

3. Characteristics of the study area

3.1 Overview of the study area

3.1.1 Regional context

The Iluka Road to Woodburn study area covers 35 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 Road to the north. The study area ends approximately 2 km south of Woodburn, and as a consequence 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 LGAs of Clarence Valley and Richmond Valley. Land use is dominated by a small number of major (public) land uses 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 **Figure 3.1**, there are established residential communities at:

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. While the original settlement has all but disappeared, the locality retains a strong connection to the past and to its Italian heritage through a small but 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 – 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 hectare) 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.

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 Biophysical characteristics

3.2.1 *Key biophysical environmental characteristics*

Much of the original native forest on the Clarence and Richmond River floodplains was removed for timber in the 19th century and replaced by agriculture. Remnant native forest still exists in the Tabbimoble Swamp Nature Reserve, while there are also large areas of State Forest dedicated to timber production. Adjoining the study area to the east are broad coastal heath and wetland areas of Bundjalung National Park. Wetlands mapped *under State Environmental Planning Policy No. 14 – Coastal Wetlands* (SEPP 14) cover a wide area east of the highway and drain into the Esk River, which itself drains into the Clarence River upstream from Iluka.

3.2.2 *Topography, geology and soils*

A preliminary geotechnical investigation of the study area has been undertaken, including sample boreholes at nine locations along the 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.

Topography

The study area generally comprises low hills, undulating rises, broad valleys, alluvial plains, backswamps and drainage depressions. **Figures 3.2 and 3.3** show the topography and relief of the study area, grouped into two terrain units:

- 'Elevated areas' greater than 10 m above sea level and covering approximately the southern two-thirds of the study area, characterised by undulating rises and low hills rising to approximately 40 m above sea level.
- 'Lowland areas' less than 10 m above sea level and characterised by alluvial floodplains, including backswamps.

Drainage channels typically flow from west to east into the lowland area.

Geology

The majority of the study area is comprised of quartz sandstone and shale, with thin interbeds of finer sediments and minor coal. Sedimentary structures are dominant, as might be expected on a low-lying alluvial floodplain of relatively young geological age.

Existing drainage paths such as Tuckombil Canal and Tabbimoble Creek, and the low lying swamp areas typically exhibit gravel, sand, silt and clay in varying layering and depths and are likely to be potentially compressible. The northern end of the study area near Woodburn is covered by estuarine alluvial plain deposits and typically comprises mud overlain by sand, silt, clay and gravel.

Quarries are generally located on Kangaroo Creek Sandstones or Quartz Sandstones (see **Figure 3.4**). Extensive sand mining has occurred within Broadwater and Bundjalung National Parks, but is no longer carried out.

The geology of the study area is shown in **Figure 3.5**.

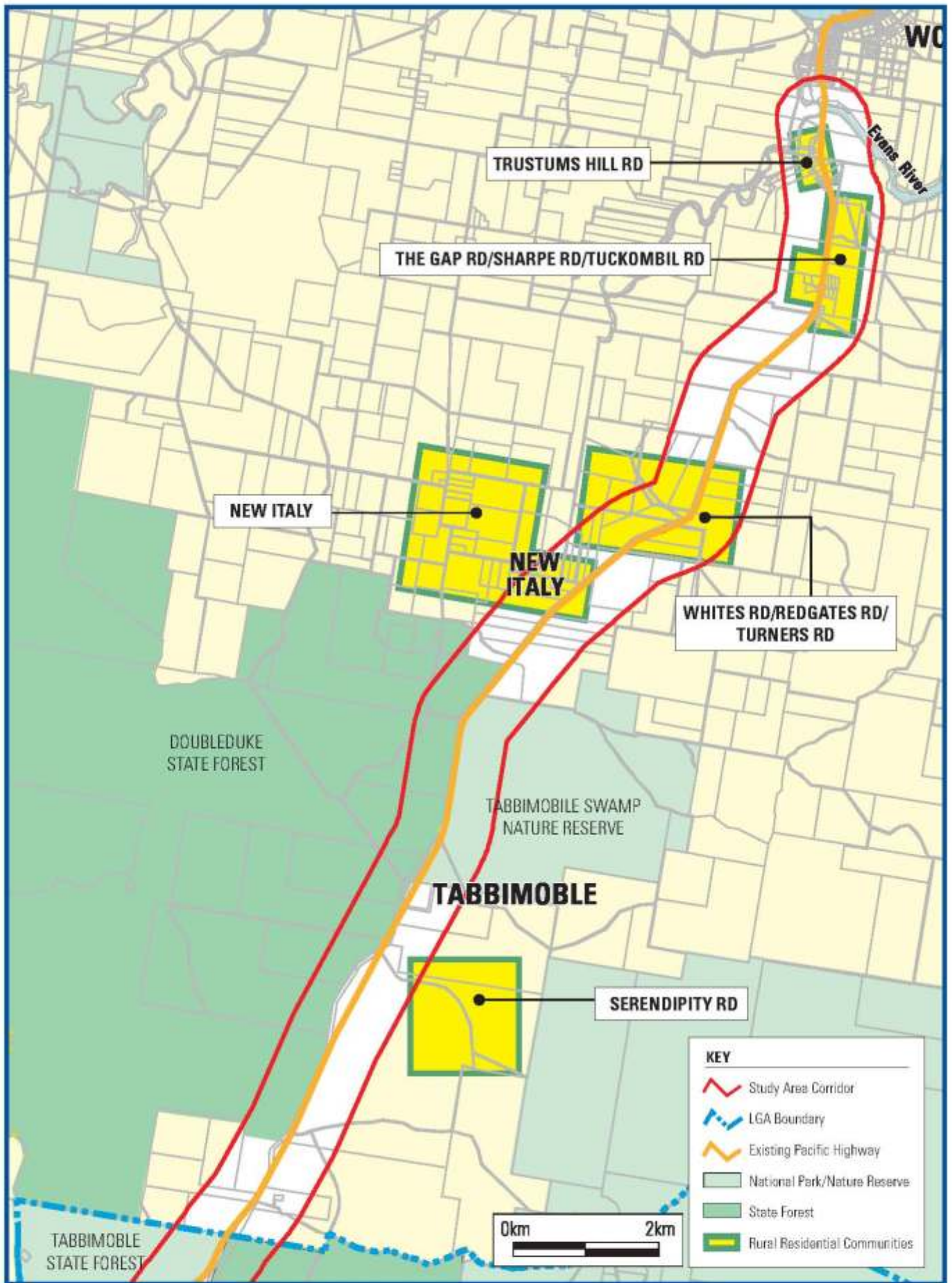
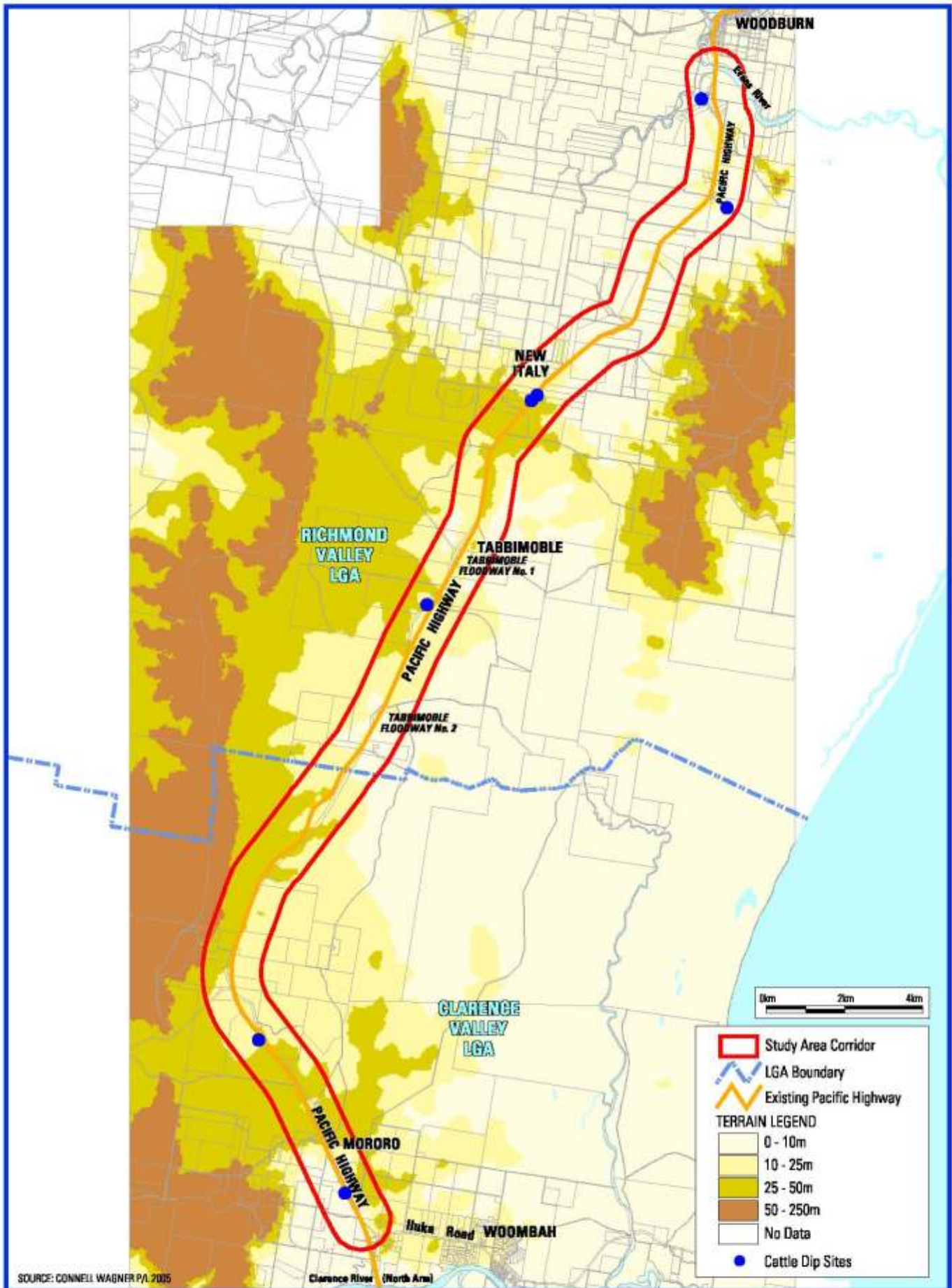


