

## 3. Characteristics of the study area

Further investigations have been undertaken since the release of the Concept Design Report in March 2006, including targeted summer flora and fauna surveys, geotechnical investigations along with indigenous and non-indigenous heritage studies. This section updates the Concept Design Report as a consequence of those investigations.

### 3.1 Overview of the study area

#### 3.1.1 *Regional context*

The Iluka Road to Woodburn study area covers 33 km of mostly low-lying rural land between the Clarence and Richmond Rivers, as shown in **Figure C**. The study area is bounded generally by the Iluka Road turnoff with the Pacific Highway in the south, and Tuckombil Canal to the north. The study area ends approximately 2 km south of Woodburn. The Iluka Road to Woodburn project does not pass through any urban or built-up areas.

Approximately half of the study area lies within each of the adjoining Local Government Areas (LGAs) of Clarence Valley and Richmond Valley. Land use is dominated by State Forest, National Park and Nature Reserve including Bundjalung National Park, the Mororo Creek and Tabbimoble Swamp Nature Reserves, and the Mororo, Devils Pulpit Tabbimoble and Doubleduke State Forests. In the south, private land holdings comprise mostly sugar cane farms interspersed with pockets of grazing land. In the north, there is a greater concentration of rural residential development and numerous small to medium rural holdings. Between New Italy and Woodburn in particular, there is an apparent trend towards smaller rural residential holdings and rural subdivision.

As illustrated in **Figures 3.1a** and **3.1b**, there are established residential communities at:

**Woombah** – The residents of Woombah occupy a substantial area of land either side of Iluka Road. There are approximately 200 dwellings; however its proximity is south of the southern tie in of this project

**Banana Road** – the residents of Banana Road occupy an area of land to the west of the highway at its southern tie-in. There are approximately eight households at Banana Road.

**Serendipity Road** – the residents of Serendipity occupy a substantial area of land between the Pacific Highway and Bundjalung National Park, which is registered under a system of Community Title. There are approximately 12 households at Serendipity, which is the limit of development on the land under the existing development consent.

**New Italy** – the New Italy community traces its origins to a group of Italian immigrants who settled in the area in the 1880s. The locality retains a strong connection to the past and to its Italian heritage through an active community and the presence of the New Italy Museum and cultural centre adjacent to the Pacific Highway. Swan Bay New Italy Road provides an alternative (low-standard) access between New Italy and Woodburn. New Italy comprises approximately 20 dwellings on medium sized rural allotments.

**Whites Road, Redgates Road, Turners Road** – Whites Road comprises a cluster of approximately 10 small rural residential holdings in a confined area of mostly cleared land west of the highway. Turners and Redgates Roads provide access to scattered private properties east of the highway.

**The Gap Road, Sharpe Road, Tuckombil Road, and Wondawee Way** – The Gap Road is one of the only sealed roads of any length in the study area, and connects the highway with the beaches and camping areas within Bundjalung National Park. Sharpe Road is a recent

subdivision of small (1 ha) rural residential allotments adjacent to the eastern side of the highway immediately to the north of The Gap Road. Tuckombil Road is a residual section of the former Pacific Highway, which is now a local road and which has begun to attract new rural residential development close to Woodburn. It comprises approximately 10 dwellings. Wondawee Way is situated opposite The Gap Road on the western side of the Pacific Highway and consists of approximately six dwellings accessed via an unsealed track.

**Trustums Hill, Williams Road** - Trustums Hill has been identified by Richmond Valley Council as a suitable location to accommodate some future growth in Woodburn's residential population. Existing development at Trustums Hill is focused around the old Pacific Highway, which is now a local road (Trustums Road). It comprises approximately 15 dwellings.

The remainder of the study corridor comprises scattered single residences only. There are no other 'communities' or any concentrations of settlement, that are serviced by roads within the study area although the towns and villages of Woodburn, Evans Head, Woombah and Iluka are located just outside the study area.

### 3.2 Visual characteristics

Generally, the study area comprises floodplains cut by a variety of creeks. Mountain ranges form the backdrops for views along the highway through the study area, the significant ones being Chatsworth Hill to the south and Mount Doubleduke and Richmond Range to the west. Sugar cane fields are predominant at the southern end of the project. Extensive dense forests of eucalypt, angophora and melaleuca line the highway for considerable lengths.

New Italy provides regional cultural landscape interest. The New Italy Museum Complex is in a pleasant garden courtyard setting, of a scale that is welcoming to and restful for travellers. An earth embankment next to the road edge and the separation to the highway provides an effective acoustic screen. This combined with a stand of significant existing eucalypts presents a pleasant entrance to the New Italy Museum Complex.

### 3.3 Biophysical characteristics

#### 3.3.1 *Topography, geology and soils*

Geotechnical investigation of the study area was initially undertaken in 2005. More detailed investigations were conducted in 2007 including 130 test pit excavations and 50 boreholes along the preferred route. The following section of the report presents the findings of the geotechnical investigation and provides a summary of the physical geography of the study area, such as the topography, geology and soils.

#### 3.3.2 *Geotechnical investigations*

Geotechnical investigations for concept design were conducted from June-August 2007. The work involved subsurface investigation at 180 locations. Boreholes were drilled to investigate deep alluvial soils and also to identify the presence of any potential soft soil and acid sulphate soils, and were excavated into rock to check the suitability for cut materials.

Inspection and mapping of cuttings along the existing highway were also conducted to gather information on adopted batter slopes and their condition.

#### 3.3.3 *Investigation results*

The elevated and lowland terrain types were defined as 'undulating rises and low hills' (elevated areas) and 'alluvial plains, including floodplains and back swamps' (lowland areas).

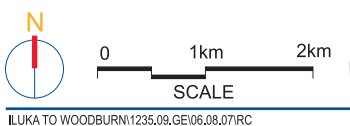
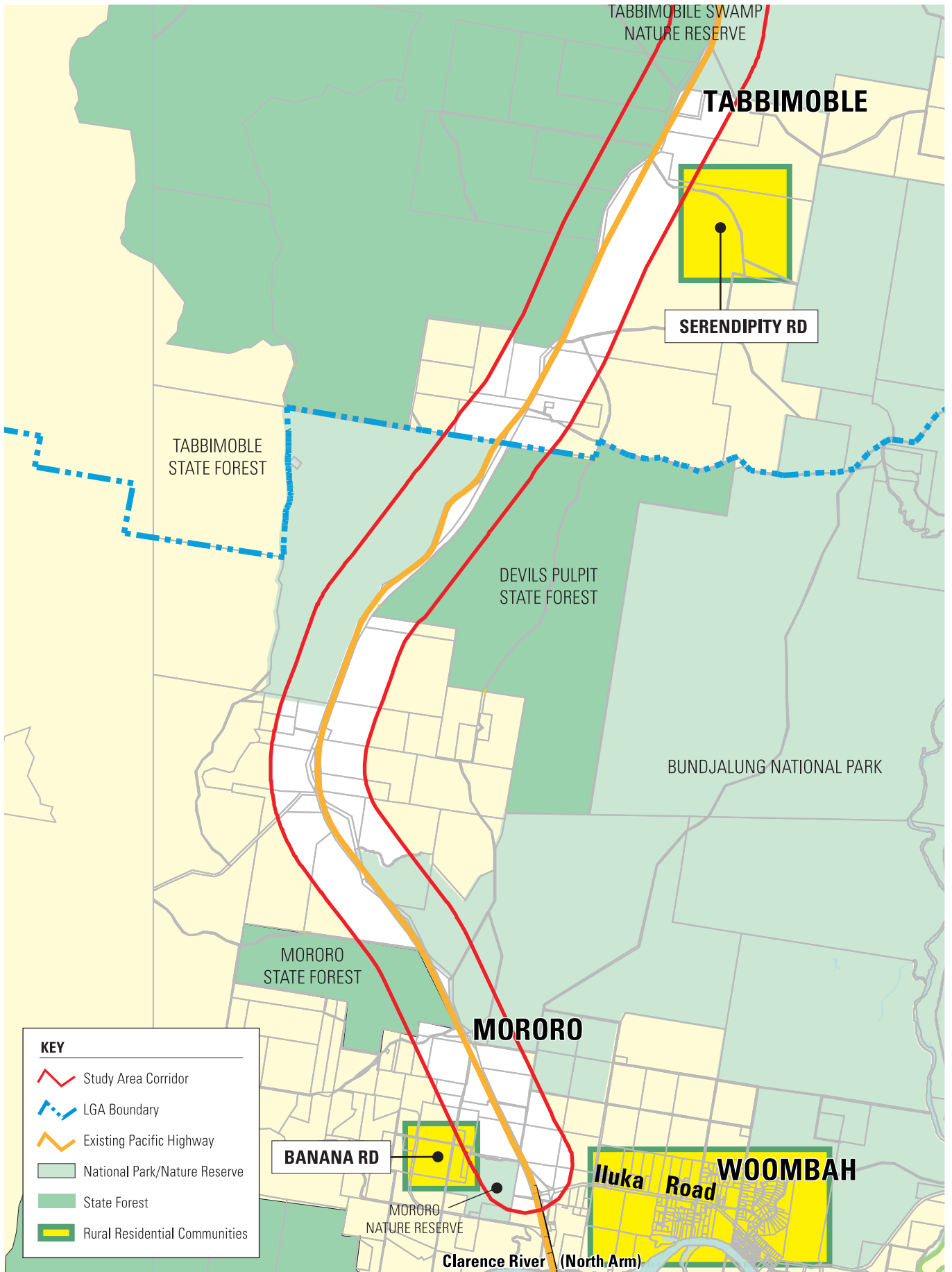


