.*). However, the ultimate ratio may vary considerably (higher or lower) and is based on wetland quality and condition (Mike Svikis, Department of Infrastructure, Planning and Natural Resources) and would be the subject of negotiation between Main Roads and NSW Department of Infrastructure, Planning and Natural Resources.

The proposed compensatory habitat package includes 22.1 hectares of SEPP 14 wetlands, which well exceeds the proposed ration of 10:1.



## 2. Proposed Compensatory Habitat Package

The proposed compensatory habitat package comprises purchase of three blocks of land to compensate for flora and fauna habitat to be removed or edge-affected and compensatory measures aimed at conserving the Long-nosed Potoroo.

It was initially proposed that the Main Roads would purchase an additional two blocks of land to incorporate into the proposed compensatory habitat package however negotiations with the land owners of these properties have failed to secure their purchase, and negotiations have been discontinued.

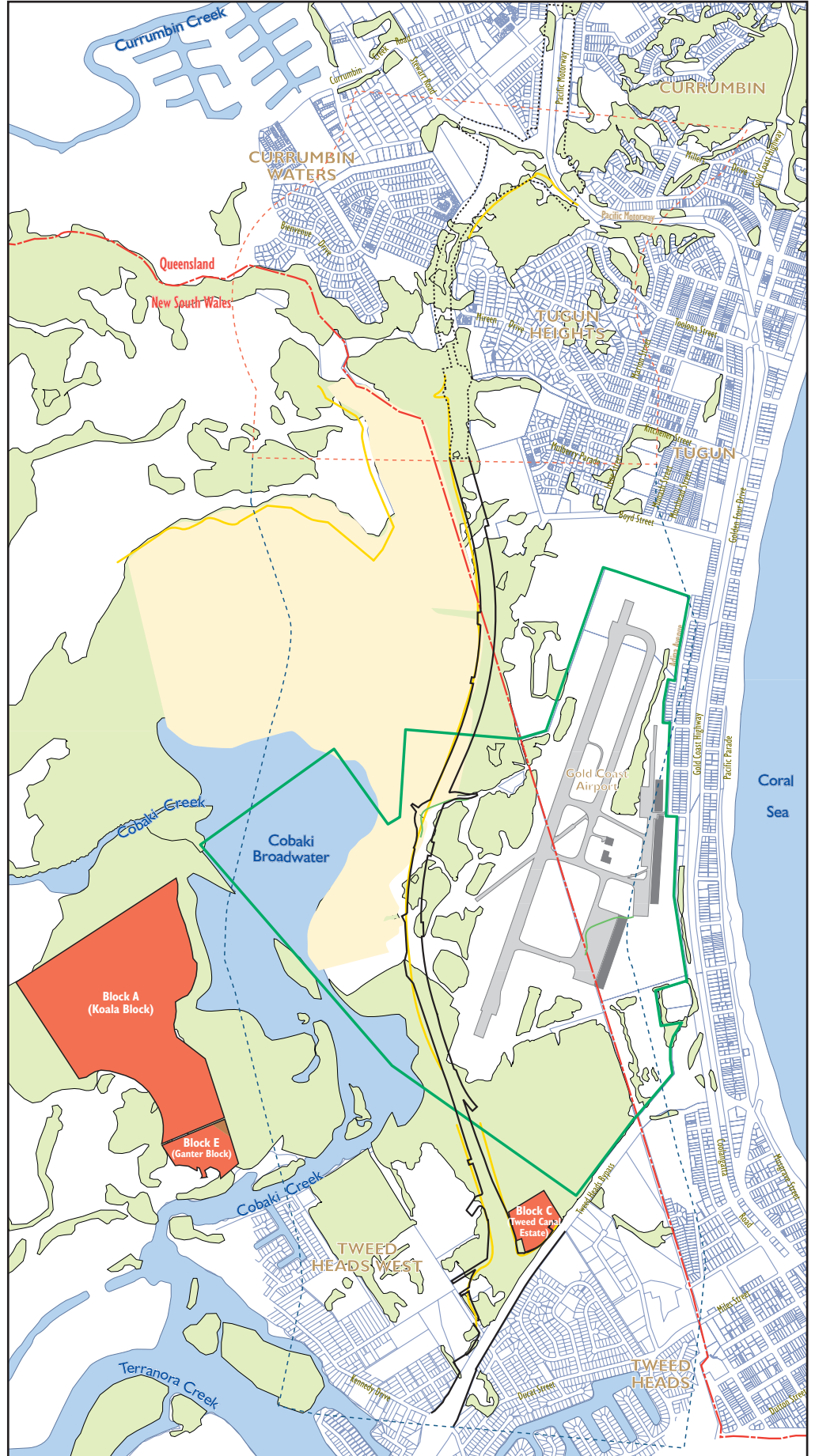
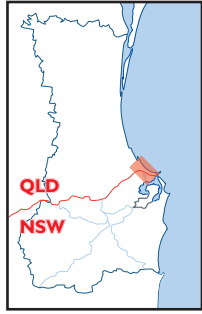
### 2.1 Proposed Land Package

The blocks of land proposed for inclusion in the compensatory habitat package are shown in Figure 2.1 and detailed in Table 2.1.

**Table 2.1: Summary of Blocks Proposed as Compensatory Habitat**

Candidate Site	Property Description	Area (ha)	Location	Zoning	Ownership
Block A (Koala Block)	Lot 3 DP837715	64.8	NSW	1A Rural, 7A Environmental Protection (Wetlands and Littoral Rainforests - SEPP 14)	Main Roads
Block C (Tweed Canal Estate)	Part Lots 8 DP8655, Lot 1 DP226067	4.7	NSW	1A Rural	Privately- owned
Block E (Ganter Block)	Lot 18 DP583263	6.3	NSW	1A Rural, 7A Environmental Protection (Wetlands and Littoral Rainforests - SEPP 14)	Main Roads
Total Land Package		75.8			

Block A (Koala Block) and Block E (Ganter Block) have been purchased by the Main Roads for the purposes of compensatory habitat. Block C (Tweed Canal Estate) will be purchased as part of the Tugun Bypass proposal. A brief description of each block is given in Sections 2.1.1. to 2.1.3.



- Tugun Bypass Footprint Stage 1
- Tugun Bypass Footprint Stage 2
- Stage 1 Study Area
- Stage 2 Study Area
- Gold Coast Airport Boundary
- Queensland/NSW Border
- Proposed Land Package
- Vegetation Distribution
- Fox Control
- Fauna Exclusion Fence



Figure 2.1 Proposed Compensatory Habitat and Measures

### 2.1.1 Block A (Koala Block)

Block A is located on the south-western side of the Cobaki Broadwater. It is the largest of the blocks forming the compensatory habitat package and is almost equivalent to the total amount of key habitat lost and edge-affected. A number of ecological surveys have been undertaken on the site (see Warren 1997 for a review). The site has been subject to a number of development applications over the past five years or so. These applications have all been refused by Tweed Shire Council on grounds including flooding, slope and midge/mosquito issues. Although there is some clearing (less than 30%) in the southern part of the site, the northern part contains significant native vegetation that is relatively intact (see Appendix A). However, where goats have been allowed to graze over some sections of the site, the understorey (including weeds) is absent. This understorey may recover if the goats are removed, however monitoring and active management may be required.