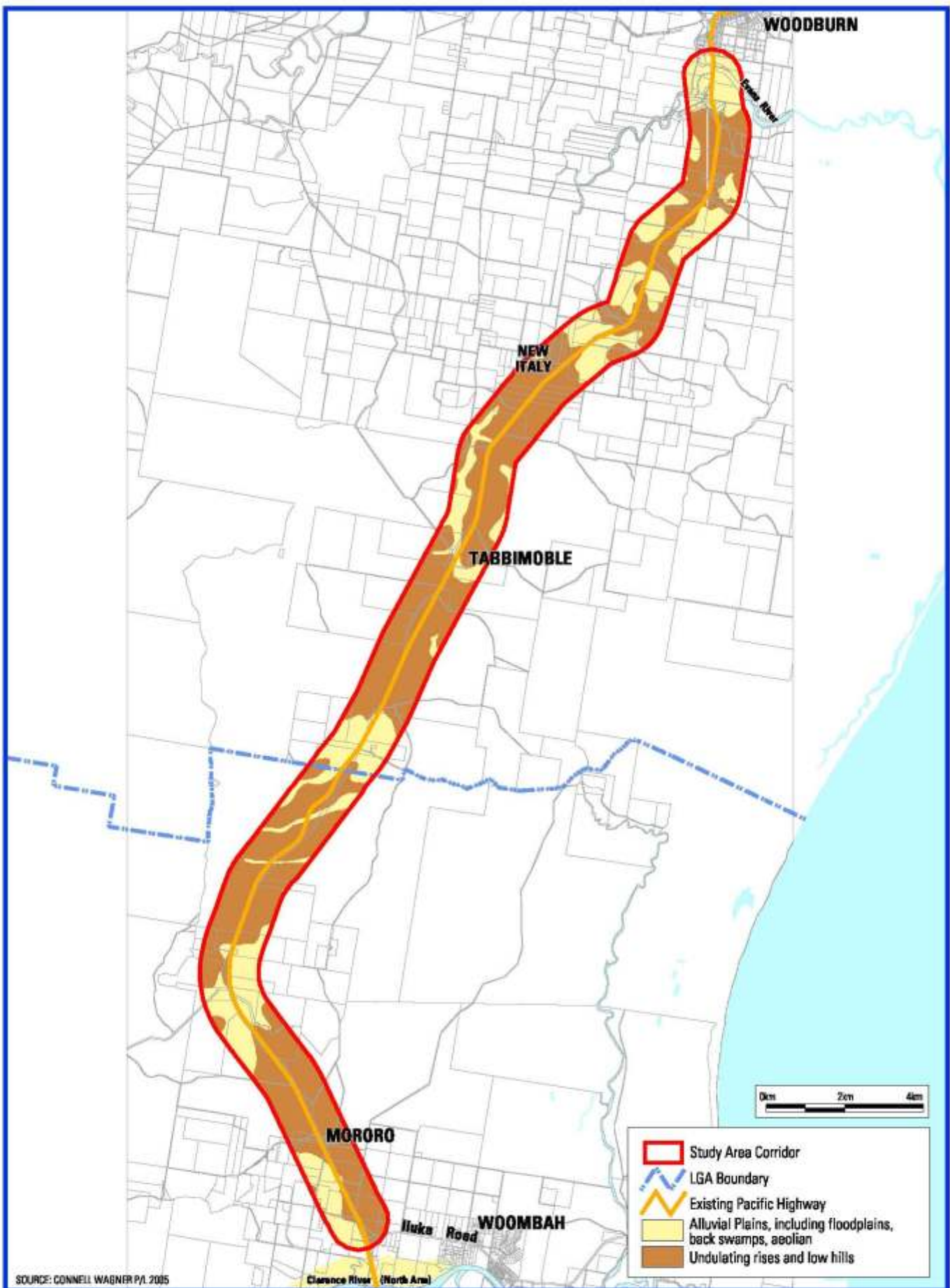
FIGURE 3.1
RURAL RESIDENTIAL
COMMUNITIES



SOURCE: CONNELL WAGNER PA 2005



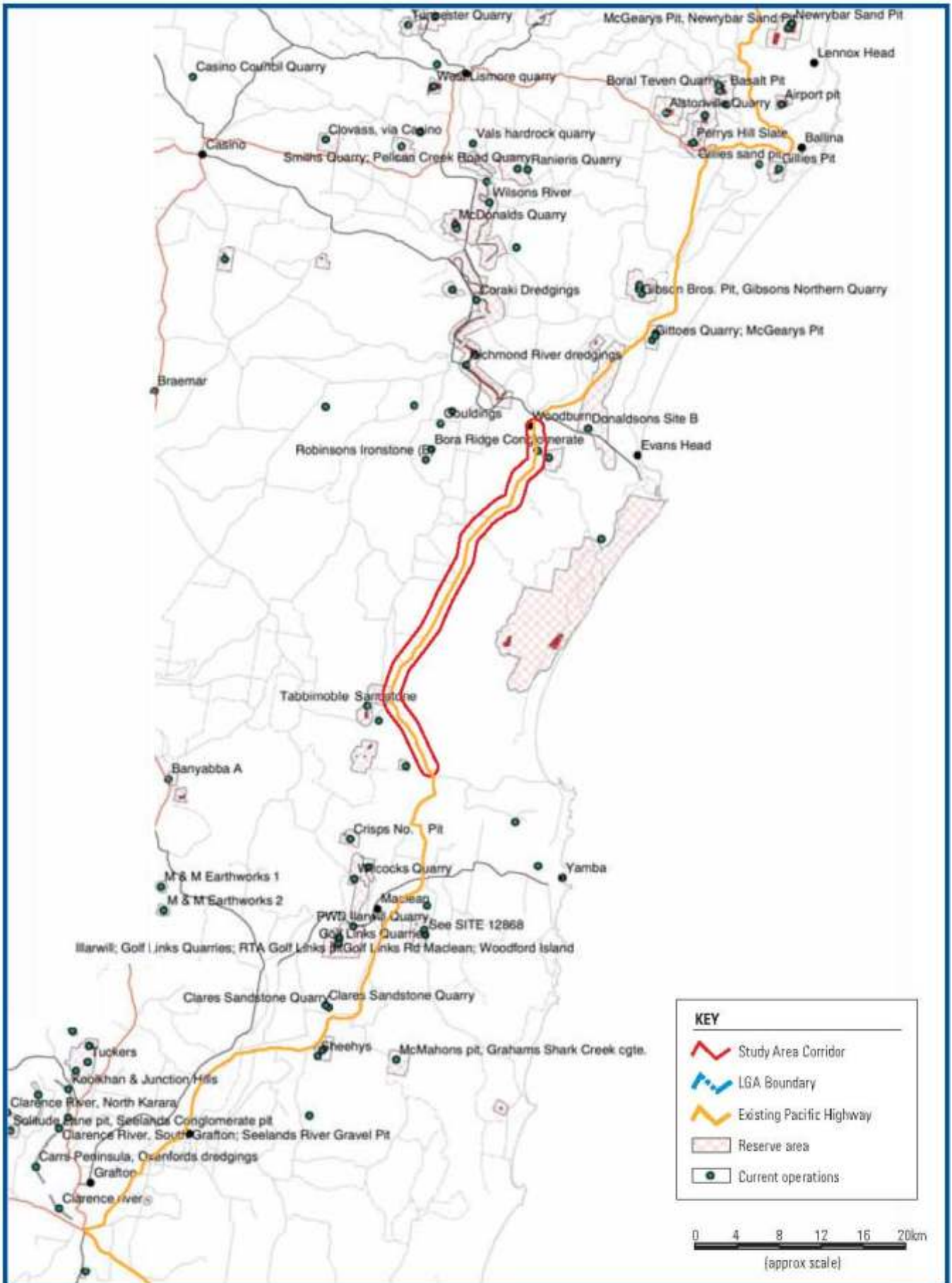
FIGURE 3.2
TOPOGRAPHY MAP

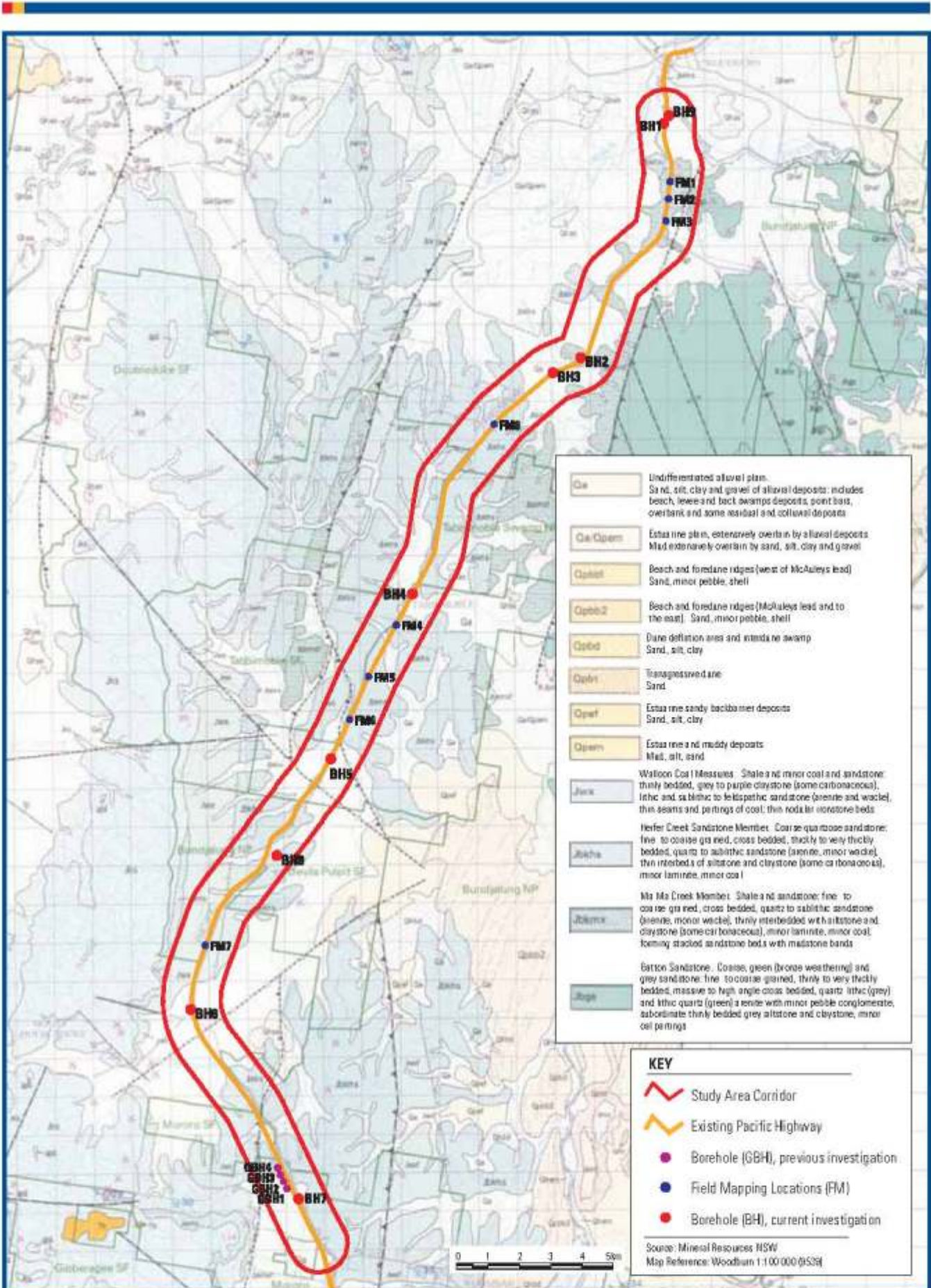


SOURCE: CONNELL WAGNER P/L 2005



FIGURE 3.3
TERRAIN MAP





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Soils

The predominance of alluvial soils reflects the low-lying and estuarine nature of the study area. The Richmond and Clarence River floodplains exhibit thick alluvial soils, while the Tabbimoble lowlands, the stagnant alluvial plains and drainage depressions give rise to thick, waterlogged soils.

All of the alluvial soils display poor foundation properties, due to their waterlogged nature. The less waterlogged alluvial soils display high shrink-swell characteristics, which also diminishes their foundation properties.

On higher ground and in undulating lands, more stable soils are characterised by broad drainage depressions and broad crests. These landscapes are erosional and the soils are highly erodible, especially on cleared or steeper slopes.

The alluvial soils at the northern and southern ends of the study area have been identified by the Department of Natural Resources (DNR) as being potential acid sulphate soils (see **Figure 3.6**). The Iluka sand sheets at the southern end of the study area have a high water table and represent a lower risk of acid generation, while the northern end of the study area has a fluctuating water table and represents a generally higher risk of acid generation.