Figure 3.1a

Rural Residential Communities

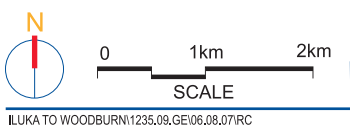
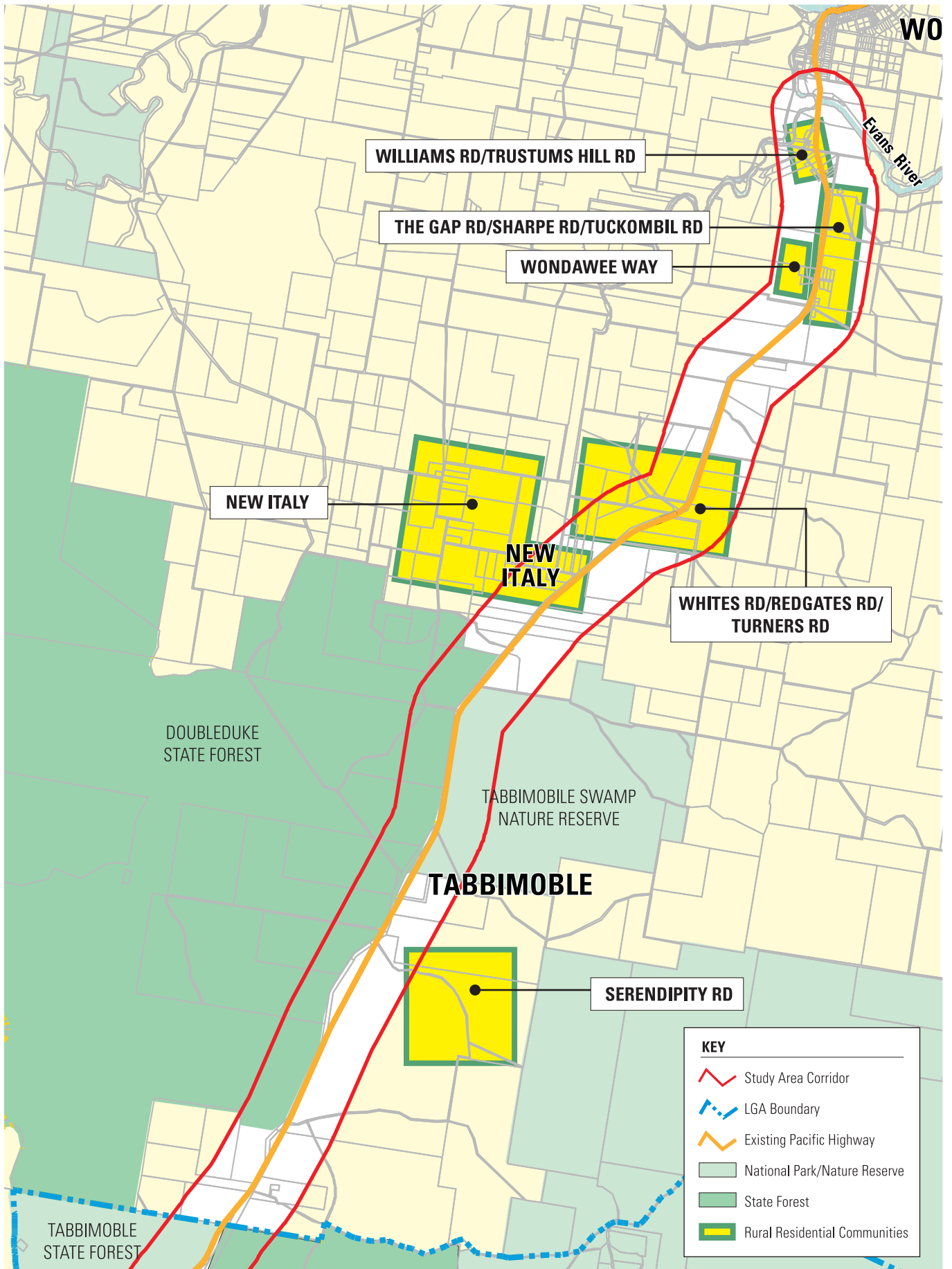


Figure 3.1b

Rural Residential Communities

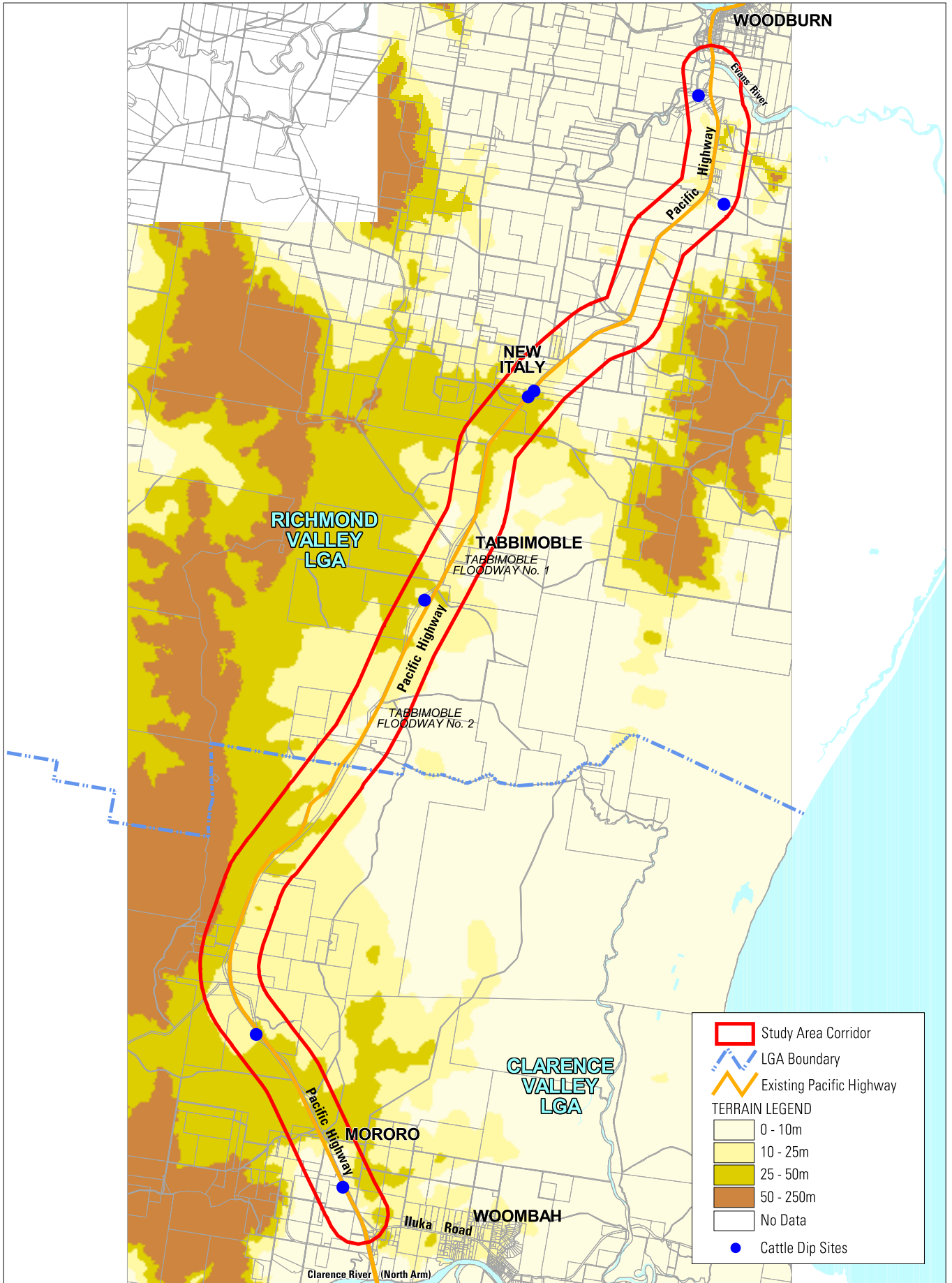


Figure 3.2

Topography Map

Source: Base data - Roads & Traffic Authority 2005  
 Topography - derived from LPI NSW (10m contours) by Connell Wagner P/L 2005



### 3.3.4 *Undulating rises and low hills*

The higher ground through the study area is characterised by weathered soils underlain by bedrock of extremely weathered, low strength sandstone/siltstone. The terrain ranges between 5 m AHD and 40 m AHD, with slopes in the range from 2 to 15%.

Soils were found to be stiff to hard clays or sandy clays, between 1 m and 6 m deep, overlying extremely weathered to medium strength sandstone and siltstone.

Potential acid sulphate soils were found in one test location at the southern end of the route and three test locations at the northern end of the route. Potential acid sulphate soils were not found in other locations. Further laboratory testing is underway to identify the extent of acid sulphate soils in the study area where excavations are required for road construction.

### 3.3.5 *Alluvial plains including floodplains, back swamps and aeolian deposits*

The alluvial plains are generally flat (slopes less than 3%), and are identified as being at elevations of:

- Reduced Level (RL) 4 m and RL8 m Australian Height Datum (AHD) (northern section. Richmond River, Tuckombil Canal floodplain).
- RL5m – RL10m AHD (Tabbimoble Floodways).
- RL25m AHD (Tabbimoble Creek).

Two main types of alluvial soils were encountered, although all exhibited deep soil profiles with shallow groundwater. Back swamp areas are typically soft, and during periods of high rainfall often become waterlogged and boggy, and are slow to drain.

In the southern half of the route, the alluvial soils comprise firm to very stiff clays, sand clays and dense sands, to typical depths of 12 to 19 m, overlying residual clays, siltstone and sandstone.

In the northern quarter of the route, the alluvial soils are medium dense sands, stiff clays and silts to depths of up to 7 m, overlying residual dense sands to up to 8 m depth, overlying sandstone and shale.

Preliminary results suggest no adverse soil conditions affecting the current preferred concept design which could have resulted in a change in selected cut and fill locations.

## 3.4 Hydrology and hydraulics

The Pacific Highway between Iluka Road and Woodburn crosses several floodplains and numerous waterways, and consequently this length of the highway experiences flood inundation from time to time. A detailed hydrologic and hydraulic analysis of the flooding behaviour and drainage patterns of the study area is ongoing at the time of preparing this report. The following discussion describes the known drainage characteristics of the study area.

For the purposes of the hydrologic modelling, the study area has been divided into the following portions (from south to north):

- Clarence River floodplain.
- Tabbimoble Creek and Floodways.
- Richmond River floodplain.

The southern section of the project crosses numerous small, ephemeral creeks within the Clarence River floodplain, also exhibiting a highly two-dimensional nature.

The Tabbimoble Creek and Floodway crossings also exhibit a two dimensional nature, flowing from west to east and discharging beneath the highway to a large, low-lying area behind the coastline.

The northern section of the project crosses the Richmond River floodplain, which consists of a relatively complex network of creeks and waterways (including Richmond River, Rocky Mouth Creek, Swampy Creek and Tuckombil Canal) and exhibits a highly two-dimensional nature (i.e. the network of streams extends upstream as well as across a wide catchment). Historically, the highway has been inundated for extended periods at the crossings in the area north of New Italy. This suggests that the downstream system (likely Rocky Mouth Creek or Richmond River) may have been at capacity, preventing local catchment runoff from escaping.

#### **3.4.1 Hydrologic (flooding) analysis**

Hydrologic (flooding) modelling was required to generate flood hydrographs for the hydraulic models and included the following:

- Development of XP-RAFTS hydrologic models for each existing crossing, using design rainfall parameters from Australian Rainfall and Runoff (AR&R) and existing catchment information.
- Verification of the hydrologic models to provide confidence in their ability to predict design event discharges. The models were verified using the Rational Method because of the absence of detailed historical observations and records.
- Calculation of peak design event discharge predictions for each crossing, for a range of design event magnitudes in accordance with AR&R.

#### **3.4.2 Hydraulic analysis**

Detailed hydraulic models have been prepared for pre- and post-development conditions. These models will be used to:

- Predict existing extents, depths and durations of flood inundation in the vicinity of the highway.
- Identify flood affected structures across the floodplains.
- Design upgraded creek and culvert crossings so that the highway can achieve the required flood immunity.
- Quantify any hydraulic impacts associated with the project – with particular attention to flood-affected properties.

Hydraulic modelling was undertaken using the 1d/2d MIKE FLOOD software package. The Richmond River, Tabbimoble and Clarence River floodplains were modelled in five MIKE FLOOD models in the following regions:

- North of New Italy.
- Tabbimoble Floodway Number 1.
- Tabbimoble Floodway's Numbers 2 and 3.
- Tabbimoble Creek and Overflow.
- Clarence River floodplain north of Iluka Road.

The preliminary results from the above regions are presented below.