Block A contains at least 11 different vegetation communities (Figure 2.2). Nine of these are of conservation significance at the regional level and two (Swamp Oak Forest and Swamp Oak/Mangrove Forest) are of state significance (Appendix B). In addition, at least 17 flora and fauna species of legislative significance were recorded on the site (Appendix B). A further seven fauna species of legislative significance may occur within the site. Block A also comprises approximately 18.7 hectares of State Environmental Planning Policy (SEPP) Number 14 wetlands.

Koalas (*Phascolarctos cinereus*) have been recorded on the site and surrounds by Tweed Shire Council (1993), the Australian Koala Foundation (Phillips and Callaghan 1996), Warren (1995, 1997) and Parker (2001). Steve Phillips (*pers. comm.*) reported in 1996 that a Koala population was found on the ridge in the northern part of the site. Phillips and Callaghan (1996) mapped Secondary Koala habitat within Block A. Warren (1997) recorded one Koala on the site and concluded that it did not support a locally or regionally significant population of Koalas or breeding individuals. Parker (2001) undertook a community Koala survey as part of the Fauna Impact Statement for the Piggabeen Road Deviation to the south of Block A. He concluded that use of the area appears to have declined over the past decade.

Clive Easton (Entomologist, Tweed Shire Council) has been visiting the site for the past 18 years as part of Council's investigation of mosquito problems in the area. He has noted that the site contains the following:

- mature hollow-bearing trees;
- a diversity of possums and gliders;
- a high diversity of waders; and
- abundant reptiles and macropods.

The site also includes a natural salt water lake fed by seepage from the adjoining swamps and freshwater springs, providing habitat for fish and invertebrates.

Block A is surrounded by privately-owned land zoned Environmental Protection on most sides. It is bounded by residential development to the south and by the Cobaki Broadwater Village Mobile Home Park to the west.

### 2.1.2 Block C (Tweed Canal Estate)

Block C will be purchased as part of the Tugun Bypass proposal. Residual land not required for construction purposes is proposed to offer compensatory key habitat for the Wallum Sedge Frog (*Litoria olongburensis*). While the site is relatively small, it is strategically located to act as a buffer from edge effects and future development for the nearby Swamp Orchid colony. The site is located adjacent to the Tweed Heads Bypass and is relatively disturbed.

Block C is 4.7ha in size and no flora or fauna species of conservation significance were recorded from the site during the present study. The dominant tree species on this block is broad-leaf paperbark (*Melaleuca quinquenervia*). There are two main areas on the block which form natural communities; they include the regionally significant Paperbark Forest and Paperbark Regrowth and equate to approximately 50% of the total area proposed for compensation (Figure 2.3). The remainder of the site is highly disturbed as a result of clearing, grazing and severe weed infestation. The Paperbark Forest differs from the Paperbark Regrowth in the diversity of composition and structure of the understorey. The Paperbark Regrowth is more sparse, has less diversity, and comprises mainly sedges in the ground layer. However, both communities are not considered to be remnant intact examples of the vegetation type and are undergoing pressures from grazing, edge effects and surrounding clearing.

These natural communities potentially provide habitat for a diversity of bat species, the Koala, Swordgrass Brown (butterfly) (*Tisiphone abeona morrissi*), Wallum Froglet and Wallum Sedge Frog (*Litoria olongburensis*). The site forms part of an area of core habitat as described by Scotts (2000).

A site investigation by Dr Glen Ingram in April 2004 confirmed that the Paperbark Forest community, and to a lower extent the Paperbark Regrowth, could potentially be used to create artificial ponds for the Wallum Sedge Frog to breed in. The Wallum Sedge Frog is an 'acid frog', which breed in low pH water, usually less than pH 6. Typical of their breeding medium is the 'black' water of the Wallum (Ingram, 2004).

Block C adjoins the Gold Coast Airport land, which has known populations of the Wallum Sedge Frog. The site was determined to be a candidate for building deep (about one metre), artificial ponds for the sedge frog to breed in. However the site's groundwater should be tested to determine if it is brackish at any season throughout the year.

This site is bounded by NSW Crown land leased by the Tweed Heads Pony and Hack Club to the west and north and by the Tweed Heads Bypass to the east. It would be located directly adjacent to the proposed Tweed Heads Bypass interchange.

### 2.1.3 Block E (Ganter Block)

Block E has been purchased by Main Roads as part of the compensatory habitat package. The block is adjacent to Block A, increasing the area of habitat compensation to the south-western side of the Cobaki Broadwater. The majority of the block is zoned as 7(A) Environmental Protection (Wetland and Littoral), with the remainder zoned as Rural (1A). Block E contains approximately 3.4 hectares of SEPP 14 wetlands.

A vegetation and habitat assessment was undertaken on this block in late April 2004. Four native vegetation communities were identified during this field assessment, one of which is considered to have regional conservation significance, they include:

- Swamp Oak Woodland;
- Mangrove Forest (regionally conservation significant);
- Marine Couch Saltmarsh; and
- Tallowood / Paperbark Forest.

The remainder of the block (less than 40%) comprises cleared exotic grassed areas (Figure 2.4). A number of large hoop pines (*Araucaria cunninghamiana*) occur in the north-east corner of this block. The low lying tidal mangrove and saltmarsh flats on this block connect the adjacent Block A with Cobaki Creek.

This site is not particularly diverse in species composition but contributes substantially to the compensatory SEPP 14 wetland habitat in the compensatory package and allows for greater connectivity along the Cobaki and Terranora Broadwaters, through Cobaki Creek.

During the site inspection in April 2004, mounds were discovered within a portion of Block E (SEPP 14) which has a high potential to indicate the presence of the Water Mouse (*Xeromys myoides*). Main Roads have committed to undertaking further survey work to determine if the Water Mouse is present in the area. This work is expected to be undertaken in June 2004.