Geotechnical investigations

Preliminary geotechnical investigations were conducted in April and May 2005. The work involved inspection of topography, drainage features, floodplains and backswamps, and sub-surface investigations at nine selected locations. Boreholes were excavated into areas of rock and the deeper alluvial soils, to check the suitability for cut materials, and also to identify presence of any potential soft soil and acid sulphate soils. The information was also used to further characterise sub-surface geology and terrain mapping. Geotechnical investigation locations are illustrated in **Figure 3.7**.

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

Investigation results

The elevated and lowland terrain types were defined as 'Alluvial plains including floodplains, backswamps and aeolian deposits' (lowland areas) and 'undulating rises and low hills' (elevated areas). The extent of each terrain unit is presented in **Figure 3.3**.

Alluvial plains including floodplains, backswamps and aeolian deposits

The alluvial plains are generally flat (slopes less than 1%), and are identified as being at elevations of:

- Reduced Level (RL) 4m and RL8m 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. Backswamp areas are typically soft, and during periods of high rainfall often become waterlogged and boggy, and are slow to drain.

Other deep alluvial soils are mostly stiff silty clays, with occasional sand or gravel layers overlying weathered sandstone or shale bedrock. The depth of alluvium varies as follows:

- Richmond River/Tuckombil Canal floodplain – up to 10 m deep.
- Tabbimoble Floodways – up to 16 m deep.

Bedrock was not encountered in any of the borehole samples taken. From the available data, sandstone is likely to be present below 8-10 m depth in the Richmond River floodplain. In the Tabbimoble Floodways, sandstone and shale are expected below a depth of 17 m. The weathering and strength of bedrock is unknown, and the depth to rock in the Clarence River floodplain is also unknown.

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 rises between 8 m AHD and 40 m AHD, with slopes in the range from two to 10%. Existing Pacific Highway cuttings exhibit cut faces of typically 20 to 60%, and are showing signs of erosion and fretting.

Soils were found to be stiff to hard silty or sandy clays, between 2 m and 6 m deep. Bedrock was encountered in one borehole only (BH8). However, rock was mapped at eight existing Pacific Highway cuttings. Based on these inspections and other available data, the underlying bedrock comprises extremely weathered and low strength sandstone/siltstone.

Potential acid sulphate soils were found in two boreholes (BH 1 and 2) located in Richmond River Alluvial plain at the northern end of the study area. Acid sulphate soils were not found in other locations. Further investigations are recommended to identify the extent of potential acid sulphate soils in the study area where excavations are required for road construction. These investigations will be undertaken during the detailed geotechnical study for the proposed concept design.

3.2.3 Hydrology and hydraulics

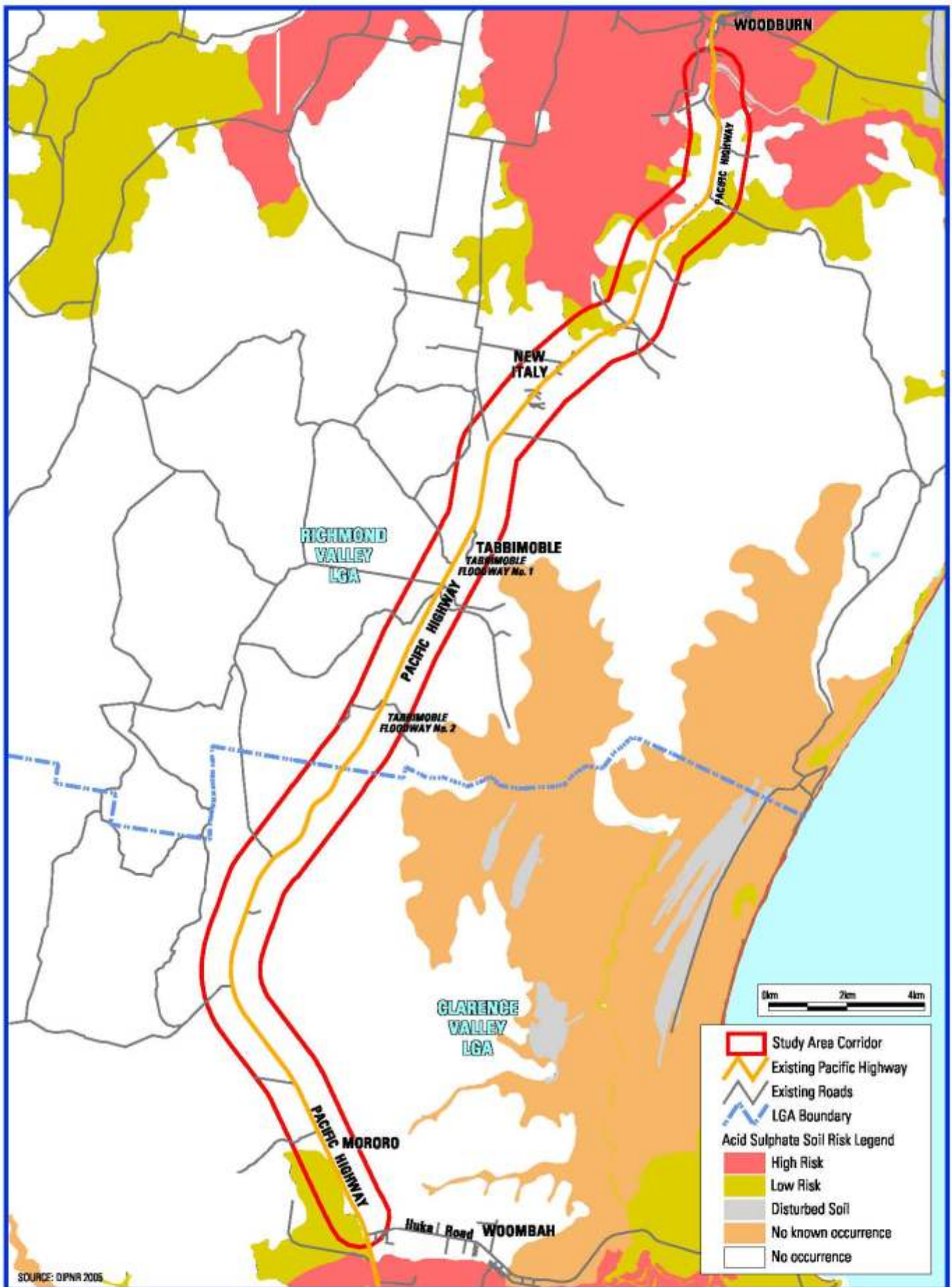
The Pacific Highway between Iluka Road and Woodburn crosses several floodplains and numerous waterways, and consequently this length of the highway experiences flood inundation from time to time. A detailed hydrologic and hydraulic analysis of the flooding behaviour and drainage patterns of the study area was in progress at the time of preparing this report. While findings and conclusions are not available for inclusion in this report, the following discussion describes the known drainage characteristics of the study area and the parameters of the study now under way.

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

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

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 (ie 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.

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



SOURCE: OPNR 2005



FIGURE 3.6
ACID SULPHATE SOIL RISK MAP

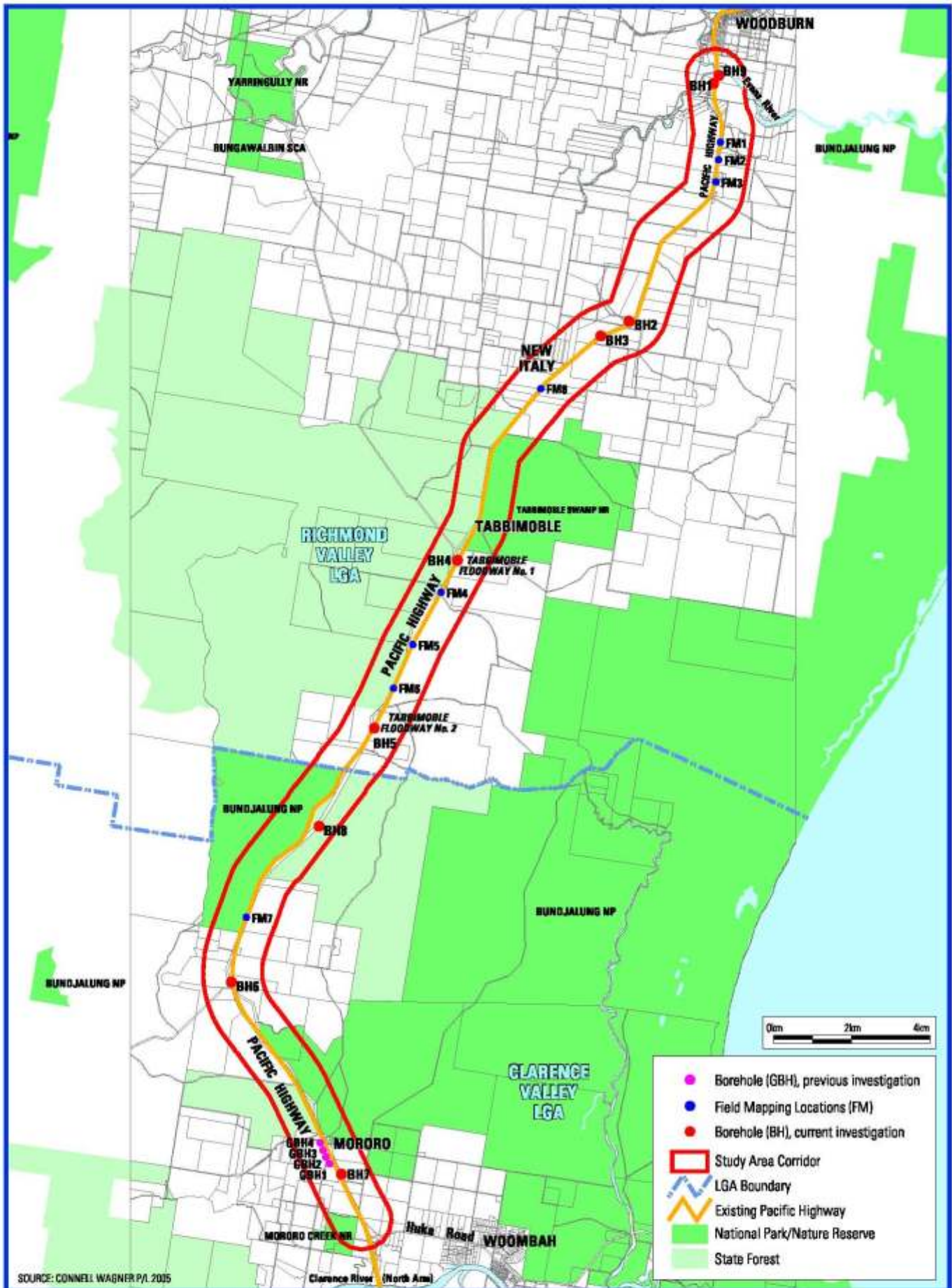


FIGURE 3.7
GEOTECHNICAL TEST LOCATIONS

Hydrologic analysis

Analysis carried out to date has consisted of:

- Development and verification of hydrologic models for each existing crossing, using design rainfall parameters and existing catchment information. Verification of the models aims to provide confidence in their ability to predict 'event' discharges, and was carried out in a process adopted to cover the absence of detailed historical observations and records; and
- Calculation of peak design event discharge predictions for each crossing, for a range of design event magnitudes.

Hydraulic analysis

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

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

Detailed development of the hydraulic models can commence when the detailed survey of the proposed concept design corridor has been completed. The hydrologic and hydraulic study will then proceed, to provide a detailed description of how flood waters behave in the study area, and to what extent this will influence the design of the proposed Pacific Highway upgrade.