#### **North of New Italy**

The Pacific Highway north of New Italy is affected by flooding from the Richmond River and local catchments. The local catchment flood levels are affected by the tailwater from Richmond River flood events.

Peak flood levels from Richmond River flood events were obtained from the "Woodburn to Ballina – Preferred Route/Concept Design – Hydrology/Hydraulics Report" (Brown Consulting

Pty Ltd, July 2007). Peak flood predictions at Rocky Mouth Creek from the above study are presented in Table 3.1 below.

**Table 3.1 Richmond River Flood Event - Peak Flood Levels at Rocky Mouth Creek**

ARI (years)	Peak Flood Level (m AHD)
1	2.54
5	3.38
20	4.09

The Pacific Highway north of New Italy has a pavement level of approximately 3.5 m AHD. It can be seen from Table 3.1 that a 20 year average recurrence interval (ARI) or higher Richmond River flood event will submerge the highway.

Peak flood level predictions from local catchment flooding are presented in Table 3.2 below.

**Table 3.2 Local Catchment Flooding**

ARI (years)	Peak Flood Level (m AHD)
20	3.4 – 3.8
100	3.5 – 3.9

It can be seen from Table 3.2 that flood waters from the 20 year and 100 year ARI local events are predicted to submerge the Pacific Highway by approximately 0.3–0.4 m for the 20 year and 100 year ARI design events respectively.

### Clarence River floodplain

The Pacific Highway is affected by flooding from the Clarence River and local catchments. Peak flood levels from Clarence River flood events were obtained from the "Lower Clarence River Flood Study Review – Final report" (WBM, March 2004). Peak flood predictions from the above study in the vicinity of the Pacific Highway are presented in Table 3.3 below.

**Table 3.3 Clarence River Flood Event – Peak Flood Levels**

ARI (years)	Peak Flood Level (m AHD)
20	2.5 – 3
100	3 – 3.5

The Pacific Highway is predicted to be immune to 20 year and 100 year ARI Clarence River design flood events to the north of Iluka Road, however, some local flooding up to 0.2 m in depth is predicted in the vicinity of Banana Road for both the 20 year and 100 year ARI local catchment design flood events.

### Tabbimoble Creek and Overflow

Preliminary calculations indicate that this section of the highway has 100 year ARI immunity in the vicinity of Tabbimoble Creek and Tabbimoble Overflow, however, some local flooding up to 0.2 m in depth is predicted in the vicinity of the rest area north of Jacky Bulbin Road for both the 20 year and 100 year ARI design flood events.

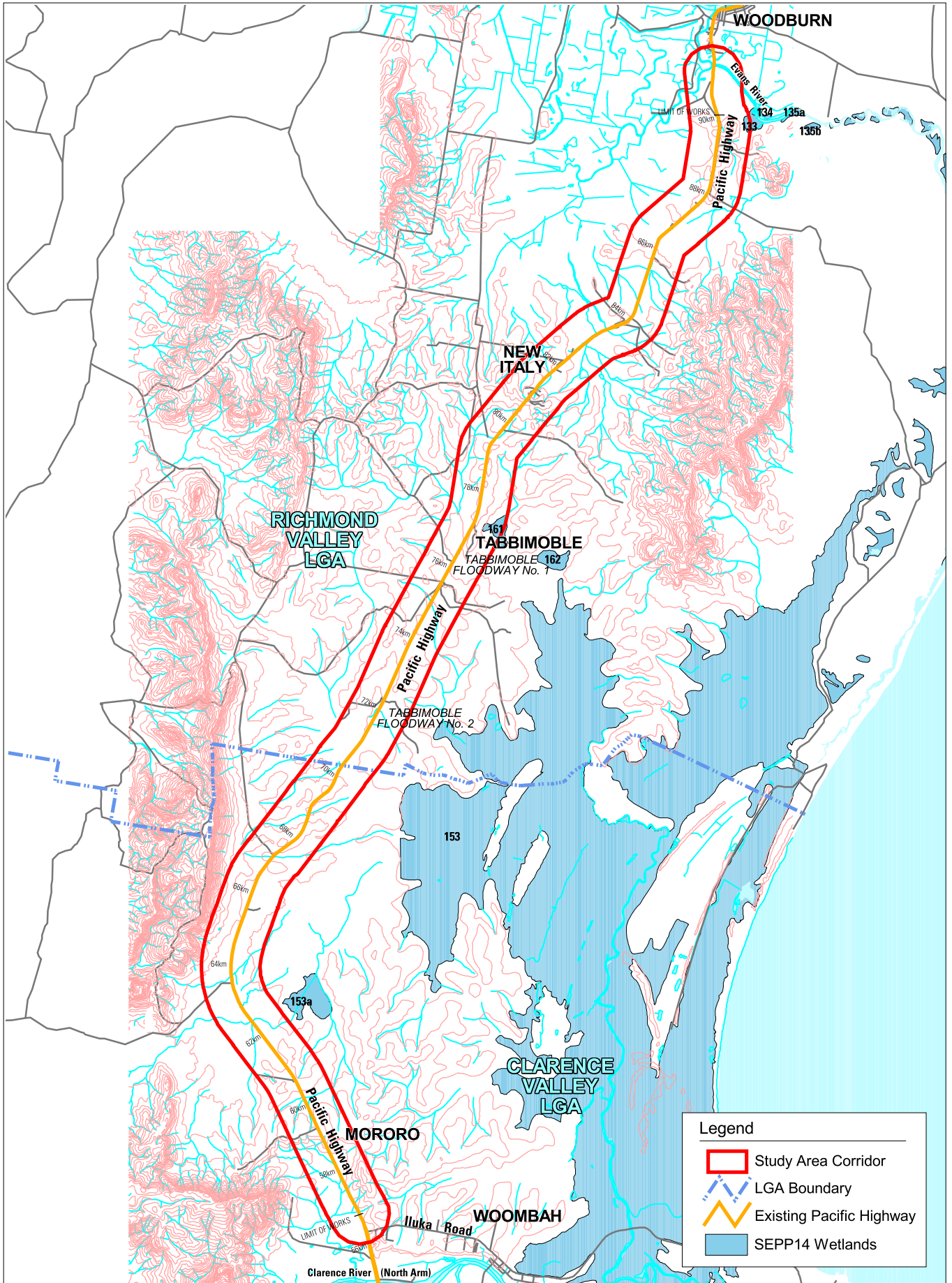
### Tabbimoble Floodway's Numbers 2 and 3

Preliminary calculations indicate that this section of the highway has 100 year ARI immunity.

### Tabbimoble Floodway Number 1

Preliminary calculations indicate that this section of the highway has 100 year ARI immunity.





**Legend**

- Study Area Corridor
- LGA Boundary
- Existing Pacific Highway
- SEPP14 Wetlands



Source: Base data - Roads & Traffic Authority 2005  
SEPP14 Wetlands - National Parks & Wildlife Service 2004

**Figure 3.3**

SEPP14 Wetlands

### 3.5 Ecology

An initial ecological assessment was carried out on the flora and fauna of the study area in winter 2005. This included vegetation sampling, classification and mapping in order to ascertain the extent and types of flora and habitat. Surveys were conducted to ascertain the extent and type of fauna within the study area. In addition to visual surveys, call playback tests, traps and ultrasonic detection were used. Following the initial investigations, a targeted summer flora survey, a targeted frog survey and a survey of *Melaleuca irbyana* at New Italy were all conducted in February 2006.

The Iluka Road to Woodburn study area is characterised by extensive tracts of native vegetation exhibiting high biodiversity including a range of threatened flora and fauna species and endangered ecological communities (EECs). The findings of these surveys for flora and fauna are discussed below.

#### 3.5.1 *Vegetation*

Five broad vegetation types occur in the study area:

- Dry Open Forest.
- Swamp Sclerophyll Forest.
- Floodplain Forest.
- Wet Heath/Sedgeland.
- Freshwater Swamp.

These five vegetation types cover 14 vegetation associations, four of which fall under the definition of an EEC listed under the *NSW Threatened Species Conservation Act 1995* (TSC Act). The four EECs concerned, which are illustrated in **Figures 3.4a** and **b**, are:

- Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions.
- Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions.
- Subtropical coastal floodplain forest of the NSW North Coast bioregion.
- Freshwater wetlands on the coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions.

A substantial percentage of the survey corridor is vegetated with either Swamp Sclerophyll Forest or Subtropical Coastal Floodplain Forest. Nearly all the recorded threatened plant species and regionally significant plant species occur in these EECs.

The dominant vegetation types within the study area are Dry Open Forest, Swamp Sclerophyll Forest and Floodplain Woodland. These three vegetation types account for 47%, 15% and 14%, respectively, of the native vegetation within the study area and 10 of the 14 vegetation associations.

#### 3.5.2 *Threatened flora species*

An assessment of the likelihood of threatened species occurring in the study area was based on:

- Department of Environment and Conservation's (DECC's) Atlas of NSW Wildlife for a 20 km radius search area.
- review of previous studies.
- review of the habitat preferences of threatened species resulting from the database search.
- interpretation of Comprehensive Regional Assessment Aerial Photograph Interpretation (CRAFTI) vegetation maps.

The vegetation surveys, including the targeted summer survey, were conducted in compliance with the 'precautionary principle' whereby the presence of suitable habitat was used as an indicator of the possible presence of a species in the study area. The assessment drew a distinction between those threatened species that were likely to occur in the study area (by virtue of presence of suitable habitat) and those that were unlikely to occur. Those species that are considered likely to occur are therefore assessed as though they have been recorded.

Eight species of flora listed as threatened under the TSC Act were recorded in the study area, as shown in **Figures 3.5a** and **b**. Three of these are endangered and five vulnerable as outlined in **Table 3.4** below. Three of these species were also listed under the Commonwealth EPBC Act as vulnerable (*Desmodium acanthocladum*, *Prostanthera cineolifera* and *Prostanthera palustris*).

**Table 3.4 Threatened species under the TSC Act recorded in the study area**

Common Name	Botanical Name	Conservation Status	
		NSW	Commonwealth
Small-leaved Paperbark	<i>Melaleuca irbyana</i>	NSW	Commonwealth
Fern	<i>Lindsaea incisa</i>	E	-
Sedge	<i>Cyperus aquatilis</i>	E	-
Orchid	<i>Oberonia titania</i>	E	-
Spiny Desmodium	<i>Desmodium acanthocladum</i>	V	V
Swamp Mint Brush	<i>Prostanthera palustris</i>	V	V
Maundia	<i>Maundia triglochinooides</i>	V	-
Cineolifera	<i>Prostanthera cineolifera</i>	V	V

Source: Connell Wagner, 2007.

The following 18 species, which are listed as threatened species under the TSC Act, are potentially present in the study area on the basis of species habitat requirements, but were not recorded during the field surveys. They are therefore considered, for the purpose of this report and in accordance with the 'precautionary principle', as being likely to occur in the study area.