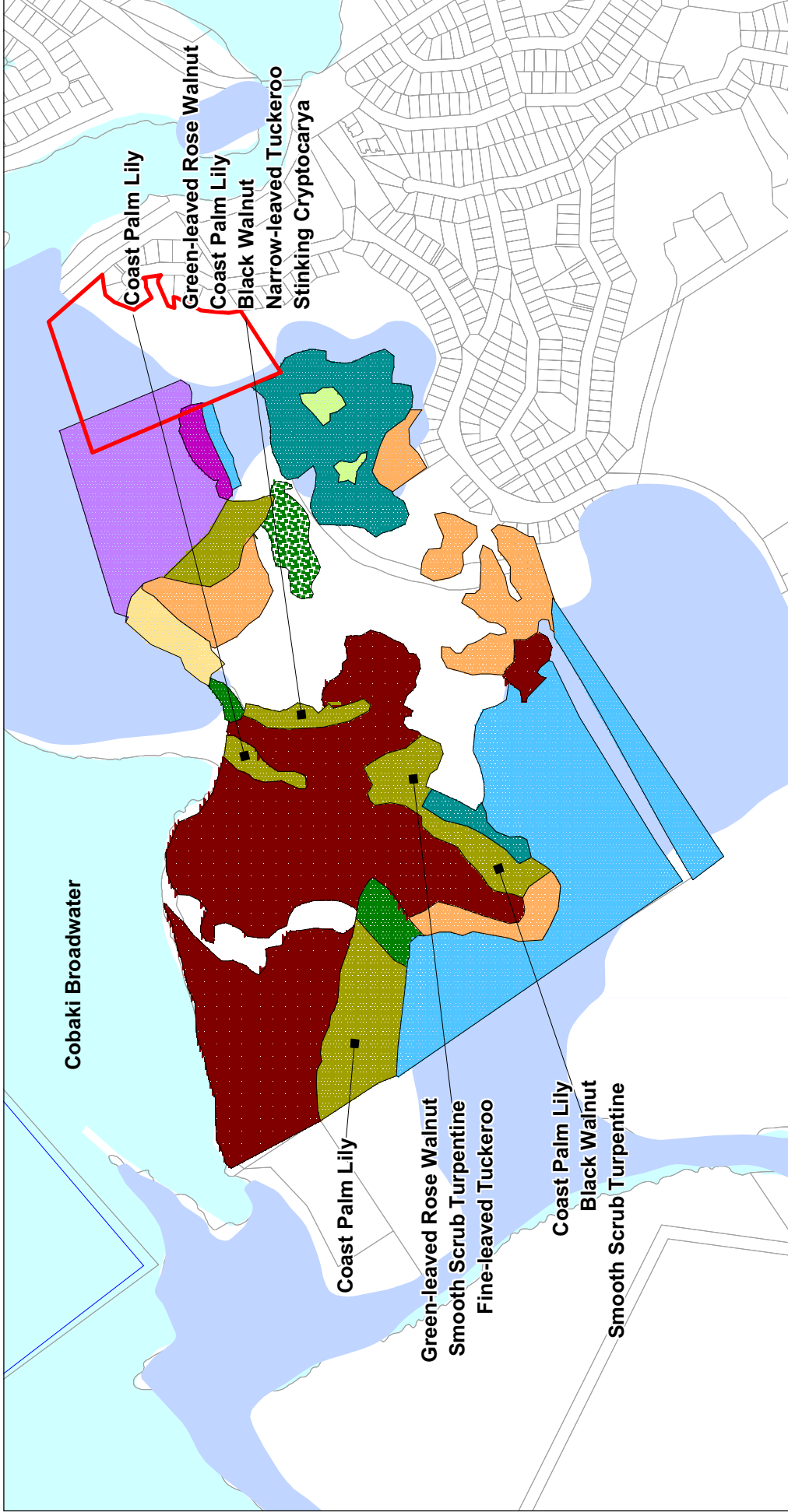


Figure 2.2 Vegetation Communities - Block A (Koala Block)

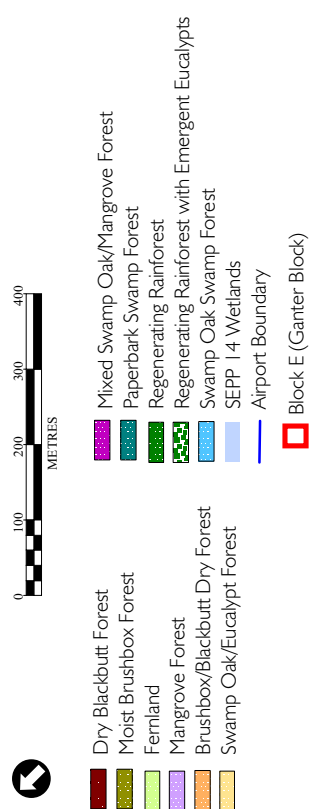





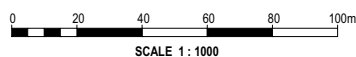




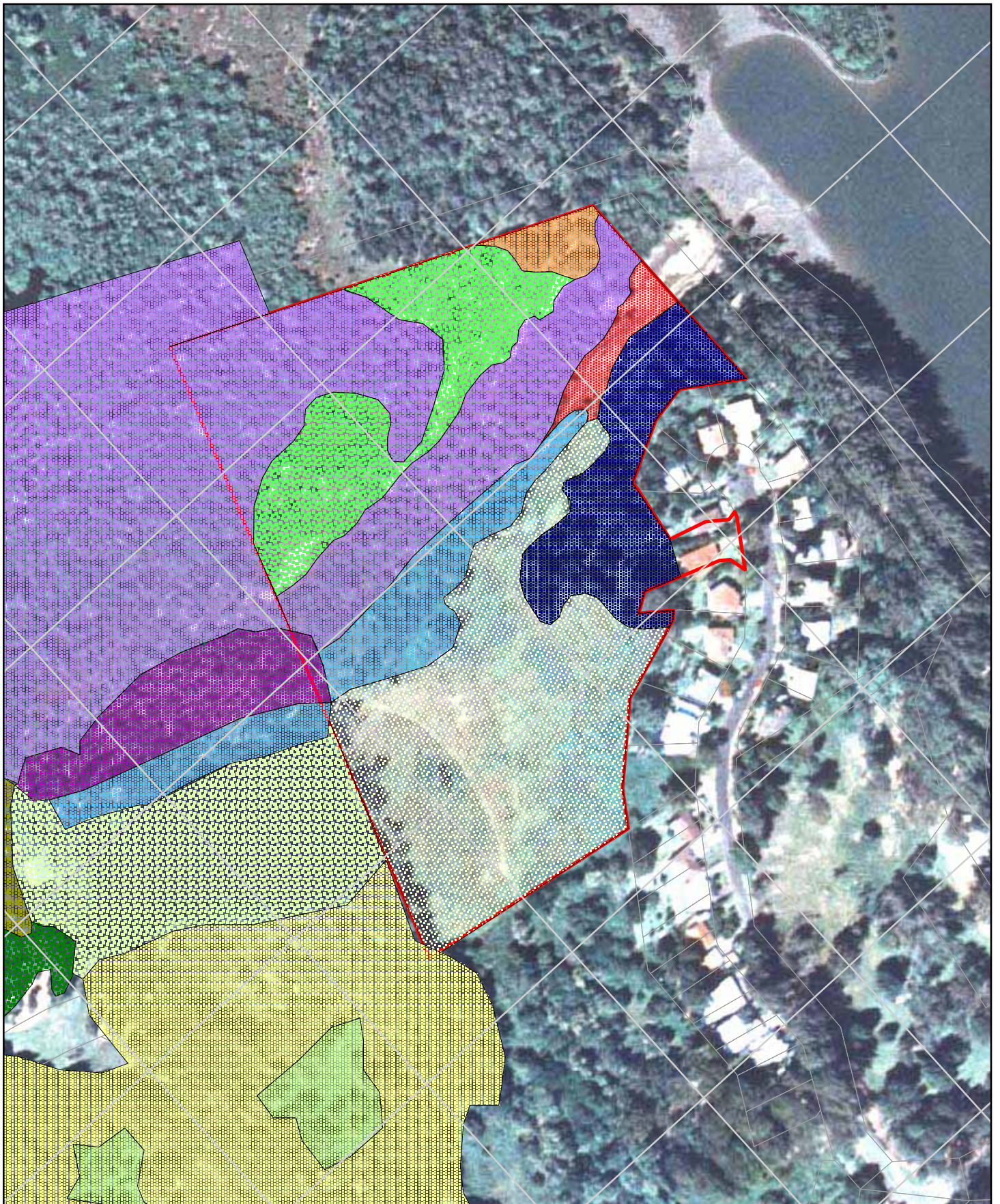


Figure 2.3 Vegetation Communities - Block C (Tweed Canal Estate)

-  Investigation Area
-  Construction Drains
-  Highly Disturbed Paperbark Forest
-  Paperbark Regrowth
-  Paperbark Forest

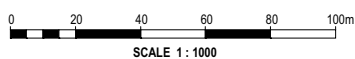






- Investigation Area
- Dry Blackbutt Forest
- Moist Brushbox Forest
- Exotic Grassed Paddock
- Stand of Hoop Pine
- Mangrove Forest
- Marine couch saltmarsh
- Mixed Swamp Oak/Mangrove Forest
- Paperbark Swamp Forest
- Saltmarsh
- Swamp Oak Forest
- Tallowood Paperbark Forest
- Wetland

Figure 2.4 Vegetation Communities - Block E (Ganter Block)





## 2.2 Proposed Compensatory Measures

A population of Long-nosed Potoroos has been recorded adjacent to the proposed Tugun Bypass in the vicinity of Boyd Street. This population is currently under threat from cumulative impacts associated with adjacent developments including the Cobaki Lakes development and associated access track off Boyd Street. It is likely that mortality due to road strike and predation will increase in the future. In addition, cumulative impacts resulting from habitat loss and fragmentation associated with the proposed Tugun Bypass may increase the susceptibility of this regionally significant population to extinction. It is therefore recommended that compensatory measures are implemented in order to improve habitat quality and reduce threats to this species.