3.2.4 Water quality

Background

The surface water catchments between Iluka Road and Woodburn are typically freshwater and small (mostly 1st to 3rd order streams). Many are ephemeral and flow only after heavy or prolonged rainfall. The catchments in the south of the study area flow south to the Clarence River system, while the northern catchments flow north to the Evans River system, which is part of the Richmond River catchment. Because of the relatively low lying and undulating nature of the route many small creeks towards the centre of the route do not flow to either the Clarence or Evans River catchments, but discharge to adjacent coastal swamps and SEPP 14 wetlands (see **Figure 3.8**). At the northern end of the study area Rocky Mouth Creek and Tuckombil Canal join immediately upstream of the existing highway and eventually form the Evans River. Both Rocky Mouth Creek and the Tuckombil Canal are subject to tidal influences.

The catchments of most of the creeks in the study area are predominantly vegetated with undisturbed native vegetation held in several National Parks and State Forests. However, some of the small creeks at the southern end of the route drain areas of agricultural land (primarily sugar cane), while others along the route have small patches of cleared paddocks and/or scattered rural residences in their catchments.

Objectives

A baseline water quality assessment was undertaken to provide information on the quality of surface and groundwater along the existing Pacific Highway route. Accordingly, the water quality assessment was undertaken to provide as much information on as many creeks as possible, taking into consideration likely water quality constraints associated with the route. The key aims were to:

- characterise the existing quality of surface and ground waters along the route;
- identify potential sources of ground and surface water contamination;
- characterise the likely sensitivity of receiving waters along the route; and
- identify suitable locations for repeat water quality monitoring during the concept design phase.

Review of existing data

A review of existing water quality data was undertaken and relevant government and non-government agencies were approached regarding available background information. However, it is apparent that the smaller freshwater watercourses in the study area are very poorly studied, and as a consequence there is an absence of adequate baseline physico-chemical water quality data for the small freshwater creeks throughout the study area.

Limited water quality data were obtained for monitoring locations in Rocky Mouth Creek and Tuckombil Canal at the northern end of the study area. The data were obtained from water quality monitoring undertaken by Richmond Valley Council as part of the Evans River Estuary Management Plan between December 1999 and August 2001. The monitoring locations (RVC1 and RVC2) are shown in **Figure 3.9c**.

From the sampling and analysis results, it is evident that both Rocky Mouth Creek and Tuckombil Canal have highly variable water quality and are both subject to acidic influxes from acid sulphate soils in the catchment. Both watercourses have a history of fish kills, and are subject to tidal influence. Turbidity and dissolved oxygen results fluctuate widely.

Existing groundwater quality data obtained from a groundwater monitoring bore installed by Clarence Valley Council at Mororo landfill (bore location CVC1 is shown in **Figure 3.9a**) show that groundwater quality is also highly variable. In terms of dissolved oxygen, electrical conductivity, alkalinity, and bromine, ammonia and nitrate results, the data were consistent with the Australian and New Zealand Environment Conservation Council (ANZECC, 2000) water quality guideline trigger levels for slightly to moderately disturbed ecosystems.

Water quality monitoring

Water quality sampling was undertaken at 14 surface water and three groundwater monitoring locations distributed along either side of the existing highway route. The monitoring locations are detailed in **Figures 3.9a - c**. The monitoring locations were selected to be representative of the study area, catchment characteristics and potential water quality constraints, including:

- tributaries of the Evans and Clarence Rivers (SW1, SW2, SW14);
- smaller creeks and channels draining the coastal floodplain (SW3-SW13);
- groundwater locations representative of the study area (GW1-GW3);
- tributaries of coastal swamps and SEPP 14 Wetlands to the east of the proposed alignment (SW3, SW4, SW6-9);
- areas of potential acid sulphate soil or actual acid sulphate soil (SW12-SW14);
- agricultural land uses, in particular sugar cane fields at the southern end of the study area (SW1-SW2);
- a known cattle dip site (SW7-SW9); and
- rural residences and associated rural roads (SW10).

The water samples were collected on 5 and 6 September 2005, following approximately 25 mm of rainfall in the previous week at Ballina (the closest location with reliable and easily accessible rainfall data). Annual rainfall for the region is slightly lower (100-200 mm) than the long term annual average. Consequently, water quality monitoring was hampered both by prevailing meteorological/climatic conditions and by the ephemeral nature of many of the creeks in the study area. Only seven water samples were obtained from the original 14 proposed monitoring