**Table 3.5 Threatened flora species likely to occur in the study area**

Common Name	Botanical Name	Conservation Status	
		NSW	Commonwealth
	<i>Drynaria rigidula</i>	E	-
Square-stemmed Spike-rush	<i>Eleocharis tetraquetra</i>	E	-
Slaty Red Gum	<i>Eucalyptus glaucina</i>	V	V
Square-fruited Ironbark	<i>Eucalyptus tetrapleura</i>	V	V
Sweet Myrtle, Small-leaved Myrtle	<i>Gossia fragrantissima</i>	E	E
	<i>Grammitis stenophylla</i>	E	-
	<i>Haloragis exaltata</i> sp. <i>Velutina</i>	V	V
	<i>Hibbertia marginata</i>	V	V
	<i>Lindsaea fraseri</i>	E	-
	<i>Melichrus</i> sp. ' <i>Gibberagee</i> '	E	E
	<i>Oldenlandia galioides</i>	E	-
Knotweed	<i>Persicaria elatior</i>	V	V
Lesser Swamp Orchid	<i>Phaius australis</i>	E	E
Endangered Swamp Orchid	<i>Phaius tankervilleae</i>	E	E
	<i>Phyllanthus microcladus</i>	E	E
	<i>Polygala linariifolia</i>	E	-
	<i>Rutidosis heterogama</i>	V	V

Source: Connell Wagner, 2007.

The endangered species *Melaleuca irbyana* (Small-leaved Paperbark) is considered to have the highest level of botanical constraint on the proposal. In NSW this species is restricted to the Grafton and Casino districts where it is known from approximately nine populations. The population in the study area is the most easterly recorded. The only other area where the species occurs is between Ipswich and Toowoomba west of Brisbane.

*Melaleuca irbyana* occurs south of the New Italy museum (see **Figure 3.6**) and extends for approximately 400 m on either side of the existing highway. The width of the populations varies from 50 to 150 m and is wider on the western side of the highway. The population contains approximately 800 individuals, comprising 250 trees greater than 3 m high and 550 saplings and suckers spread over about 1.5 ha. The condition of habitat is better on the western side of the highway. On the eastern side the habitat is dissected by driveways, fence lines, firebreaks and a power line easement.

The small ground fern *Lindsaea incisa*, also an endangered species under the TSC Act, is currently known from a total of only seven other locations in NSW. The population at the southern end of the corridor in Mororo State Forest, approximately 3 km north of the Iluka turn-off, is located about 40 m from the existing highway in swamp sclerophyll forest (protected ecological community). The duplication occurs to the east of the existing highway and therefore would not result in a direct impact on the species.

*Cyperus aquatilis*, which is also listed as endangered under the TSC Act, is a small sedge or grass-like plant with an annual life cycle. *Cyperus aquatilis* was recorded on the eastern and western sides of the Pacific Highway at Tabbimoble. A further targeted survey was carried out in late summer (February 2006) to determine how widespread the species is in the Tabbimoble area and to develop management options to conserve it in relation to the proposed highway upgrade, which are discussed in **Section 7.3.4**.

The other five recorded threatened species, *Desmodium acanthocladum*, *Maundia triglochinosides*, *Prostanthera cineolifera*, *Oberonia titania* and *Prostanthera palustris*, are unlikely to be impacted by the highway upgrade due to their location. The potential impact on these species and species listed as likely to be present but not recorded during the investigations, would be confirmed at the environmental assessment and detail design phases of the project.

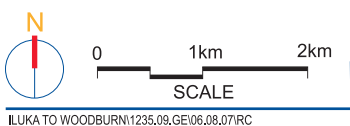
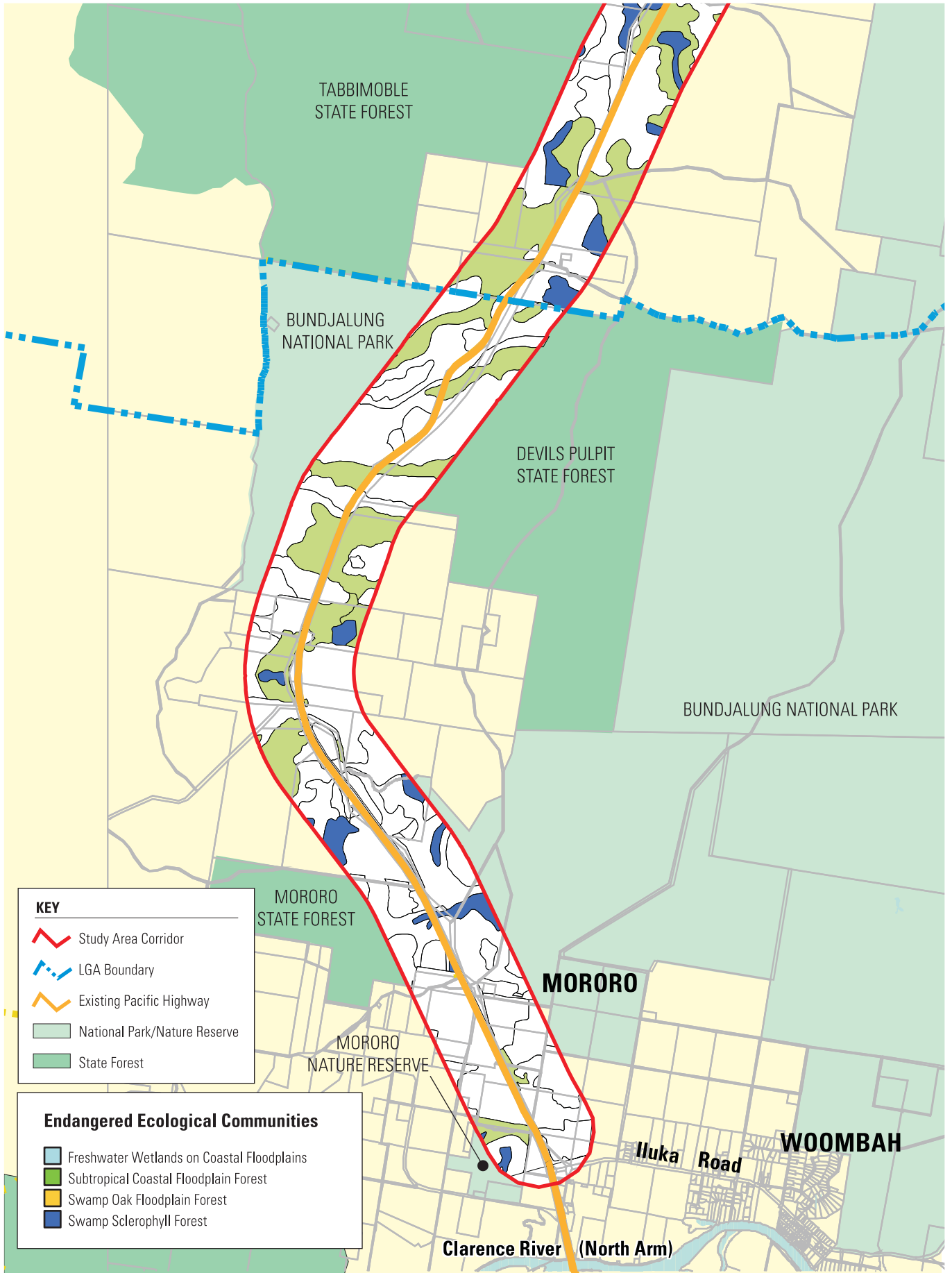


Figure 3.4a

Endangered Ecological Communities

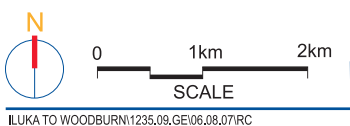
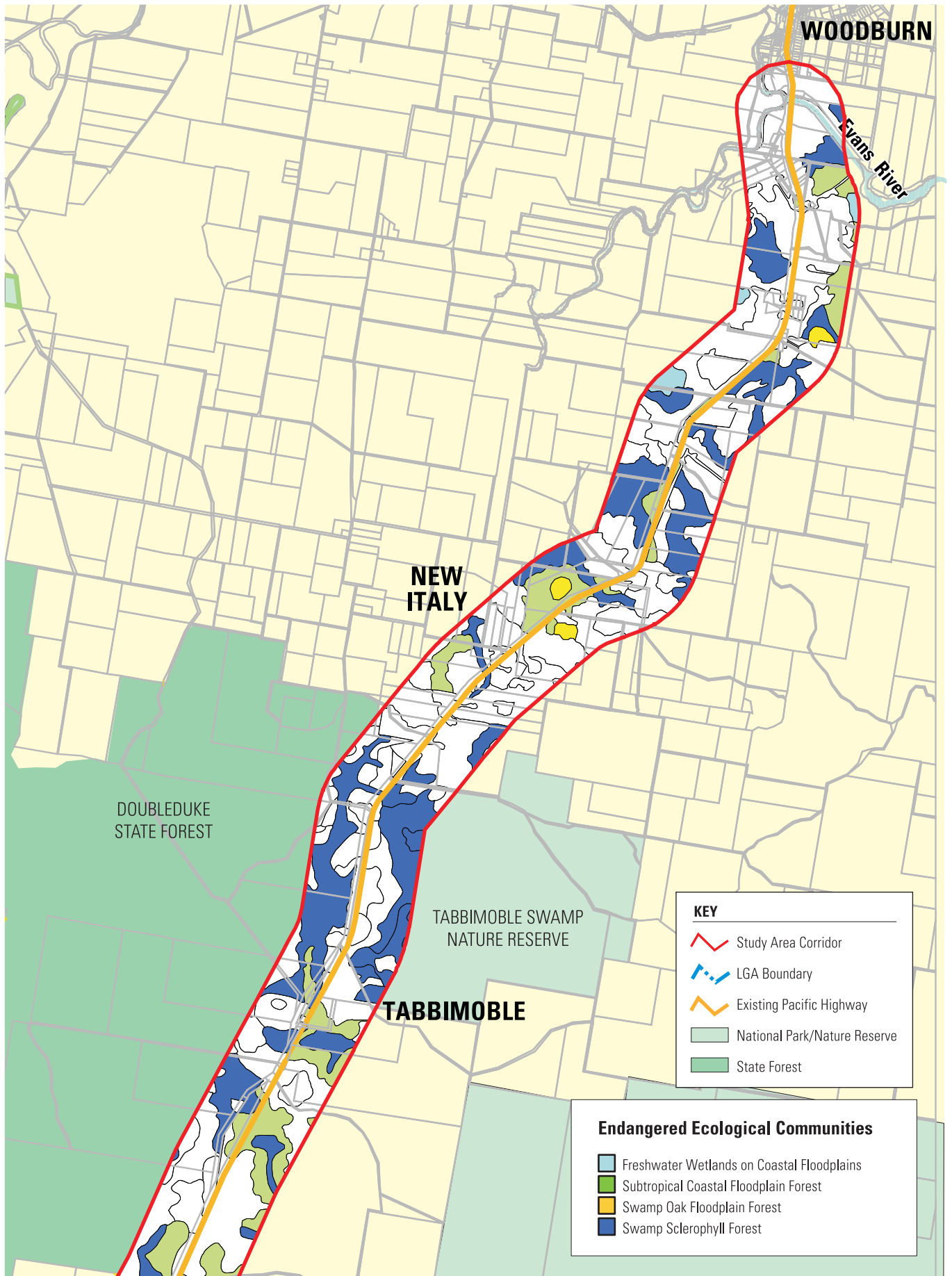