Compensatory measures for the Long-nosed Potoroos include:

- initiation of Fox control measures throughout vacant NSW Crown land to the west of the proposed Tugun Bypass;
- provision of predator control fencing around the Cobaki Lakes development area once construction commences in order to reduce the incidence of dogs and cats straying from the development preying on native wildlife in adjacent NSW Crown lands; and
- if necessary, provision of predator control fencing along both sides of the Boyd Street extension, once operational.

Some of these measures are dependent on negotiations with Leda Manorstead Pty Ltd (developers).

## 2.3 Proposed Wetland Compensation

The Department of Infrastructure, Planning and Natural Resources proposed policy on compensating for SEPP 14 wetlands is described in Section 1.3. Figure 2.5 shows the vegetation communities within the defined SEPP 14 wetlands and the extent of the proposed construction. The potential application of the proposed policy will be negotiated between the Main Roads and the NSW Infrastructure, Planning and Natural Resources and is therefore not discussed further below.

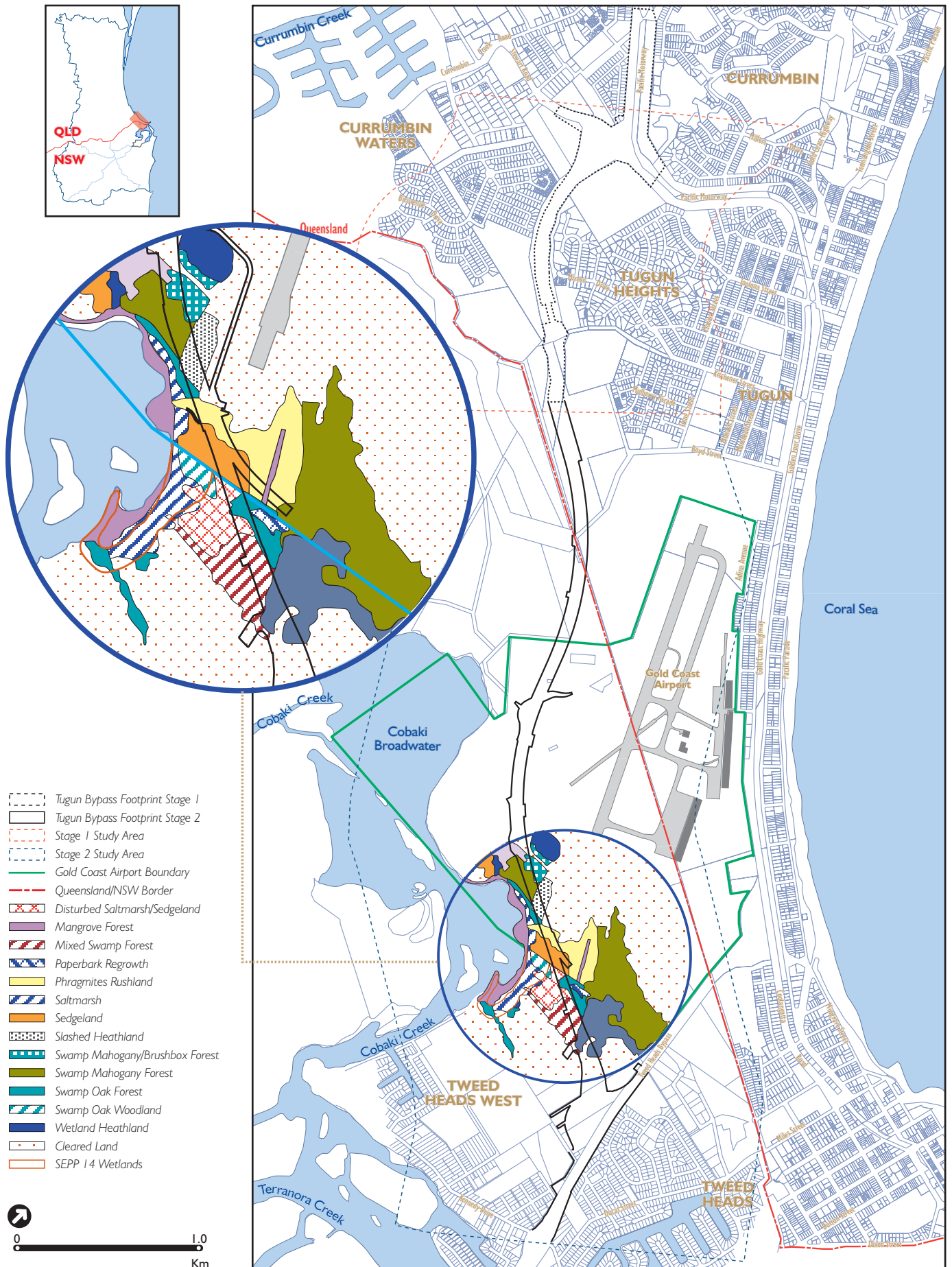


Figure 2.5 **Vegetation Communities within Environmental Planning Policy Number 14 Wetlands**

### **3. Preliminary Assessment of the Compensatory Habitat Package**

The proposed compensatory habitat package is considered from an ecological perspective only. No information is available regarding aboriginal, cultural or other values at the time of writing. The proposed compensatory land package is assessed below with regard to the three primary criteria from the draft Roads and Traffic Authority policy: proximity to the impacted area, size and type and quality of habitat.

#### **3.1 Proximity to Impacted Area**

Generally, the sites proposed as the compensatory habitat package are in close proximity to the proposed Tugun Bypass. Block C (Tweed Canal Estate) is directly adjacent to the proposed bypass. Block A (Koala Block) is just over a kilometre to the west, on the other side of the Cobaki Broadwater and within the local vicinity of the proposal. Block E (Ganter Block) adjoins Block A and is also approximately a kilometre west of the proposed bypass.

It should be noted that there are few sites available in the local area that are not already proposed for development. The large area of vacant NSW Crown land to the west of the proposal has been under Aboriginal land claim for the last eight years (refer to Figure 3.2). Ms Margaret Weiss (Principal Case Manager, Aboriginal Land Claim Investigations – Department of Lands) was contacted in April 2003 regarding the current status of the land claim. She advised that on 16 September 2002 the Minister refused about 7.1 hectares of the claim on the grounds that it was needed or likely to be needed for the essential public purpose of access to residential lands. The remainder of the claim being Lots 56, 57, 58 and 321 DP755740 are still to be determined. As such, the future management of this entire area is uncertain.