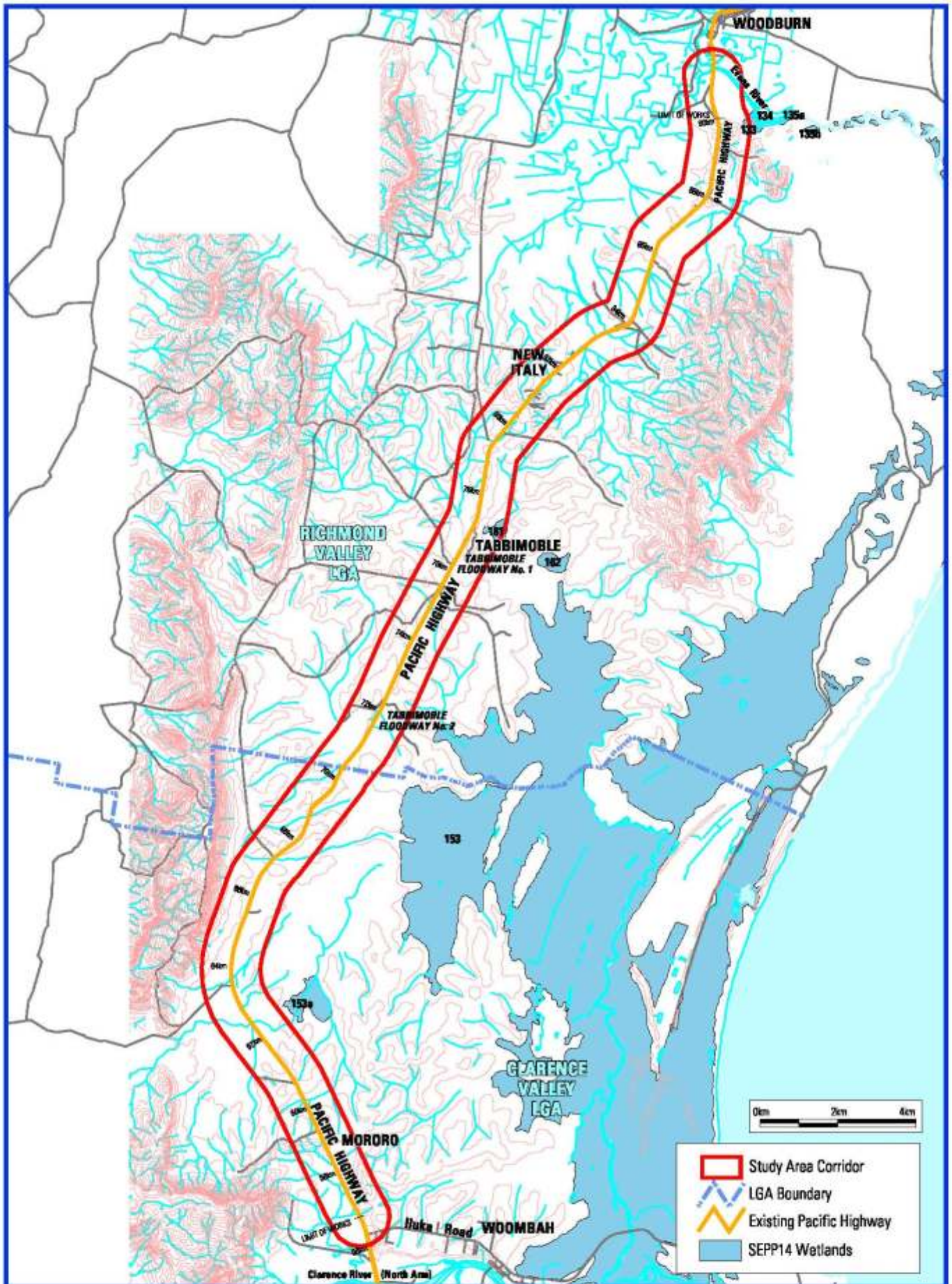


FIGURE 3.8
SEPP14 WETLANDS

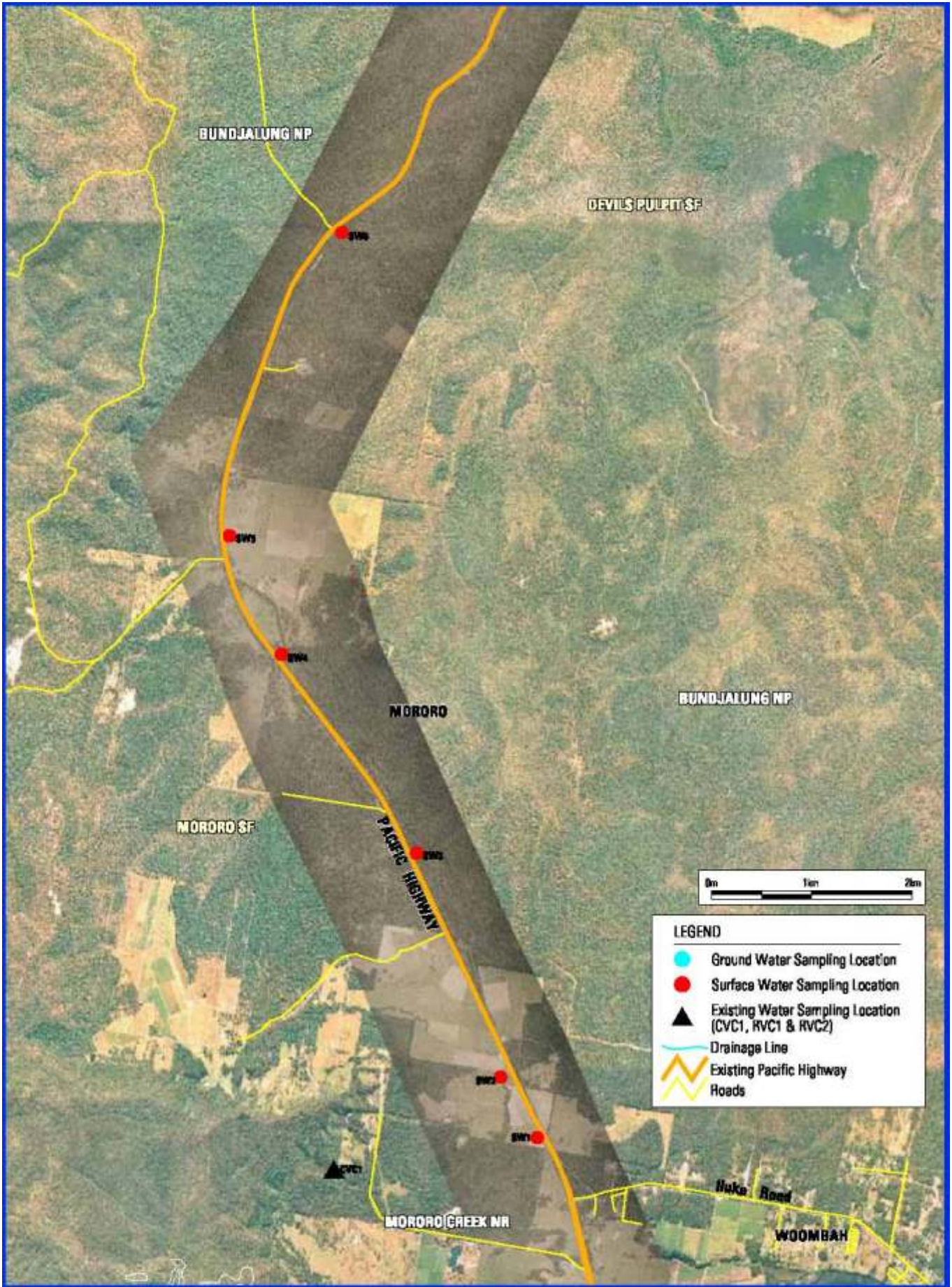
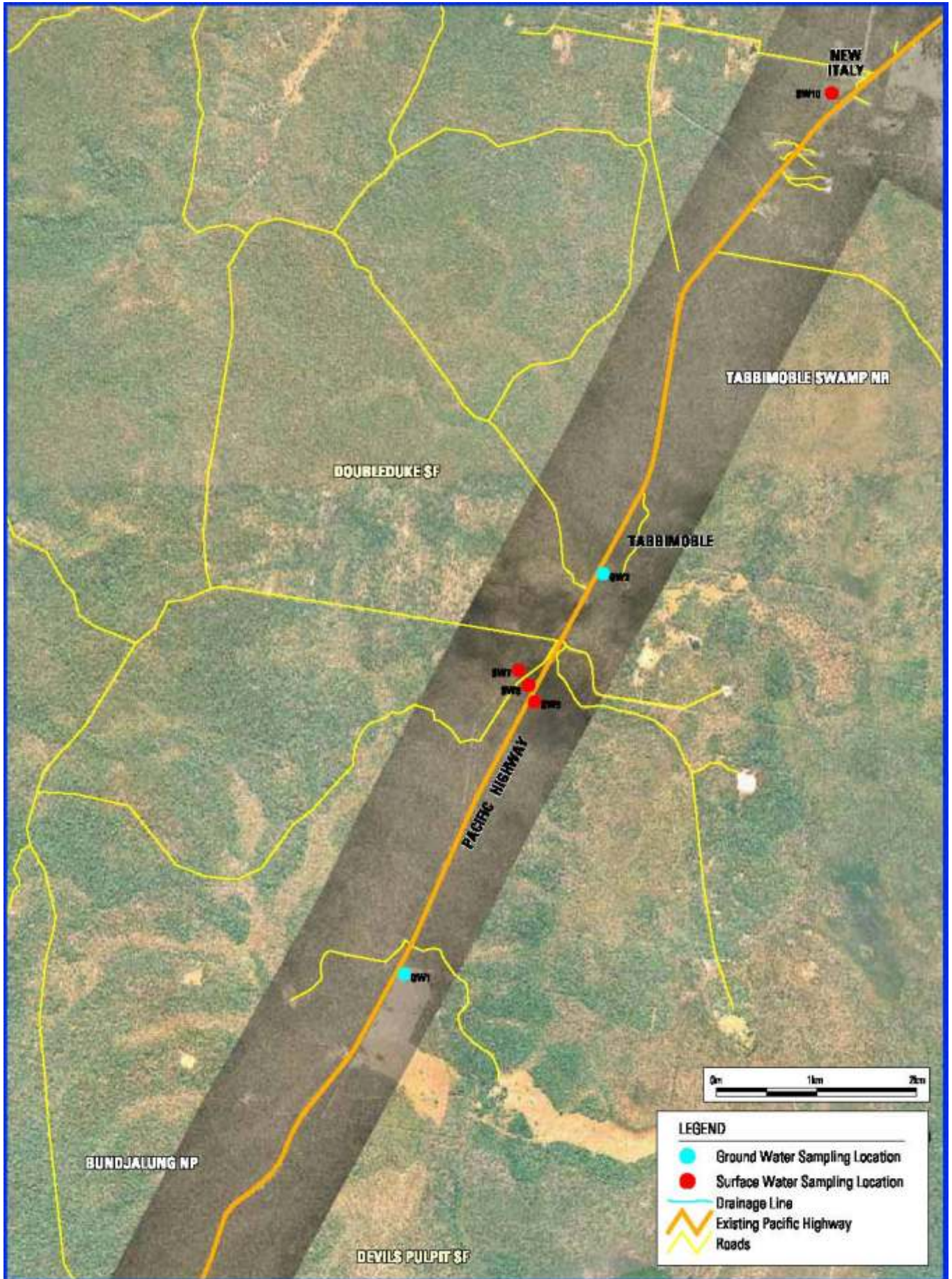


FIGURE 3.9a
WATER QUALITY
MONITORING LOCATIONS



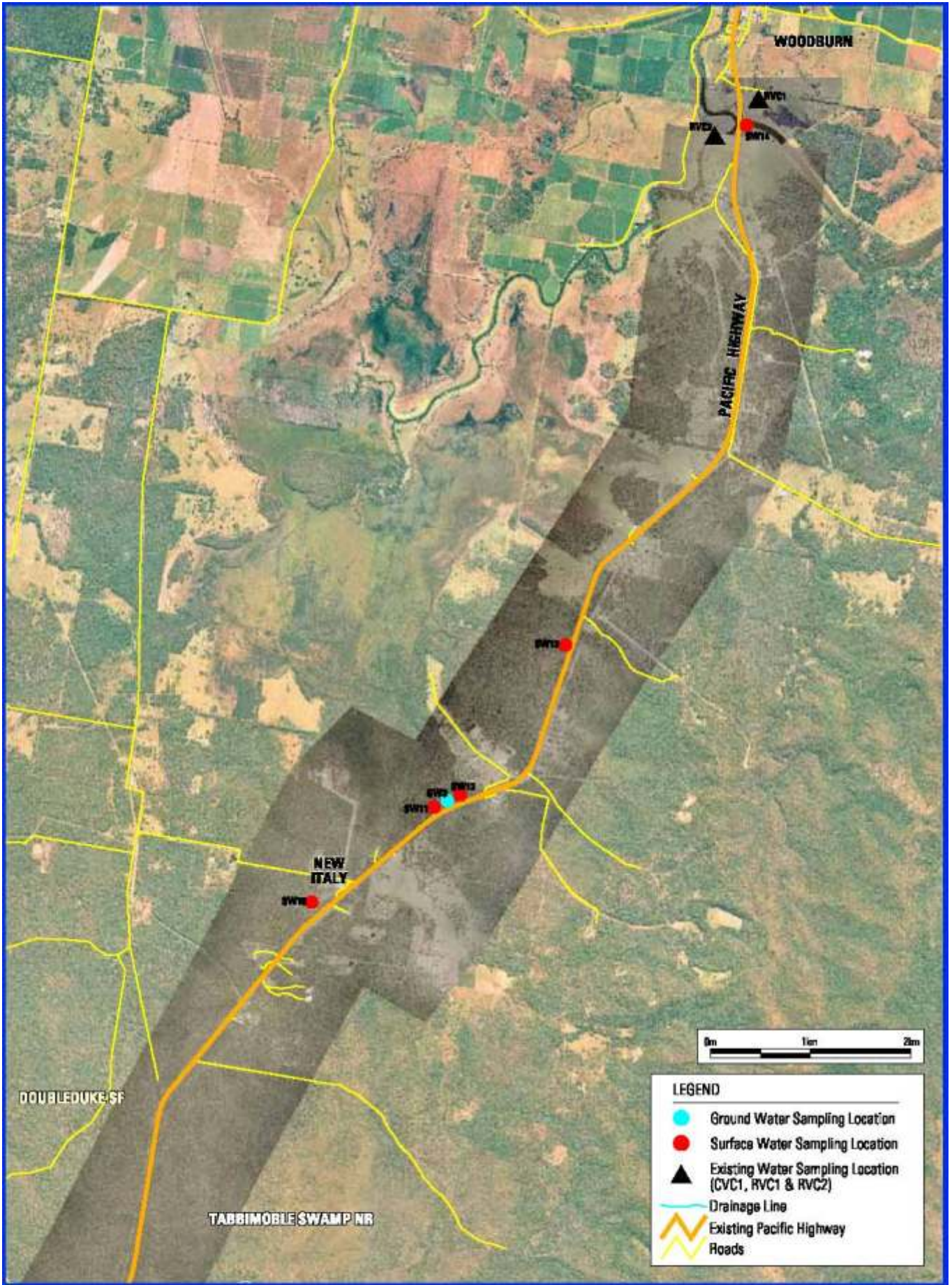


FIGURE 3.9c
WATER QUALITY
MONITORING LOCATIONS

locations. Similarly, only one groundwater sample was obtained from the three proposed locations due to the depth of the water table in the area.

Sampling and analysis showed that water quality of most of the surveyed creeks does not comply with the relevant ANZECC (2000) water quality guideline trigger values for pH, dissolved oxygen and total nitrogen.

The observed low levels of dissolved oxygen and high levels of total nitrogen may be influenced by the low flows observed during the drought conditions in September 2005, which may limit entrainment of oxygen and result in stagnation and the concentration of nutrients. It was evident that monitoring locations SW4 and SW10 had very low flows and were less than 1m wide, while locations SW5, SW11, SW12 and SW13 were larger bodies of water with no visible current.

The low pH levels observed at most locations do not generally appear, from a review of DIPNR's *Acid Sulphate Soils Risk Maps of Coastal NSW*, to be related to acid sulphate soil risks, which generally are only present at the northern extremity of the study area. However, the low pH observed at SW12 may be related to the presence of a small area of low risk acid sulphate soils located immediately upstream of the sample location.

Monitoring locations SW10 and SW14 had elevated electrical conductivity results that substantially exceeded the relevant ANZECC (2000) range. In the case of SW14 it is apparent that the result was related to tidal influence. In contrast, the elevated electrical conductivity at SW10 may be related to natural catchment processes (although this may be unlikely given that similar adjacent catchments did not display similar results), but may also be related to human activities in the catchment, including the presence of rural residences and minor roads.

All creeks exhibited low levels of total suspended solids (TSS), indicating that catchment activities and processes are not contributing substantial quantities of particulate material to the creeks under low flow conditions at the time of sampling. However, TSS levels may be elevated under higher flow conditions.

3.2.5 Ecology

An ecological assessment has been carried out on the flora and fauna of the study area. 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.

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). Flora and fauna surveys were undertaken along the study corridor over a period of 15 days between March and July 2005. The results are summarised below.

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 3.10a** 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; and
- Freshwater wetlands on 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 and Swamp Sclerophyll Forest. These two vegetation types account for 47% and 12% respectively, of the native vegetation within the study area and nine of the 14 vegetation associations.

Threatened flora species

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

- interrogation of Department of Environment and Conservation's (DEC'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; and
- interpretation of Comprehensive Regional Assessment Aerial Photograph Interpretation (CRAFTI) vegetation maps.

The vegetation surveys undertaken 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.