Figure 3.4b

Endangered Ecological Communities

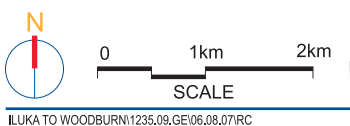
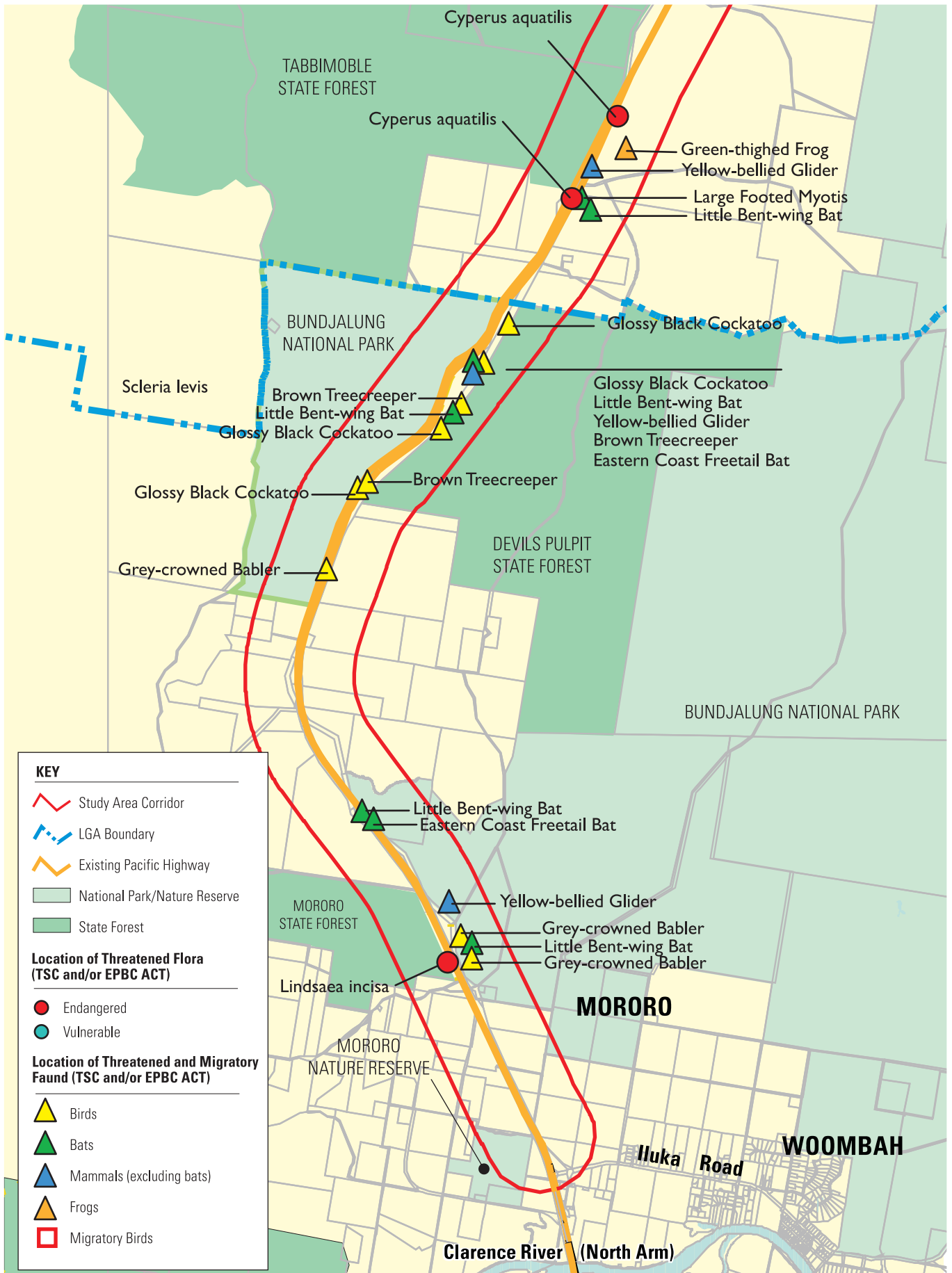


Figure 3.5a

Locations of Threatened Flora and Fauna

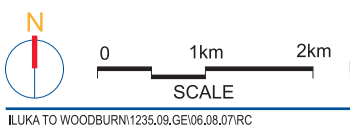
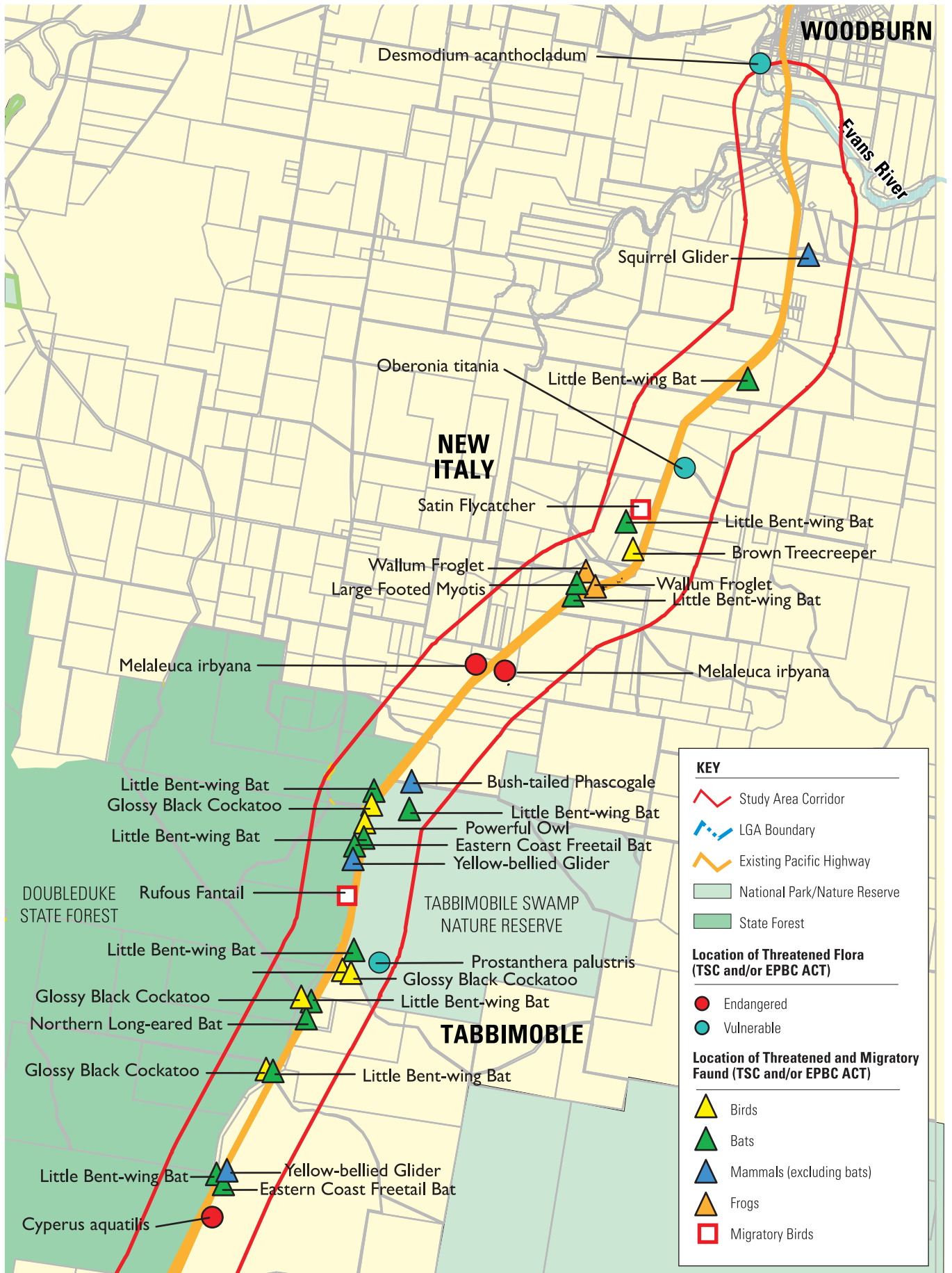


Figure 3.5b

Locations of Threatened Flora and Fauna



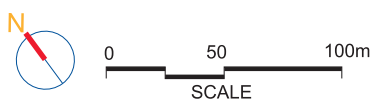
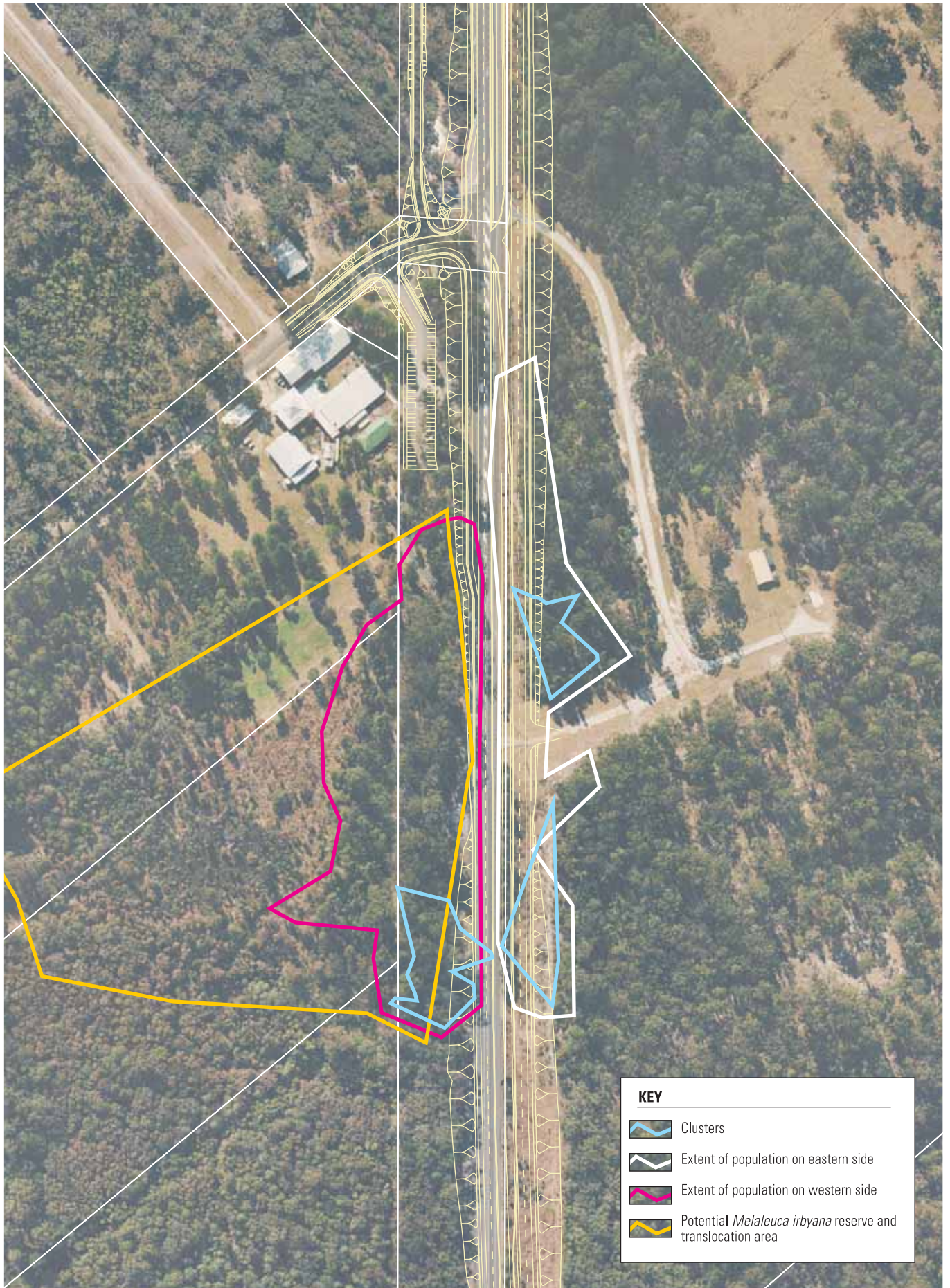