Compensatory measures would be applied adjacent to the proposal, extending a maximum of about one kilometre to the west.

#### **3.2 Size of the Land Package**

The total land package is larger (75.8 hectares) than the area of key habitat to be removed or edge-affected (66.4 hectares) by the proposed bypass. The largest single area comprising Block A (Koala Block) measures 64.8 hectares. Compensatory measures would apply over an area of about 228 hectares.

#### **3.3 Habitat Type and Quality**

Habitat quality and type are assessed with regard to the following ecological criteria: vegetation communities, habitat for threatened species, connectivity, condition and security/tenure of adjacent land.

##### **3.3.1 Vegetation Communities**

Overall, blocks making up the land package share at least ten vegetation communities (out of 31) in common with key habitat to be removed as part of the proposal. Details regarding vegetation communities are shown in Table 3.1.

**Table 3.1: Comparison of vegetation communities to be removed and compensated as part of the Tugun Bypass Proposal**

Vegetation Community	Removed by Proposal (ha)	Compensatory Habitat (ha)			Net Gain/Loss (ha)
		Block A Koala Block	Block C Tweed Canal Estate	Block E Ganter Block	
Littoral Rainforest (R)	0	2.0	0	0	+2
Regenerating Vine Forest (R)	0.6	0	0	0	-0.6
Moist Blackbutt Forest (R)	0.9	7.3	0	0	+6.4
Dry Blackbutt Forest (R)	3.3	20.8	0	0	+17.5
Blackbutt Woodland (R)	0.65	0	0	0	-0.65
Ironbark/Mahogany Forest	1.0	0	0	0	-1.0
Scribbly Gum Forest (R)	0.9	0	0	0	-0.9
Forest Red Gum Forest	0.2	0	0	0	-0.2
Regenerating Brushbox Forest	2.6	0	0	0	-2.6
Swamp Mahogany Forest (R)	2.6	0	0	0	-2.6
Swamp Mahogany/ Brushbox Forest (R)	0.1	0	0	0	-0.1
Swamp Mahogany/ Scribbly Gum Forest (R)	0.5	0	0	0	-0.5
Swamp Mahogany/ Paperbark Forest (R)	1.1	0	0	0	-1.1
Tallowwood / Paperbark Forest	0	0	0	0.7	+0.7
Paperbark Forest (R)	4.7	5.3	1.0	0	+1.6
Open Paperbark Woodland (R)	5.6	0	0	0	-5.6
Paperbark Regrowth	0.06	0	1.4	0	+1.4
Swamp Oak Forest (S)	1.4	14.3	0	0	+12.9
Swamp Oak Woodland	0.02	0	0	0.4	+0.4
Mixed Swamp Forest (R)	1.6	0	0	0	-1.6
Scribbly Gum Mallee Heathland (R in NSW, S in Queensland)	1.7	0	0	0	-1.7
Wet Heathland	1.2	0	0	0	-1.2
Slashed Heathland	2.8	0	0	0	-2.8
Saltmarsh	0.02	0	0	0.9 (marine couch)	+0.9
Disturbed Saltmarsh/Sedgeland (R)	0.7	0	0	0	-0.7
Mangrove Forest (R)	0.05	5.9	0	1.7	+7.55
Phragmites Rushland (R)	0.6	0	0	0	-0.6
Sedgeland (R)	1.2	0	0	0	-1.2
Swamp Oak/ Mangrove Forest (S)	0	0.6	0	0	+0.6
Brushbox/Dry Blackbutt Forest (R)	0	6.4	0	0	+6.4
Fernland (R)	0	0.4	0	0	+0.4
Swamp Oak/Mixed Eucalypt Forest (R)	0	1.0	0	0	+1.0

Notes: R = Regional conservation significance;  
S = State conservation significance.

As a result of the compensatory habitat package, there would be a net gain in the amounts of 14 vegetation communities (eight regional, two state) managed for conservation purposes. Vegetation communities that would benefit most in terms of conservation (net gain) are: Dry Blackbutt Forest (17.5 hectares), Swamp Oak Forest (12.9 hectares), Moist Blackbutt Forest (6.4 hectares) and Mangrove Forest (7.55 hectares). There would be a net loss in the amounts of 18 vegetation communities (13 regional, one state) as a result of the proposal. Losses would vary between 0.1 hectare and 5.6 hectares with the greatest losses being associated with Open Paperbark Woodland (5.6 hectares), Slashed Heathland (2.8 hectares), Regenerating Brushbox Forest (2.6 hectares) and Swamp Mahogany Forest (2.6 hectares).

### 3.3.2 Habitat for Threatened Species

Available data on threatened flora and fauna species is summarised in Table 3.2.

**Table 3.2: Comparison of numbers of flora and fauna species of conservation significance amongst Sites**

Significance Level	Tugun Study Area	Block A Koala Block <sup>5</sup>	Block C Tweed Canal Estate <sup>1</sup>	Block E Ganter Block <sup>6</sup>
<b>National</b>				
Flora species	4	1	-	-
Fauna species	3	0	-	-
<b>State</b>				
Flora species	11	6	-	-
Fauna species	23	10	1	-
<b>Regional</b>				
Flora species	8	-	-	-
Fauna species	12	-	-	-
ROTAP <sup>3</sup> species	9	7	-	-
JAMBA/CAMBA <sup>4</sup> species	15	1	-	-
<b>TOTAL<sup>2</sup></b>	<b>75</b>	<b>25</b>	<b>1</b>	<b>0</b>

- Notes 1: No detailed surveys have been undertaken. Results are indicative only.  
 2: Some species may be included in several categories (i.e. listed both at national and state levels; listed as ROTAP and at state or national significance levels).  
 3: ROTAP stands for Rare or Threatened Australian Plants.  
 4: JAMBA/CAMBA refers to migratory birds species protected under the Japan-Australia Migratory Birds Agreement and the China-Australia Migratory Birds Agreement.  
 5: From previous records.  
 6: No detailed information on Block E is available at present. This table will be updated following the site visit in late April 2004.

Although the type and quality of habitat appear to be similar between key habitat lost and the compensatory habitat package, the study area for the Tugun Bypass supports a greater diversity of flora and fauna of conservation significance. That part of the study area that is vegetated measures approximately 500 hectares and traverses at least 37 vegetation communities. The land package on the other hand, measures approximately 75.8 hectares and comprises 14 vegetation communities. Although the package represents about 13 percent of the Tugun Bypass study site in area, it shares 33 percent of flora and fauna species of conservation significance in common.