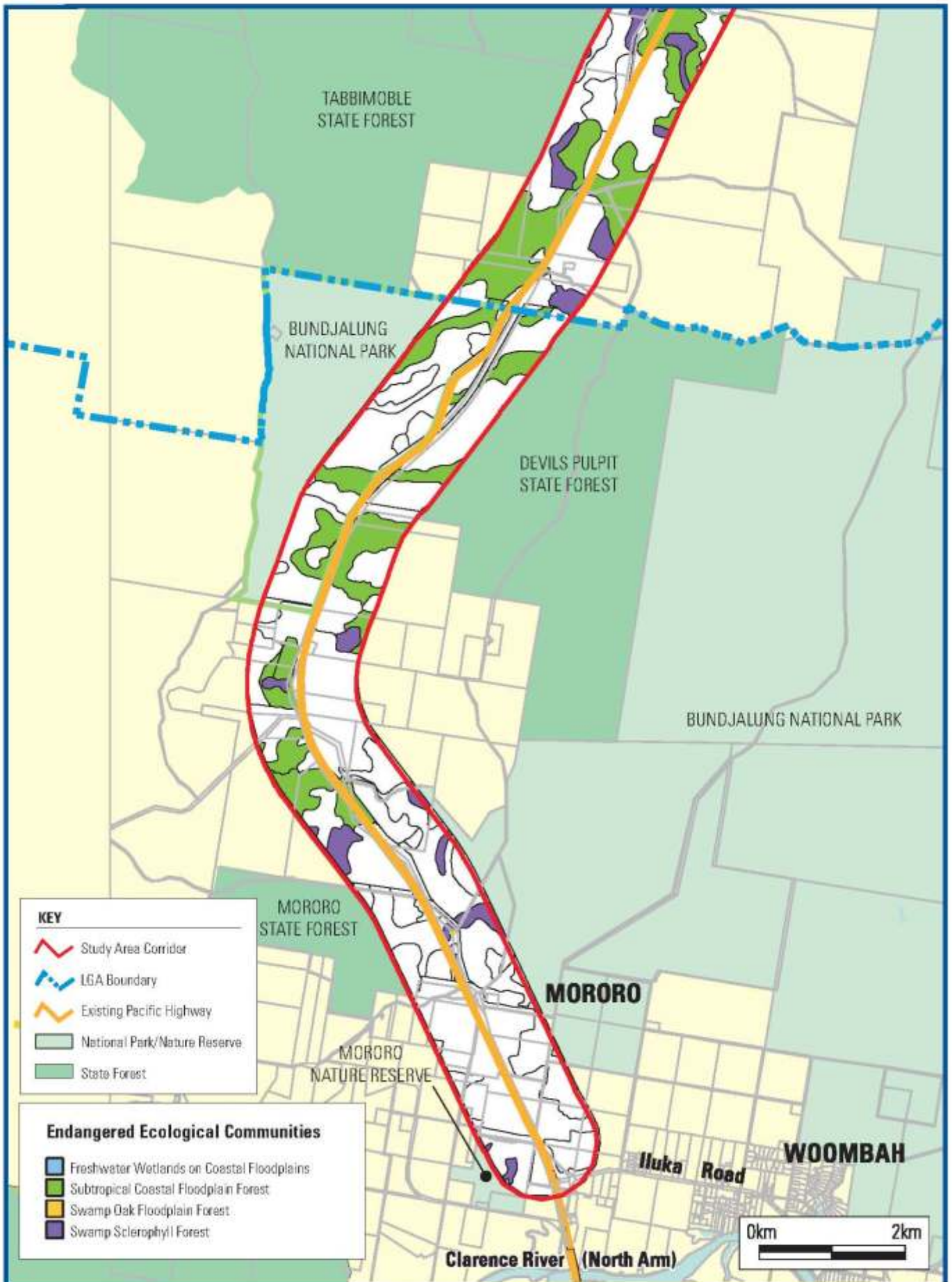
Six species of flora listed as threatened under the TSC Act were recorded in the study area, as shown in **Figures 3.11a** and **b**. Three of these were endangered:

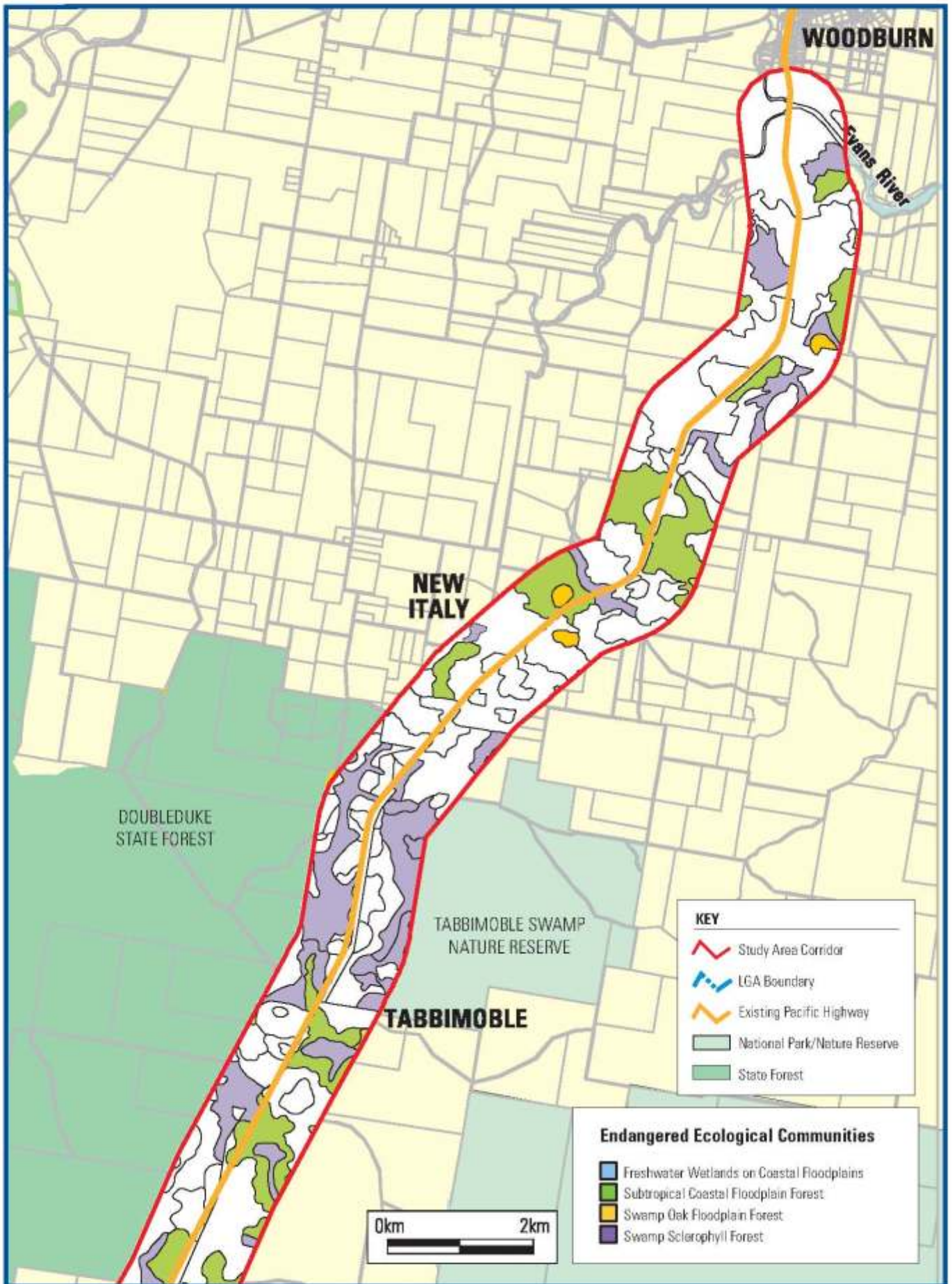
- Small-leaved Paperbark (*Melaleuca irbyana*).
- Fern (*Lindsaea incisa*).
- Sedge (*Cyperus aquatilis*).

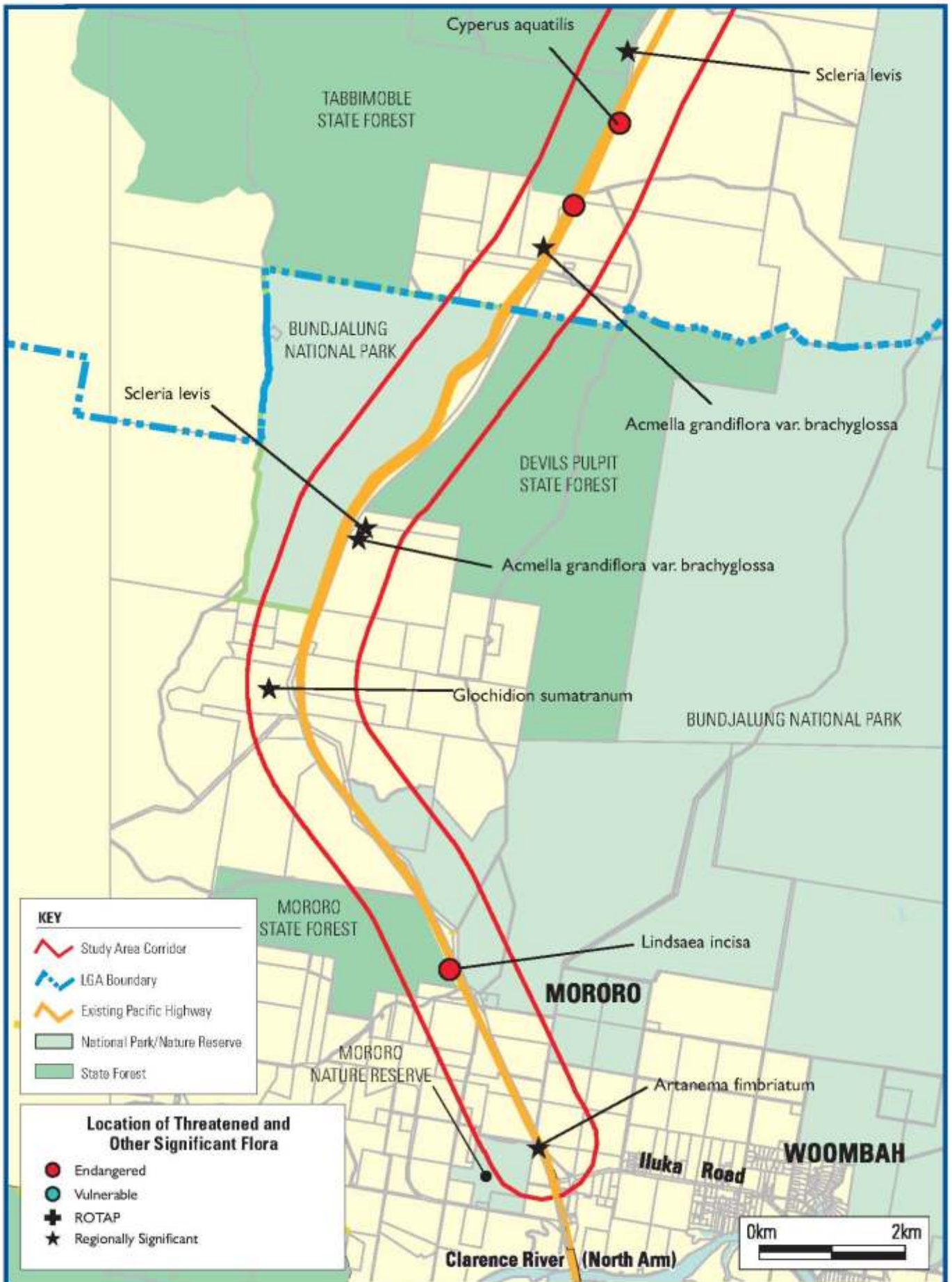
Three of these were vulnerable:

- Orchid (*Oberonia titania*).
- Spiny Desmodium (*Desmodium acanthocladum*).
- Swamp Mint Brush (*Prostanthera palustris*).

Two of these species were also listed under the Commonwealth EPBC Act as vulnerable (*Desmodium acanthocladum* and *Prostanthera palustris*).