Figure 3.6

Location of *Melaleuca irbyana*

## Terrestrial fauna

Eighteen threatened fauna species listed under the TSC Act were recorded in the study area during field investigations undertaken for this assessment:

**Table 3.6 Threatened fauna species and migratory species recorded in the study area**

Common Name	Botanical Name	Conservation Status	
		NSW	Commonwealth
Wallum Froglet	<i>Crinia tinnula</i>	V	–
Green-thighed Frog	<i>Litoria brevipalmata</i>	V	–
Brown Treecreeper	<i>Cormobates picumnus</i>	V	–
Glossy Black-Cockatoo	<i>Calyptorhynchus lathami</i>	V	–
Grey-crowned Babbler	<i>Pomatostomus temporalis</i>	V	–
Masked Owl	<i>Tyto novaehollandiae</i>	V	–
Powerful Owl	<i>Ninox strenua</i>	V	–
Brush-tailed Phascogale	<i>Phascogale tapoatafa</i>	V	–
Squirrel Glider	<i>Petaurus norfolcensis</i>	V	–
Yellow-bellied Glider	<i>Petaurus australis</i>	V	–
East Coast Freetail Bat	<i>Mormopterus norfolkensis</i>	V	–
Grey-headed Flying-Fox	<i>Pteropus poliocephalus</i>	V	V
Hoary Wattled Bat	<i>Chalinolobus nigrogriseus</i>	V	–
Large-footed Myotis	<i>Myotis adversus</i>	V	–
Little Bent-wing Bat	<i>Miniopterus australis</i>	V	–
Eastern Bent-wing Bat	<i>Miniopterus Schreibersii oceanensis</i>	V	–
Eastern Long-eared Bat	<i>Nyctophilus bifax</i>	V	–
Eastern Cave Bat	<i>Vespadelus troughtoni</i>	V	–
<b>Migratory species under the EPBC Act</b>			
Satin Flycatcher		-	-
Rufous Fantail		-	-

Source: Connell Wagner, 2007.

The location of these species as noted during the investigations is depicted in **Figures 3.5a** and **3.5b**. It is important to note that these locations represent a snapshot in time and do not preclude the presence of species in areas not shown, nor the future absence of species in areas where they have been recorded.

Interrogation of DECC's *Atlas of NSW Wildlife*, together with the presence of suitable habitat within the study area, indicates that additional threatened species are likely to occur. Species clearly exhibiting preferences for habitats not represented in the study area were eliminated from the target species list, thereby focusing field studies and impact assessments on the remaining threatened species. Threatened species for which there were no database records, but which were considered likely to occur (on the basis of habitat suitability) were also targeted. Threatened species that were found to be 'likely' to occur in the study area by virtue of habitat suitability were treated as if they had been recorded. These species are listed in **Table 3.7**.

Table 3.7 Threatened fauna species likely to occur in the study area

Common Name	Botanical Name	Conservation Status	
		NSW	Commonwealth
Wallum Sedge Frog	<i>Litoria olongburensis</i>	V	V
Stuttering Frog	<i>Mixophyes balbus</i>	E	V
Fleay's Barred Frog	<i>Mixophyes fleayi</i>	E	E
Giant Barred Frog	<i>Mixophyes iteratus</i>	E	E
White-crowned Snake	<i>Cacophis harriettae</i>	V	–
Pale Headed Snake	<i>Hoplocephalus bitorquatus</i>	V	–
Stephen's Banded Snake	<i>Hoplocephalus stephensii</i>	V	–
Red-tailed Black-Cockatoo	<i>Calyptorhynchus banksii</i>	V	–
Emu	<i>Dromaius novaehollandiae</i> (NSW North Coast Bioregion and Port Stephens LGA Population)	E2	–
Red Goshawk	<i>Erythrotriorchis radiatus</i>	E	V
Black-breasted Buzzard	<i>Hamirostra melanosternon</i>	V	–
Swift Parrot	<i>Lathamus discolor</i>	E	E
Square-tailed Kite	<i>Lophoictinia isura</i>	V	–
Hooded Robin	<i>Melanodryas cucullata</i>	V	–
Hooded Robin (southeastern subspecies)	<i>Melanodryas cucullata cucullata</i>		
Osprey	<i>Pandion haliaetus</i>	V	–
Regent Honeyeater	<i>Xanthomyza phrygia</i>	E	E
Barking Owl	<i>Ninox connivens</i>	V	–
Masked Owl	<i>Tyto novaehollandiae</i>	V	–
Rufous Bettong	<i>Aepyprymnus rufescens</i>	V	–
Eastern Pygmy-possum	<i>Cercartetus nanus</i>	V	–
Spotted-tailed Quoll	<i>Dasyurus maculatus</i>	V	–
Spotted-tailed Quoll (SE Mainland Population)	<i>Dasyurus maculatus maculatus</i>	–	E
Long-nosed Potoroo	<i>Potorous tridactylus</i>	V	–
Long-nosed Potoroo (SE Mainland Population)	<i>Potorous tridactylus tridactylus</i>	–	V
Koala	<i>Phascolarctos cinereus</i>	V	–
Common Planigale	<i>Planigale maculata</i>	V	–
Large-eared Pied Bat	<i>Chalinolobus dwyeri</i>	V	V
Golden-tipped Bat	<i>Kerivoula papuensis</i>	V	–
Black Flying-Fox	<i>Pteropus alecto</i>	V	–
Yellow-bellied Sheath-tail- bat	<i>Saccolaimus flaviventris</i>	V	–
Greater Broad-nosed Bat	<i>Scoteanax rueppellii</i>	V	–
Common Blossom-bat	<i>Syconycteris australis</i>	V	–
<b>Migratory species under EPBC Act likely to occur</b>			
White-bellied Sea-Eagle	<i>Haliaeetus leucogaster</i>	–	M
White-throated Needle-tail	<i>Hirundapus caudacutus</i>	–	M

Source: Connell Wagner, 2007.

### Key Habitat and Fauna Corridors

The diverse range of habitat types is reflected in the high number and diversity of threatened fauna recorded throughout the study area. Threatened fauna species recorded include three cave-roosting bat species, three hollow-roosting bat species, three hollow-dependent mammal species, two species of frog, and seven bird (including four hollow-dependent) species.

Hollow-bearing trees provide essential nesting/roosting/shelter habitat for many of these species. Most of the hollow-bearing trees observed during the fauna surveys were located in the dominant habitat type (Dry Open Forest) which is distributed along the length of the highway corridor. Additional important habitat for some of these species includes culverts and bridges (providing roosts for cave-dwelling bats) and winter-flowering species (providing foraging resources for gliders). These habitats are also distributed throughout the length of the highway corridor.

Key habitats and corridors identified by the DECC as occurring within, or in the vicinity of, the study area include:

- Broadwater-Tabbimoble Regional Corridor, which links Bundjalung National Park and Tabbimoble Swamp Nature Reserve.
- Devils Pulpit Subregional Corridor, which links Bundjalung National Park and Tabbimoble Creek.
- Mororo-Bundjalung Regional Corridor, which links the Mororo Corridor and Bundjalung National Park.
- Bundjalung-Tabbimoble Regional Corridor, which serves as a link between Bundjalung National Park and the Pacific Highway.

### 3.5.3 *Aquatic habitats*

The study area contains several creeks and drainage lines, with intact native vegetation, providing shelter, foraging, breeding habitat for frogs including potential habitat for threatened frogs such as the Giant Barred Frog. These habitats are also used as foraging areas by various threatened bat species.

Culverts crossing the creeklines and drainage lines are also likely to be used as roost sites for cave-dwelling bats, including the threatened *Myotis adversus* (Large-footed Myotis) and *Miniopterus australis* (Little Bent-wing Bat), which were captured in traps located at culvert entrances.

Freshwater wetland habitat within the study area provides suitable habitat for a number of threatened species listed under the TSC Act, particularly threatened wetland birds and frogs.

A search of the BioNet database system (which includes records from the collections of the Australian Museum, NSW Department of Environment and Conservation and NSW Department of Primary Industries) was undertaken to identify threatened fish species recorded within 10 km of the study area. Within the general locality, the following four threatened fish species have been recorded:

- Olive Perchlet (*Ambassis agassizii*)
- Black Cod (*Epinephelus daemeli*)
- Oxleyan Pygmy Perch (*Nannoperca oxleyana*)
- Green Sawfish (*Pristis zijsron*)

An assessment of the likelihood of occurrence of threatened fish species was based on a preliminary assessment of aquatic habitats undertaken during the field surveys. From these surveys it was considered that these species would be unlikely to occur. This would be confirmed during the environmental assessment and detail design phases of the project.