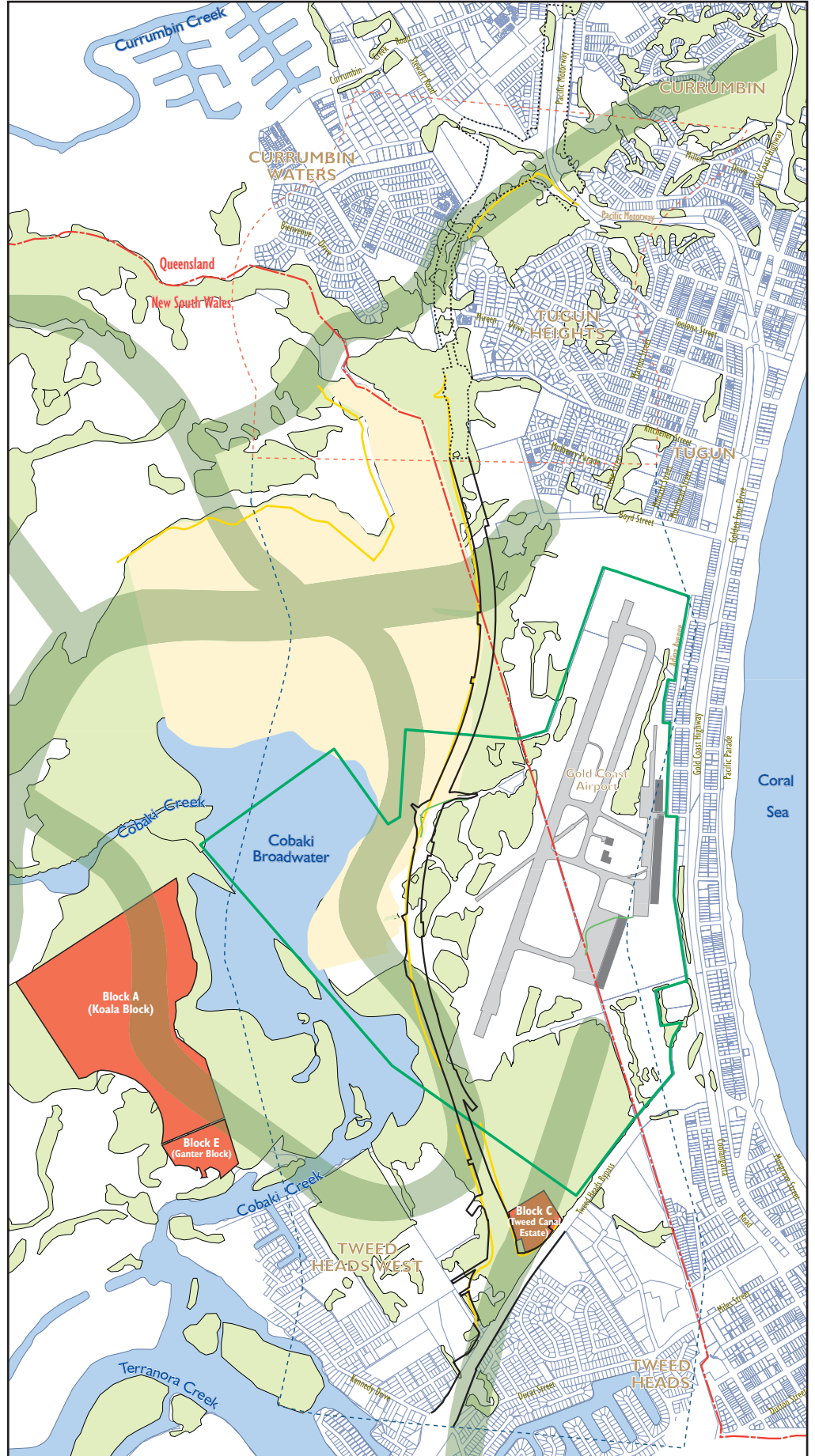
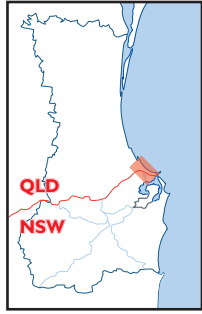


The purchase of Block A (Koala Block) provides an opportunity to conserve one of the last Koala populations in the local area. Steve Phillips (*pers. comm.*) is currently undertaking a review of the status of Koalas in the Tweed Shire and is of the opinion that the remnant population may represent one of the last in south and west Tweed. No Koalas were found within the study area of the Tugun Bypass although Primary and Secondary habitat were mapped there by Phillips and Callaghan (1996). Management for flora and fauna values in this area and adjacent suitable habitat (e.g. vacant NSW Crown land) may reverse the apparent decline of this species and act as a recolonisation source for the area. There does not seem to be any reason why Koalas could not cross Cobaki Creek (Steve Phillips *pers. comm.*) into adjacent NSW Crown land although they do not appear to have done so in the past.

Block A (Koala Block) also appears to contain a high density of mature hollow-bearing trees (on the ridge top) and consequently supports a diversity of possums and gliders (Clive Easton, *pers. comm.*). Survey work in the Tugun Bypass study area indicated that hollow-bearing trees were a limiting resource in the local area. Only one stand of mature Scribbly Gum Forest within vacant NSW Crown land to the north of Cobaki Broadwater contained any hollows. Squirrel Gliders and a high diversity of bats were recorded in this area.

### 3.3.3 Connectivity

Compensatory habitat is of higher value from an ecological perspective if it forms part of a wildlife corridor rather than being isolated within a matrix of cleared land. Habitat connectivity not only allows fauna movement but also acts to consolidate smaller parcels of land making them easier to manage (see below). Figure 3.1 shows the areas proposed as compensatory habitat in relation to sub-regional and regional corridors identified in the Tugun Bypass study area by Scotts (2000). Block A (Koala Block) and Block E (Ganter Block) form part of a sub-regional corridor extending along the western side of the Cobaki Broadwater and connecting to a regional corridor in vacant NSW Crown land. Block C (Tweed Canal Estate) also forms part of a sub-regional corridor. It should be noted that vacant Crown land in NSW is currently under an Aboriginal land claim making its future tenure and management uncertain.



- Tugun Bypass Footprint Stage 1
- Tugun Bypass Footprint Stage 2
- Stage 1 Study Area
- Stage 2 Study Area
- Gold Coast Airport Boundary
- Queensland/NSW Border
- Proposed Land Package
- Vegetation Distribution
- Fox Control
- Fauna Exclusion Fence
- Fauna Corridors

Figure 3.1 **Compensatory Habitat Corridor Values**

### 3.3.4 Security of Tenure of Adjacent Land

Generally, compensatory habitat should be located adjacent to habitat that has some form of statutory conservation protection, although unprotected habitat is also acceptable. Compensatory land proposed for acquisition is shown in relation to public and privately-owned land zoned as Public and Private Open Space, Vacant Crown land, Recreation Use and Environmental Protection around the Cobaki Broadwater (Figure 3.2). It should be noted that, although these areas presently function as flora and fauna habitat, they cannot be considered to be secure from a conservation perspective.

There are a number of areas of regional importance for biodiversity conservation in proximity to and strategically linked to Block A (Koala Block), and subsequently Block E (Ganter Block) including (refer Figure 3.2):

- vacant NSW Crown Land;
- the Gold Coast Airport environmental precinct;
- areas of open space within the Cobaki Lakes Development; and
- land zoned environmental protection in Tweed Shire.

By being brought into public ownership, Block A and Block E, together with the lands listed above would provide a continuous area of land of approximately 595 hectares which would have varying degrees of regional ecological significance and environmental protection. Although these sites presently provide habitat, the future ownership and management of some of these areas is unknown. Hidden Valley is zoned Future Urban while vacant NSW Crown land is currently under an Aboriginal land claim which has yet to be determined.

Block C (Tweed Canal Estate) is located directly adjacent to the proposal and NSW Crown land. Although the NSW Crown land is currently leased by the Tweed Heads Pony and Hack Club, the future tenure and management of this area is uncertain.

An aerial photograph of the proposed blocks and general region is included as Figure 3.3.