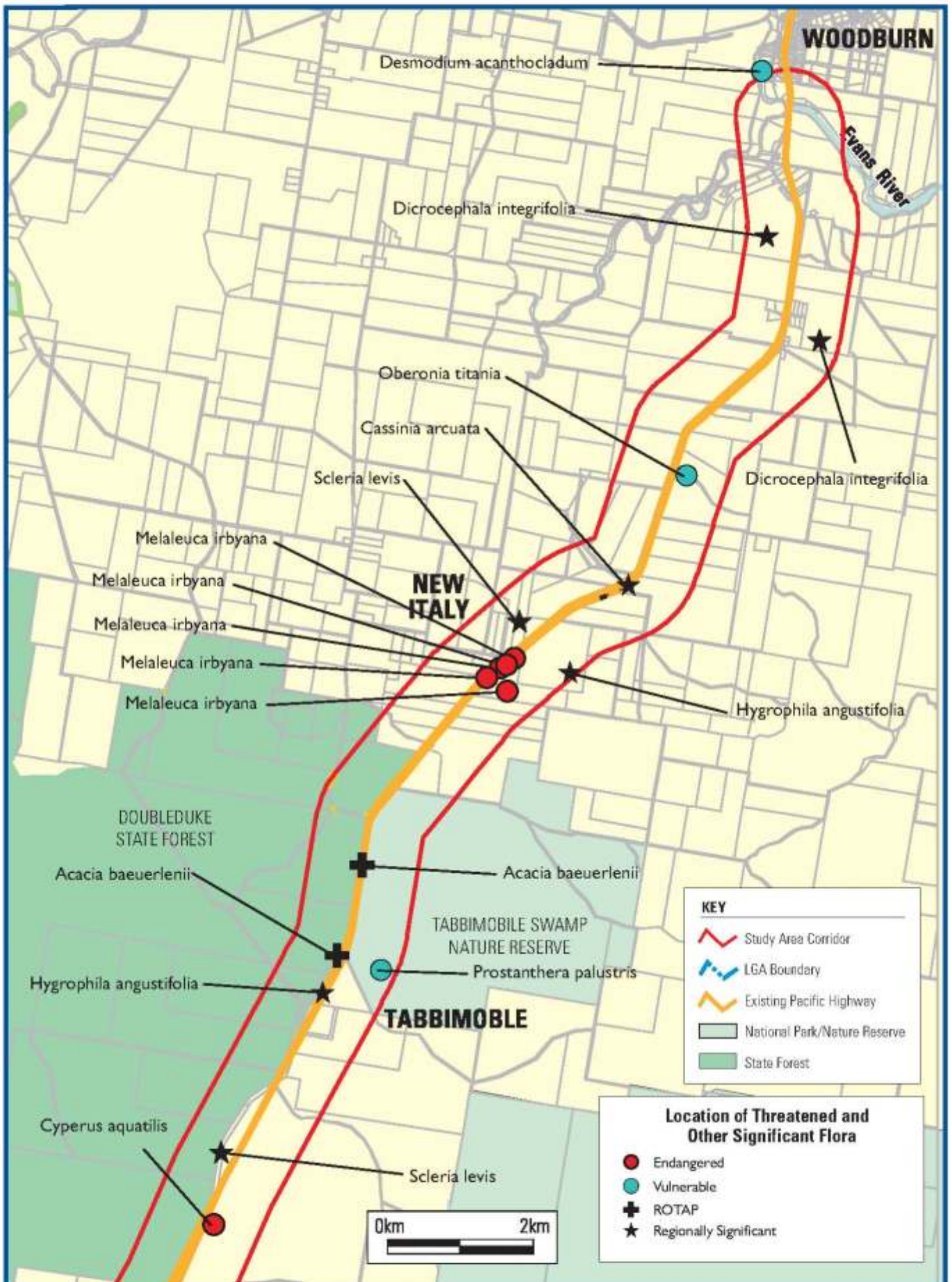


FIGURE 3.11b
LOCATIONS OF THREATENED
AND OTHER SIGNIFICANT FLORA

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, as likely to occur in the study area (see **Table 3.1**).

Table 3.1 Threatened flora species likely to occur in the study area

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

Source: Connell Wagner, 2005.

Several other conservation significant species were recorded, including 5 species identified by the Department of Environment and Conservation (DEC) and the Royal Botanic Gardens Sydney (National Herbarium) as threatened or potentially threatened species; one Rare or Threatened Australian Plant species; and several other regionally uncommon species. These species are listed below and mapped on **Figures 3.11a** and **b**.

- Sedge (*Scleria levis*).
- Herb (*Hygrophila angustifolia*).
- Grass (*Vetiveria filipes*).
- Herb (*Dicrocephala integrifolia*).
- Herb (*Artanema fimbriatum*. *Cyperus bowmannii*).
- Grasstree (*Xanthorrhoea latifolia subsp. maxima*).

The endangered species *Melaleuca irbyana* (Small-leaved Paperbark) has probably 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 at New Italy on either side of the existing highway and some was probably cleared from the present road footprint many years ago. Further field work would be required at the detailed design stage to better define the extent and distribution of this species. The small ground fern *Lindsaea incisa*, also an endangered species under the TSC Act, has a similar level of botanical constraint on the proposal. This species 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 40m from the existing highway in swamp sclerophyll forest (protected ecological community).

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.

The other three recorded threatened species, *Desmodium acanthocladum*, *Oberonia titania* and *Prostanthera palustris*, are unlikely to be impacted by the highway upgrade due to their location, but would be subject to further investigation during the refinement of the concept design.

Terrestrial fauna

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

- Brown Treecreeper (*Cormobates picumnus*).
- Glossy Black-Cockatoo (*Calyptorhynchus latham*).
- Grey-crowned Babbler (*Pomatostomus temporalis*).
- Masked Owl (*Tyto novaehollandiae*).
- Powerful Owl (*Ninox strenua*).
- Brush-tailed Phascogale (*Phascogale tapoatafa*).
- Squirrel Glider (*Petaurus norfolcensis*).
- Yellow-bellied Glider (*Petaurus australis*).
- East Coast Freetail Bat (*Mormopterus norfolkensis*).
- Grey-headed Flying-Fox (*Pteropus poliocephalus*).
- Hoary Wattled Bat (*Chalinolobus nigrogriseus*).
- Large-footed Myotis (*Myotis adversus*).
- Little Bent-wing Bat (*Miniopterus australis*).
- Common Bent-wing Bat (*Miniopterus schreibersii*).
- Northern Long-eared Bat (*Nyctophilus bifax*).
- Eastern Cave Bat (*Vespadelus troughtoni*).

Of these species, the Marbled Frogmouth (*Podargus ocellatus*) is also listed under the EPBC Act. In addition to these threatened species, two migratory species listed under the EPBC Act were recorded in the study area. Interrogation of DEC's *Atlas of NSW Wildlife*, together with the presence of suitable habitat within the study area, indicate 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 3.2 below.

Table 3.2 Threatened fauna species likely to occur in the study area

Common name	Scientific name
Green Thighed Frog	<i>Litoria brevipalmata</i>
Wallum Sedge Frog	<i>Litoria olongburensis</i>
Stuttering Frog	<i>Mixophyes balbus</i>
Fleay's Barred Frog	<i>Mixophyes fleayi</i>
Giant Barred Frog	<i>Mixophyes iteratus</i>
White-crowned Snake	<i>Cacophis harriettae</i>
Pale Headed Snake	<i>Hoplocephalus bitorquatus</i>
Stephen's Banded Snake	<i>Hoplocephalus stephensii</i>
Red-tailed Black-Cockatoo	<i>Calyptorhynchus banksii</i>

Common name	Scientific name
Emu	<i>Dromaius novaehollandiae</i> (NSW North Coast Bioregion and Port Stephens LGA Population)
Red Goshawk	<i>Erythrotriorchis radiatus</i>
Black-breasted Buzzard	<i>Hamirostra melanosternon</i>
Swift Parrot	<i>Lathamus discolor</i>
Square-tailed Kite	<i>Lophoictinia isura</i>
Hooded Robin	<i>Melanodryas cucullata</i>
Hooded Robin (southeastern subspecies)	<i>Melanodryas cucullata cucullata</i>
Osprey	<i>Pandion haliaetus</i>
Regent Honeyeater	<i>Xanthomyza phrygia</i>
Barking Owl	<i>Ninox connivens</i>
Masked Owl	<i>Tyto novaehollandiae</i>
Rufous Bettong	<i>Aepyprymnus rufescens</i>
Eastern Pygmy-possum	<i>Cercartetus nanus</i>
Spotted-tailed Quoll	<i>Dasyurus maculatus</i>
Spotted-tailed Quoll (SE Mainland Population)	<i>Dasyurus maculatus maculatus</i>
Long-nosed Potoroo	<i>Potorous tridactylus</i>
Long-nosed Potoroo (SE Mainland Population)	<i>Potorous tridactylus tridactylus</i>
Koala	<i>Phascolarctos cinereus</i>
Common Planigale	<i>Planigale maculata</i>
Large-eared Pied Bat	<i>Chalinolobus dwyeri</i>
Golden-tipped Bat	<i>Kerivoula papuensis</i>
Black Flying-Fox	<i>Pteropus alecto</i>
Yellow-bellied Sheath-tail-bat	<i>Saccolaimus flaviventris</i>
Greater Broad-nosed Bat	<i>Scoteanax rueppellii</i>
Common Blossom-bat	<i>Syconycteris australis</i>
Migratory species under EPBC Act:	
White-bellied Sea-Eagle	<i>Haliaeetus leucogaster</i>
White-throated Needletail	<i>Hirundapus caudacutus</i>

Source: Connell Wagner, 2005.

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, 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 DEC 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.

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.

Watercourses within the study area, such as creeklines and a river at the northern end, provide potential habitat for fish, including the threatened Eastern Freshwater Cod listed as endangered under the NSW Fisheries Management Act 1994. The species is associated with the Clarence and Richmond river systems in north-eastern NSW. The Clarence River is situated near the southern end of the study area, while the Richmond River occurs near the northern end of the study area.

The habitat requirements of the Eastern Freshwater Cod are poorly known, but probably resemble related species (NSW Fisheries 1999). Cod are typically found in clear flowing rivers with rocky substrate and large amounts of in-stream cover. Recent research observations have indicated that eastern cod are typically associated with deeper parts of the river near cover, especially around rocky islands and large boulders in fast-flowing water.

Main ecological characteristics

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; and
- creeks and drainage lines.

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.

3.2.6 Climate and air quality

The study area is heavily influenced by coastal weather patterns. The overall climate is warm to sub-tropical, with high annual rainfall. The wettest seasons are summer and autumn, while there is a pronounced dry season between July and December.

Mean annual rainfall figures for the study area range from approximately 1600 mm along the coast, to approximately 1000 mm at Casino. The most intense summer rain events, which can exceed 500 mm, are usually associated with the influence of tropical cyclone systems. Similarly, heavy winter rainfall events are usually associated with intense offshore low pressure systems.

Information on local air quality is limited. Rural areas with low population density do not generate airborne pollutants in sufficient concentrations to present a risk to the environment or to human health. Air quality monitoring is therefore not routinely carried out in these areas.

Based on studies carried out for other Pacific Highway upgrade projects, it is anticipated that airborne pollutants generated by this project will meet DEC criteria.

3.3 Land use

3.3.1 Existing land use

The predominant land use through the study area is retained natural forest either currently uncleared or partially cleared for pasture. Most private properties along the route are used for small scale beef cattle and horse raising on generally unimproved pasture or clearings within this natural forest. The retained forest on private land is in addition to extensive areas of State Forest, National Parks and nature reserves that border the highway in this area. Sugar cane growing is confined to the area near Iluka Road.