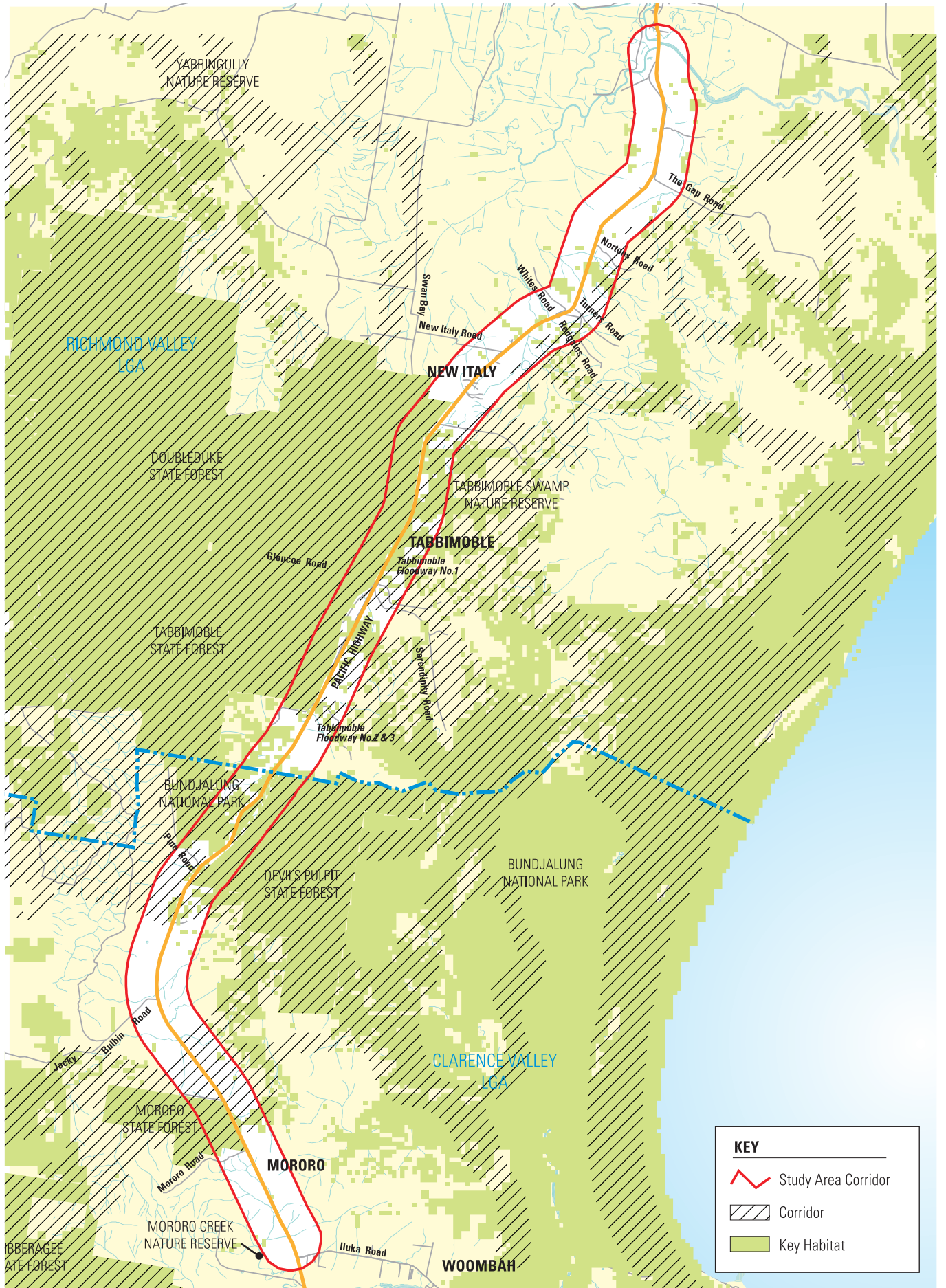
### 3.5.4 *Ecological sensitivity*

The main aspects of ecological sensitivity associated with the proposed concept design have been identified as:

- the population of *Melaleuca irbyana* near New Italy.

- individual threatened plants distributed throughout the study area.
- locations with a high density of hollow-bearing trees.
- the EECs.
- forested habitats associated with threatened species records.
- culverts and bridges which are likely roosts for cave-dwelling bats.
- creeks and drainage lines.
- location of Wallum Froglet and Green-thighed Frog

Potential impacts of the proposed concept design on flora and fauna species and habitats are discussed in **Section 7.3.4** and **7.3.5** of this report.



**KEY**




-  Study Area Corridor
-  Corridor
-  Key Habitat



Figure 3.7

Key Habitats and Corridors

### 3.6 Acoustic environment

#### 3.6.1 Existing noise environment

For the purpose of establishing ambient noise levels, measurements were conducted at six reference locations along the study route from Tuesday 1 March 2005 to Tuesday 8 March 2005. The results, detailed in Table 3.8 below, show that daytime noise levels were 1-2dB(A) higher than night-time levels.

The small difference between day-time and night-time traffic noise levels reflects the fact that night-time traffic, although lower in terms of total number of vehicles, has a higher proportion of heavy vehicles, which generally emit higher noise levels than light vehicles.

**Table 3.8 Façade road traffic noise levels**

Noise Measurement Location (Refer Figures 3.12a and b)	Distance to Pacific Highway	Façade Road Traffic Noise Level	
		dB(A) (day)	dB(A) (night)
R1: 8 Old Pacific Highway Woombah	120m	59	58
R2: 6530 Pacific Highway Tabbimoble <sup>1</sup>	65m	62	61
R3: Lot 1/796808 Pacific Highway Tabbimoble <sup>1</sup>	45m	63	62
R4: 7680 Pacific Highway Tabbimoble	45m	65	64
R5: Lot 15/5861 Pacific Highway Tabbimoble	65m	64	62
R6: 32 Trustums Hill Road Woodburn	55m	62	61

*Note 1: Measurements at locations R2 and R3 were in free-field (free of reflective objects). To account for noise reflection from the buildings, a façade correction of 2.5dB(A) was added to the measurement results.*

Source: Connell Wagner, 2005.

Classified traffic counts were conducted on the Pacific Highway at the southern and northern ends of the study route during the noise monitoring period. Results of the traffic counts showed that:

- Traffic volumes throughout the study area were similar.
- The average daytime (15-hour) traffic volumes and proportions of heavy vehicles were in the order of 6,000 vehicles per day (vpd) and 20% respectively.
- The average night-time (9-hour) traffic volumes and proportions of heavy vehicles were in the order of 1,000vpd and 60% respectively.

This traffic information forms the baseline to which the measured noise levels relate. Predicted increases in traffic volume can then be translated into increased noise levels. Similarly, noise level can be predicted in relation to the distance from the highway. These matters are discussed in Section 7.9.

### 3.7 Indigenous heritage

#### 3.7.1 Local Aboriginal Land Councils

The southern part of the study area between Iluka Road and Tabbimoble Creek lies within the territory administered by the Yaegl Local Aboriginal Land Council (LALC), and within the area of interest to the Ul Gundahi Elders group.

The area north from Tabbimoble Creek to New Italy lies within the boundaries of the Bogal LALC, while the area from New Italy to the northern limit of the project area at Tuckombil Canal is shared by the Bogal, Jali and Ngulingah LALCs. This sharing arrangement has arisen due to the high spiritual and archaeological significance of the Evans Head/Goanna Headland locality to the Bundjalung people from a wide geographical area.

### **3.7.2**      *Native title claims*

Searches of the National Native Title Register, Register of Native Title claims, Register of Indigenous Land Use Agreements and the Applications Summary were undertaken for the Richmond Valley and Clarence Valley LGAs on 4 May 2005 and 28 August 2007. Advice provided by the National Native Title Tribunal indicates that two entries relevant to the study area have been active throughout this period. Both have been accepted for Native Title registration and are currently in mediation.

The first of these (NC96/16) was lodged by the late Lawrence Wilson on behalf of the Bandjalang dialect group (the Bandjalang Aboriginal Corporation). It relates to five separate land parcels east and north-east of the existing highway reserve between Iluka Road and Woodburn. One of these land parcels (designated 'Area B') lies immediately east of the Pacific Highway reserve and forms Tabbimoble Nature Reserve.

The second entry (NC98/19) was also lodged by Lawrence Wilson on behalf of the Bandjalang dialect group. The application relates to a 3,315 km<sup>2</sup> area comprising all claimable land south from Broadwater Headland to Woody Bluff, inland to Nortons Gap and Busbys Flat. This application encompasses all of the Iluka Road to Woodburn study area.

The above native title claims generally do not affect the proposed Pacific Highway upgrade, as the claims do not apply to freehold lands, or to lands lawfully owned and occupied. On acquisition of any land required for the construction of the project however, the RTA would be required to extinguish the relevant native title claims (if any) prior to acquiring the land.

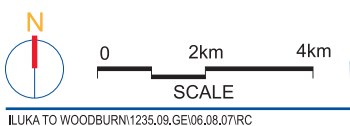
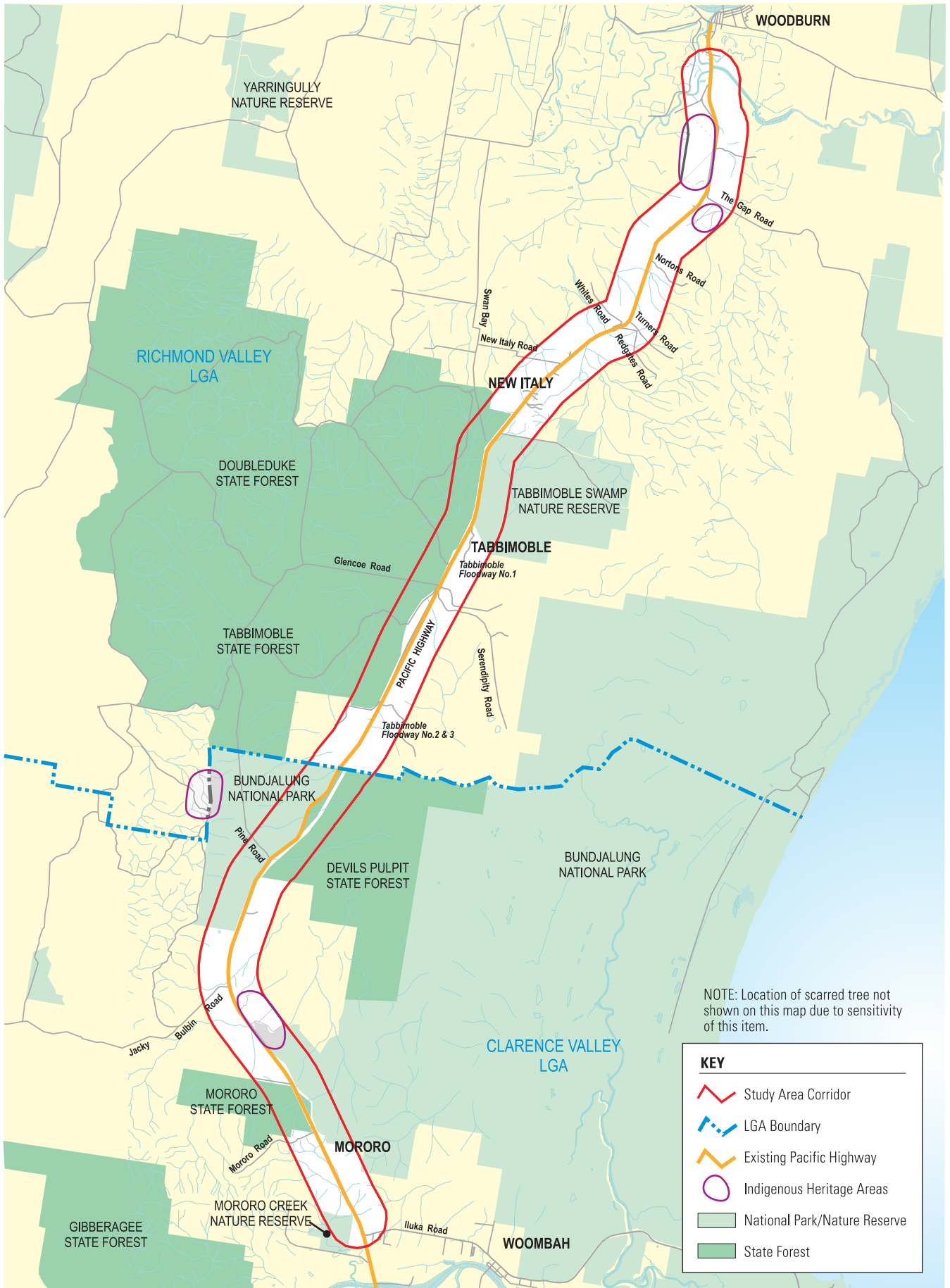
### **3.7.3**      *DECC Aboriginal Heritage Register*

Fourteen Aboriginal sites have been registered to date on the DECC Aboriginal Heritage Information Management System within a 5 km radius of the study area. One of the DECC registered sites falls within the study area itself. This is a post-contact Aboriginal burial located south of The Gap Road, approximately 150 m east of the existing highway reserve.