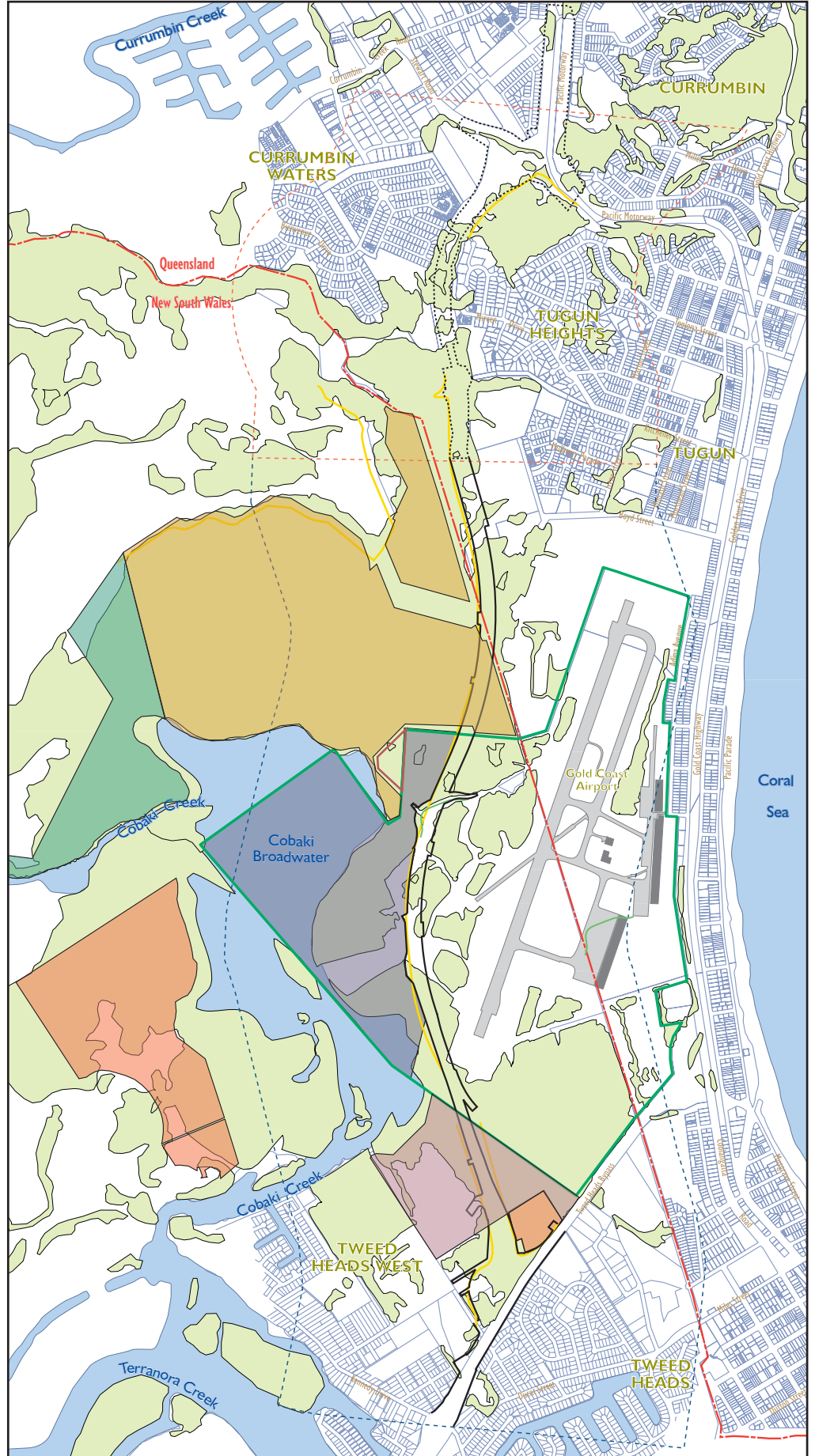
## 3.4 Other Non-ecological Factors

Two other factors need to be considered in assessing a compensatory habitat package. These are management issues and acquisition.

### 3.4.1 Management Issues

The practical and cost implications of managing compensatory habitat also need to be considered by relevant land managers before committing to long-term management. Although all blocks of compensatory habitat would be purchased by the Main Roads, the ultimate ownership and future management of these is currently uncertain. In management terms, Block A (Koala Block) combined with Block E (Ganter Block), could potentially be managed by the Department of Lands as part of a larger area including vacant NSW Crown land to the north.





- Tugun Bypass Footprint Stage 1
- Tugun Bypass Footprint Stage 2
- Stage 1 Study Area
- Stage 2 Study Area
- Gold Coast Airport Boundary
- Queensland/NSW Border
- Proposed Land Package
- Cobaki Lakes Environmental Precinct
- GCAL Environmental Precinct
- NSW Crown Land Leased by Tweed Heads Pony and Hack Club
- Aboriginal Land Claim
- Vegetation Distribution
- Fauna Exclusion Fence



Figure 3.2 Regional Context of Compensatory Habitat Package

All compensatory measures would be funded by the Main Roads. Fox baiting is likely to be undertaken by the NSW Rural Lands Protection Board. Fencing around the south-eastern part of the Cobaki Lakes development is likely to be undertaken by Main Roads and maintained by the NSW Department of Lands. The construction and maintenance of predator control fencing is dependent on negotiations with Leda Manorstead who are constructing the Cobaki Lakes development.

### **3.4.2 Acquisition**

No matter how suitable a proposed compensatory habitat area may appear to be from an ecological perspective, the fact that it is not for sale, is unaffordable or that it cannot be effectively managed for conservation purposes may exclude it as a viable option. Main Roads has acquired Block A (Koala Block) and Block E (Ganter Block) for compensatory habitat purposes. Block C (Tweed Canal Estate) will be acquired as part of the proposal. Main Roads has discontinued negotiations with land owners to acquire a further two blocks in the vicinity of the proposed bypass for compensatory habitat, as their attempts to secure these blocks have been unsuccessful.



Figure 3.3 Aerial Photograph of Proposed Blocks and General Region



## 4. Conclusions

The compensatory habitat package comprising a land package and compensatory measures, provides an initial opportunity to acquire and manage land with the aim of conserving local and regional biodiversity in the long-term. The land package consists predominantly of Blocks A (Koala Block), C (Tweed Canal Estate) and E (Ganter Block). Overall, based on limited data, the land package represents a favourable environmental outcome from a local and regional perspective for the following reasons:

- it fulfils the size and proximity criteria set out in the draft NSW Roads and Traffic Authority policy;
- it compensates for key habitat that would be lost and edge-affected as a result of the proposal ;
- it is in close proximity to the impacted area and is directly or indirectly connected to habitat within the Tugun Bypass study area;
- it compares favourably with the type and quality of habitat within the Tugun Bypass study area;
- it shares 26 percent of vegetation communities and 33 percent of legislatively significant flora and fauna species in common with the Tugun Bypass study area;
- it represents an opportunity to conserve 12.9 hectares of Swamp Oak Forest, a vegetation community considered to be of state significance in both Queensland and NSW;
- it represents an opportunity to conserve 7.55 hectares of regionally significant Mangrove Forest in the Cobaki area;
- it contains a regionally significant Koala population that may be one of the last populations in south and west Tweed;
- it contains mature hollow-bearing trees that appear to be a limiting resource in the Tugun Bypass study area;
- it represents an opportunity to further secure 22.1 hectares of SEPP 14 wetlands that are zoned Environmental Protection;
- it forms a strategically located link connecting habitat areas around the Cobaki Broadwater for flora and fauna; and
- it provides an opportunity for the establishment of a continuous area of land having environmental protection around the Cobaki Broadwater.

An opportunity exists to rehabilitate disturbed areas within the properties and to further enhance the habitat and compensatory values of the sites.

There are no criteria by which to measure the suitability or effectiveness of compensatory measures. However, the measures proposed as part of the package represent an initial approach to compensate some of the residual impacts on Long-nosed Potoroos. The measures are aimed at reducing predation by domestic pets and Foxes. These would also benefit other ground-dwelling mammal and reptile species.

The potential exists to create artificial breeding ponds for the Wallum Sedge Frog within Block C of the proposed compensatory habitat package. Further investigation would be required to determine if the water quality is suitable for the artificial ponds.



Further investigation into the potential presence of the Water Mouse on Block E will be undertaken in the near future. Management of this block in relation to the Water Mouse habitat may be undertaken depending on the findings of future studies.

Finalisation of the compensatory habitat package would only occur after negotiations between the Main Roads and relevant government agencies (including the Department of Infrastructure, Planning and Natural Resources, National Parks and Wildlife Service) and landowners are complete.

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## **Appendix A**

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Photographs of Blocks A (Koala Block, photos 1-36), C (Tweed Canal Estate and E (Ganter Block)



**Photo 1: View from entry driveway looking towards Tweed Heads**



**Photo 2: Looking from entry towards Mobile Home Park and Cobaki Lakes development**





**Photo 3: View from clearing on top of hill near house pad**



**Photo 4: View from clearing on top of hill near house pad**





**Photo 5: View from house pad looking south-east**



**Photo 6: View from top looking south-west towards new development**



**Photo 7: View from top of cleared area**



**Photo 8: View from cleared area mid-way up hill**





**Photo 9: View from clearing on top of hill near house pad**



**Photo 10: Understorey growth near Cobaki Broadwater**





**Photo 11: Salt water lake**



**Photo 12: Salt water lake**





**Photo 13: Salt water lake**



**Photo 14: View looking back from Cobaki Broadwater on cleared land**





**Photo 15: Forest on front face of hill**



**Photo 16: Cobaki Broadwater**





**Photo 17: Cobaki Broadwater**



**Photo 18: Cleared area at base on Cobaki Broadwater side**





**Photo 19: Cleared areas adjacent to Cobaki Broadwater**



**Photo 20: Forest/Cobaki Broadwater**





**Photo 21: Cobaki Broadwater**



**Photo 22: SEPP 14 Wetland**





Photo 23: Forest understorey near lake



Photo 24: SEPP 14 Wetland at Cobaki Broadwater





**Photo 25: Front of block at Cobaki Broadwater – goats grazing in background  
(foreground no goats for 12 months)**



**Photo 26: Forest at front near Cobaki Broadwater**





**Photo 27:** Forest understorey – see fenceline where goats have been in background (foreground no goats for 12 months)



**Photo 28:** Forest on front of hill





Photo 29: Forest at top



Photo 30: view from between forest at top





**Photo 31: Forest on rear of hill**



**Photo 32: Blackbutt Forest on front of hill**





Photo 33: Raptor nest on top of hill



Photo 34: Blackbutt and Tallowood Forest on rear of hill





**Photo 35: SEPP 14 Wetland at rear of block**



**Photo 36: Forest understorey on front of hill**





**Photo 37:** Vegetation representative of Paperbark Forest on Block C



**Photo 38:** Paperbark Regrowth on Block C





**Photo 39:** Disturbed paperbark forest and weed infestation on Block C



**Photo 40:** Mangrove Forest on Block E with Saltmarsh (marine couch) in foreground





**Photo 41:** Saltmarsh and Swamp Oak Woodland on Block E



**Photo 42:** Cleared exotic grassland comprising the southern half of Block E



**Photo 43:** Mangrove Forest on Block E with hoop pine in background



## **Appendix B**

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Vegetation Communities and Flora  
and Fauna Species of Conservation  
Significance Recorded from Block A  
(Koala Block)



**Table B1: Vegetation Communities Occurring on Lot 3 DP837715 (Koala Block)**

Community	Conservation Significance	Area (ha)	Present in Tugun Study Area?
Paperbark Forest	Regional	5.3	✓
Swamp Oak Forest	State	14.3	✓
Mangrove Forest	Regional	5.9	✓
Swamp Oak/Mangrove Forest	State	0.6	✗
Dry Blackbutt Forest	Regional	20.8	✓
Brushbox/Dry Blackbutt Forest	Regional	6.4	✗
Moist Blackbutt Forest	Regional	7.3	✓
Fernland	Regional	0.4	✗
Swamp Oak/Mixed Eucalypt Forest	Regional	1.0	✗
Regenerating Rainforest	Regional	1.0	✓
Regenerating Rainforest with Emergent Eucalypts	Regional	1.0	✓
<b>TOTAL</b>		<b>64.0</b>	

**Table B2: List of Species Known from or Potentially Occurring in Lot 3 DP837715 (Koala Block)**

Common Name	Scientific Name	Conservation Significance	Found in Tugun Study Area
<b>Flora Recorded:</b>			
Bakers Wattle	<i>Acacia bakeri</i>	TSC (V)	✘
Veiny Lace Flower	<i>Achidendron muellerianum</i>	NCR (R), ROTAP	✓
Brush Cassia	<i>Cassia marksiana</i>	ROTAP	✘
Coast Palm Lily	<i>Cordyline congesta</i>	ROTAP	✓
Stinking Cryptocarya	<i>Cryptocarya foetida</i>	TSC (V), NCR (V), EPBC (V), ROTAP	✓
Black Walnut	<i>Endiandra globosa</i>	NCR (R), ROTAP	✓
Smooth Scrub Turpentine	<i>Rhodamnia maideniana</i>	NCR (R), ROTAP	✓
<b>Fauna Recorded:</b>			
Black-necked Stork	<i>Ephippiorhynchus asiaticus</i>	TSC (E), NCR (R)	✓
Osprey	<i>Pandion haliaetus</i>	TSC (V)	✓
Freckled Duck	<i>Stictonetta naevosa</i>	TSC (V)	✘
Bush Hen	<i>Amauornis olivacea</i>	TSC (V)	✓
Collared Kingfisher	<i>Todiramphus chloris</i>	TSC (V)	✓
Yellow-eyed Cuckoo Shrike	<i>Coracina lineata</i>	TSC (V)	✘
Mangrove Honeyeater	<i>Lichenostomus fasciogularis</i>	TSC (V)	✓
Black Flying Fox	<i>Pteropus alecto</i>	TSC (V)	✓
Koala	<i>Phascolarctos cinereus</i>	TSC (V)	✘
Rose-crowned Fruit Dove	<i>Ptilinopus regina</i>	TSC (V)	✓
<b>Fauna that May Occur:</b>			
Powerful Owl	<i>Ninox strenua</i>	TSC (V), NCR (V)	✘
Masked Owl	<i>Tyto novaehollandiae</i>	TSC (V)	?✓
Yellow-bellied Sheath-tail Bat	<i>Saccolaimus flaviventris</i>	TSC (V)	✘
Eastern Little Mastiff Bat	<i>Mormopterus norfolkensis</i>	TSC (V)	✘
Greater Broad-nosed Bat	<i>Scoteanax rueppellii</i>	TSC (V)	✘
Little Bent-wing Bat	<i>Miniopterus australis</i>	TSC (V)	✓
White-bellied Sea Eagle	<i>Haliaeetus leucogaster</i>	CAMBA	✓