### **3.7.4**      *Other Aboriginal heritage registers*

Searches of the Commonwealth and National Heritage Lists, the NSW State Heritage Register, the RTA Heritage and Conservation Register and heritage schedules of the North Coast REP and Richmond Valley and Clarence Valley LEPs revealed no listed Aboriginal sites in or close to the study area. Nineteen Indigenous places in the Richmond Valley and Clarence Valley LGAs are registered on the National Estate database. The closest of these is located at Woombah, several kilometres east of the study area, and would not be affected by the proposal.





**Figure 3.8**  
Indigenous Heritage Areas

### 3.7.5 *Unregistered Aboriginal sites*

Field studies were conducted on 31 May, 1-3 June and 11 August 2005 to identify previously unrecorded sites. The section between Wondawee Way and Williams Road towards the northern end of the project was re-inspected on 9 August 2007, and broadened to include the area to be affected by a proposed interchange.

The field surveys were attended by representatives of the local indigenous communities and focused on landforms with high archaeological potential located within a 60 m wide strip centred on the existing highway. Four archaeological areas, comprising one low-density scatter of stone artefacts and three isolated artefact finds, were recorded during the field survey, in the general vicinity of the locations shown on **Figure 3.8**.

Owing to their limited size, level of disturbance and lack of further research potential, two of the isolated artefact finds (IR2W-1 and IR2W-3) were assessed as having low scientific significance in the local context. Aboriginal field representatives assisting with the survey advised that, if collected, these artefacts would be of educational value to the Aboriginal community.

The recorded artefact scatter (IR2W-2) and additional isolated stone artefact site (IR2W-4) were also small and disturbed. However, both sites have the potential to be larger and to contain subsurface potential archaeological deposits (PADs) on adjacent ridge crests. The scientific and cultural significance of these two sites could only be reliably assessed on the basis of the results of a sub-surface investigation of the associated PADs.

The survey included the finding of a scarred tree in the vicinity of New Italy which has been verified as being of high significance to local indigenous women. At the request of the site custodian, the precise location of the scarred tree has not been included in this report. However, the study team through its indigenous heritage consultant, has been able to verify that the tree is a sufficient distance from the existing highway to ensure that it would not be affected by any of the works required for the proposed Pacific Highway upgrade.

## 3.8 Non-Indigenous heritage

### 3.8.1 *Listed heritage items*

The area around the Richmond and Clarence Rivers was settled mainly during the mid-nineteenth century, by timber getters and dairy farmers, followed closely by sugar cane growers. Fishing has also long been a staple of the local economy, and accounts for the development of coastal towns such as Iluka.

The existing landscapes within the study area are largely the product of early timber harvesting and dairy farming. Land was extensively cleared of timber, and much of the existing forest cover is natural regrowth.

Searches of the Richmond River Local Environmental Plan 1992, the Maclean Local Environmental Plan and the NSW Heritage Office State Heritage Inventory for local and State significant heritage items have identified the following listed heritage items/places within the general project area (refer to **Figure 3.9**):

- New Italy Settlement.
- Vineyard Haven, New Italy.
- New Italy School site.

The RTA has also been consulted with regard to its corporate register under Section 170 of the *Heritage Act 1977*, and other internal heritage inventories. The RTA has advised that there are no items within the study area, on the Section 170 register or any other RTA inventory, that are likely to be affected by the proposed highway upgrade.

### **New Italy Settlement area**

The New Italy Settlement landscape is of State significance as evidence of a settlement built through the tenacity, forbearance and technical skills (especially horticultural and architectural) of a group of settlers. Although few original structures or relics have survived, the New Italy Museum Complex, located at the junction of the Pacific Highway and Swan Bay New Italy Road, preserves a link to the archaeological and cultural heritage of the locality. (Refer to **Figure 3.9**). Items of heritage significance identified as part of the Museum Complex include:

- an obelisk of concrete and Italian marble (reputedly located on the site of the former mud brick house).
- a covered, above ground well.
- statuary and 'pioneer and his dog' monuments.
- a post and rail fence considered to be of original materials.
- more recent pavilion, restaurant, hall, display hall and Aboriginal art gallery buildings.

### ***New Italy School site***

Artefacts/items associated with the school site (located some 2 km north west of the museum complex) are considered part of the much larger New Italy landscape which contains wells, fruit plantings and archaeological evidence of churches, domestic buildings and artefacts, shops and cellars. The physical condition of the site is considered fair to good and the archaeological potential of the school site is high.

### **Vineyard Haven, New Italy Settlement**

'Vineyard Haven' is listed as an item of State heritage significance under the *NSW Heritage Act, 1977*. Vineyard Haven occupies the property originally taken up by the French Palis Brothers, and then the Italian Giovanni Guarischi, and contributes to the State significant New Italy Settlement Landscape. It contains remnants of the landscape encountered by the settlers and evidence of their domestic and work practices. These relics and archaeological items include a dam site, a timber lined well, a mound, vines, vine contours on the landscape, former water trenches and other archaeological evidence of settlement.

This property is situated on the corner of Swan Bay New Italy Road and Forest Road, approximately 1.5 km to the west of the Pacific Highway (refer **Figure 3.9**).

#### **3.8.2 Other heritage items**

A heritage study was commissioned by the Richmond Valley Council and was commenced in January 2004 (*Richmond Valley Council A Community-based heritage study*, February 2007). The study was adopted by Council on 20 March 2007 and is currently on public exhibition. The study assessed over 470 items within the local government area and the report gave recommendations for listing or for further study to be undertaken of items.

The New Italy Settlement identified within the NSW Heritage Register indicates only three portions of land that make up the item (the Museum Complex, Vineyard Haven, and the School site). However, the Register notes that the sites listed should be considered as part of a broader landscape (including archaeological evidence of wells, cellars, a church and fruit and pine tree plantings) and the curtilage of the site should be expanded to include other areas of the landscape as it is the only known settlement of its type in NSW.

The *Richmond Valley Council Heritage Study* has nominated an area for the listing of New Italy Settlement Landscape for state heritage listing based on a map drawn by a pioneer settler around 1920 (refer **Figure 3.9**).

The following heritage items were recommended to be placed on Richmond Valley's Local Environmental Plan:

- New Italy Cyprus Road Well
- New Italy Memorial
- New Italy Museum Complex
- New Italy Roder's Well
- New Italy Vine Haven

However, while these items have been recommended for listing, they have not as yet been listed on any Local Environmental Plan or the State Heritage register.

During the preliminary heritage assessment, no other 'relics' (within the meaning of that term as defined in Section 4 of the *Heritage Act 1977*) were identified in the vicinity of the existing Pacific Highway. However, a more detailed search for and assessment of 'relics' of settlement will be undertaken during the environmental impact assessment phase of the project.

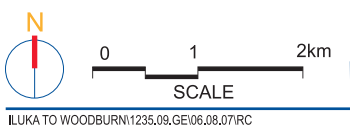
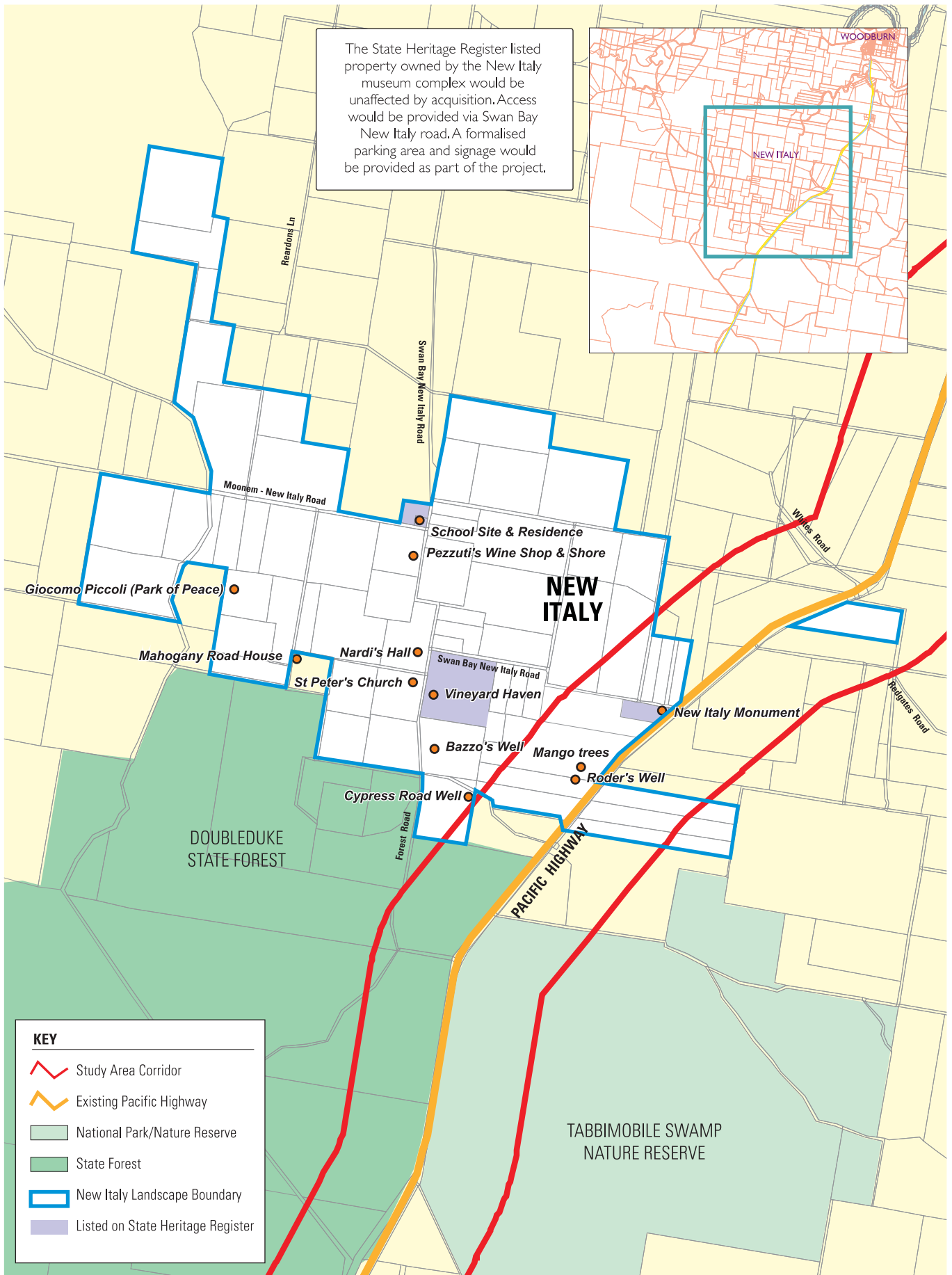


Figure 3.9

Non-Indigenous Heritage