Previous highway upgrading works have left a number of small land blocks along the highway. The prior upgrades have also left clusters of residential blocks with frontage to the original highway alignment. Most residential areas are primarily located off the highway on minor access roads. However, a number of residences have direct highway frontages.

The only commercial centre in the study corridor is at New Italy, comprising a heritage museum and related small-scale tourist facilities.

The current land use of properties with frontage to the existing highway is summarised in **Table 3.3**, noting that there may be more than one activity per property. There are 181 individual allotments of land fronting the Pacific Highway. Some holdings however comprise more than one allotment. Therefore, the number of individual 'properties' or holdings fronting the highway is less than 181.

Table 3.3 Current land use activity: numbers of properties engaged in the activity

Land Use Activity*	No of Properties
Natural forest on private land	80
Pasture	55
Sugar cane	17
Commercial	5
Residential or rural living	48
State Forest, National Park, nature reserve, canal	20
Prior highway upgrade remnants	31
Total	181

* Each property may have more than one activity.

Source: Connell Wagner, 2005.

Land uses along the highway corridor are generally consistent with the zones established under the MLEP (Clarence Valley) and the RRLEP (Richmond Valley).

3.3.2 Potential future land use

Upgrading the highway presents few options for development of new land use strategies. There is minimal residential development along the route with vast areas conserved as State Forest or National Park. Both Clarence Valley Council in the south and Richmond Valley Council in the north advised in July 2005 that there were no development applications pending with regard to any properties within the defined corridor.

3.3.3 Agricultural lands assessment

Most of the land fronting the highway, which could be directly impacted by highway upgrading, has low agricultural capability and current use is dominated by forestry or forest dominant reserves. The special class lands near Iluka Road reflect the occurrence of land suitable for sugar cane on selected pockets there, while that at the Woodburn end reflects the presence of the Richmond River alluvial flood plain. While sugar could be grown on some of the land being used for pasture, industry economics are also a determining factor. Part of this land is already occupied by residential development near Woodburn.

The highway corridor passes through an area of relatively low agricultural productivity, a consequence of low fertility soils, poor drainage and a concentration on ecological and cultural conservation and forestry. Given the focus of recent *Native Vegetation Act 2003* legislation on limiting new clearing, there appears to be little scope for substantially changing the agricultural productivity along the highway corridor. Apart from sugar cane production in the southern sectors, crop production potential for properties affected by the highway upgrading appears very small.

3.3.4 Agricultural capability

The sugar cane farms towards the south of the study area, and the Richmond River floodplain just south of Woodburn, are on land which has limited agricultural capability for diverse long term or permanent cropping. Soils within the study area are generally of moderate to low fertility (see section 3.2.2) and most of the land along the corridor is suitable for grazing but not for cultivation and is not well suited to pasture improvement. The better agricultural land is found on the well drained lower slopes where there are extensive areas of swamp forest. The State Forests, nature reserves and Bundjalung National Park occupy most of this land within the study area.

3.4 Recreation and tourism

Tourism and recreation facilities within the study area include Bundjalung National Park, Tabbimoble Swamp Nature Reserve and New Italy. Higher traffic flows along the highway coincide with holiday periods being predominantly January, April and October. These higher flows reflect the use of the highway to reach tourism destinations on either side of the study area including the coastal towns of Iluka and Evans Head, and other destinations between Sydney and Queensland.

The New Italy Museum Complex is a small tourist attraction that is well patronised because of its location on the highway, relying mostly on passing trade rather than destination visits. It is estimated that the New Italy Museum Complex would have approximately 60,000 visitors annually.

A Driver Reviver facility operates at New Italy during holiday periods. The Driver Reviver caters for approximately 30,000 visitors annually (Richmond Valley Council *pers comm*, 2005).

3.5 Public utilities

Four service organisations own or operate utility services on or near the highway corridor. These are Country Energy, which distributes electricity to rural areas within NSW, Telstra, which provides telecommunications locally and nationally, and Clarence Valley and Richmond Valley Councils. Plant belonging to Telstra and Country Energy generally follows the existing highway alignment. Telstra's plant, including the fibre optic cable, is located entirely underground, while Country Energy's power distribution network consists primarily of overhead wires.

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 monitoring locations are shown in **Figures 3.12a** and **b**. The results, detailed in **Table 3.4**, showed 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 3.4 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 ¹	65m	62	61
R3: Lot 1/796808 Pacific Highway Tabbimoble ¹	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; and
- the average traffic speed was approximately 110 km/h.

3.7 Planning and settlement patterns

The study area does not include any towns and as a result there is no demographic data specific to the immediate area along the Pacific Highway. Most data provided in this section has been obtained from the Australian Bureau of Statistics (ABS, 2001) census for the broader community within the Clarence Valley and Richmond Valley LGAs.

Further information has been provided by local Councils and through discussions with community members.

3.7.1 Demographic profile

The current population of Woodburn is approximately 550 people. The population of the rural area between Woodburn and the Richmond Valley/Clarence Valley LGA boundary is approximately 200. Richmond Valley's population grew by 2.5% between 1991 and 2001 (ABS census data, 2001). The overall trend is consistent with population growth throughout the North Coast of NSW, one of the fastest growing regions in NSW.

Richmond Valley Council expects Woodburn's population to grow to 700 over the next 20 years, and the rural area between Woodburn and the LGA boundary to 500 over the same period.

New Italy, which is located between Woodburn and Iluka, is a heritage museum and small-scale tourist facility devoted to the history of the area, which was first settled by Italian migrants in 1882. New Italy's resident population is located mostly west of the Pacific Highway on medium sized rural allotments, and would not be directly affected by the proposed highway upgrade.

The population of the southern end of the study area (within Clarence Valley LGA) is likely to remain relatively static over the next 20 years as growth of the area is restricted by the large areas of land occupied by National Parks, nature reserves, State Forests and cane farms. Clarence Valley Council has advised that there is little likelihood of any change to existing land use strategies or strategic planning policy, in respect of land within the study area, in the foreseeable future.

The towns of Iluka and Woombah have a combined population of approximately 2,750, which increases considerably during the summer holiday period.

3.7.2 Age profile

The north coast region of NSW is ageing more rapidly than the State as a whole. There are more aged people and young people in Richmond Valley than in the rest of the State (Richmond Valley Social Plan 2001). Further, the number of aged people in Richmond Valley increased by 19% between 1991 and 2001, with the largest concentrations of aged people being in Coraki, Evans Head and Casino.

The former Maclean LGA (now part of Clarence Valley) also accommodates a median age (44 years) higher than the State average (34 years). The former Maclean LGA accommodates 26.5% of people over the age of 55 which is higher than the state proportion of 21%. Iluka is considered to accommodate a notably higher aged population than other areas in the former Maclean Shire.

3.7.3 Housing

The study area comprises predominantly dispersed low density semi-rural to small rural holdings with smaller residential blocks of land at Trustum's Hill and along Williams Road. Single dwellings are the main style of housing within the study area and there are few scattered caravans and cabins.

The Richmond Valley Council State of the Environment Report 2004 indicates that there are three areas within the LGA available for immediate rural residential development. These are Fairy Hill, Swan Bay and North Casino, none of which is within the study area. Further discussion with Richmond Valley Council has indicated that there are no known future release or development areas in the region in closer proximity to the study area. However, this appears contrary to the population growth predictions for the rural area south of Woodburn, as mentioned above. Trustum's Hill is a potential future development area and there has been recent subdivision (to create seven one-hectare rural residential allotments) at Sharpe Road, which is a short distance south of Woodburn as shown in **Figure 3.1**.

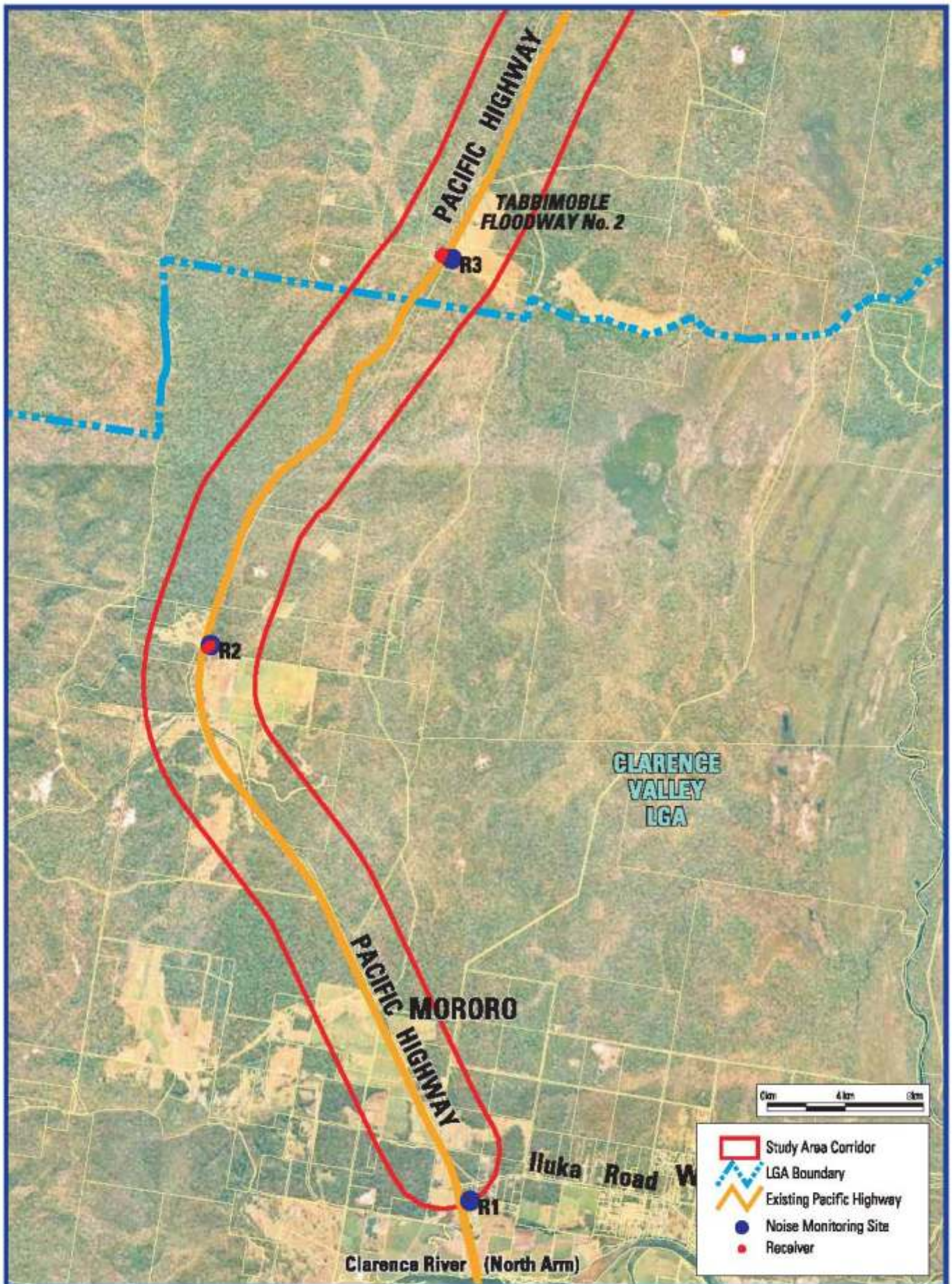


FIGURE 3.12 a
NOISE MONITORING LOCATIONS AND
DWELLINGS LOCATED WITHIN 300m OF
THE EXISTING/PROPOSED ROAD ALIGNMENT

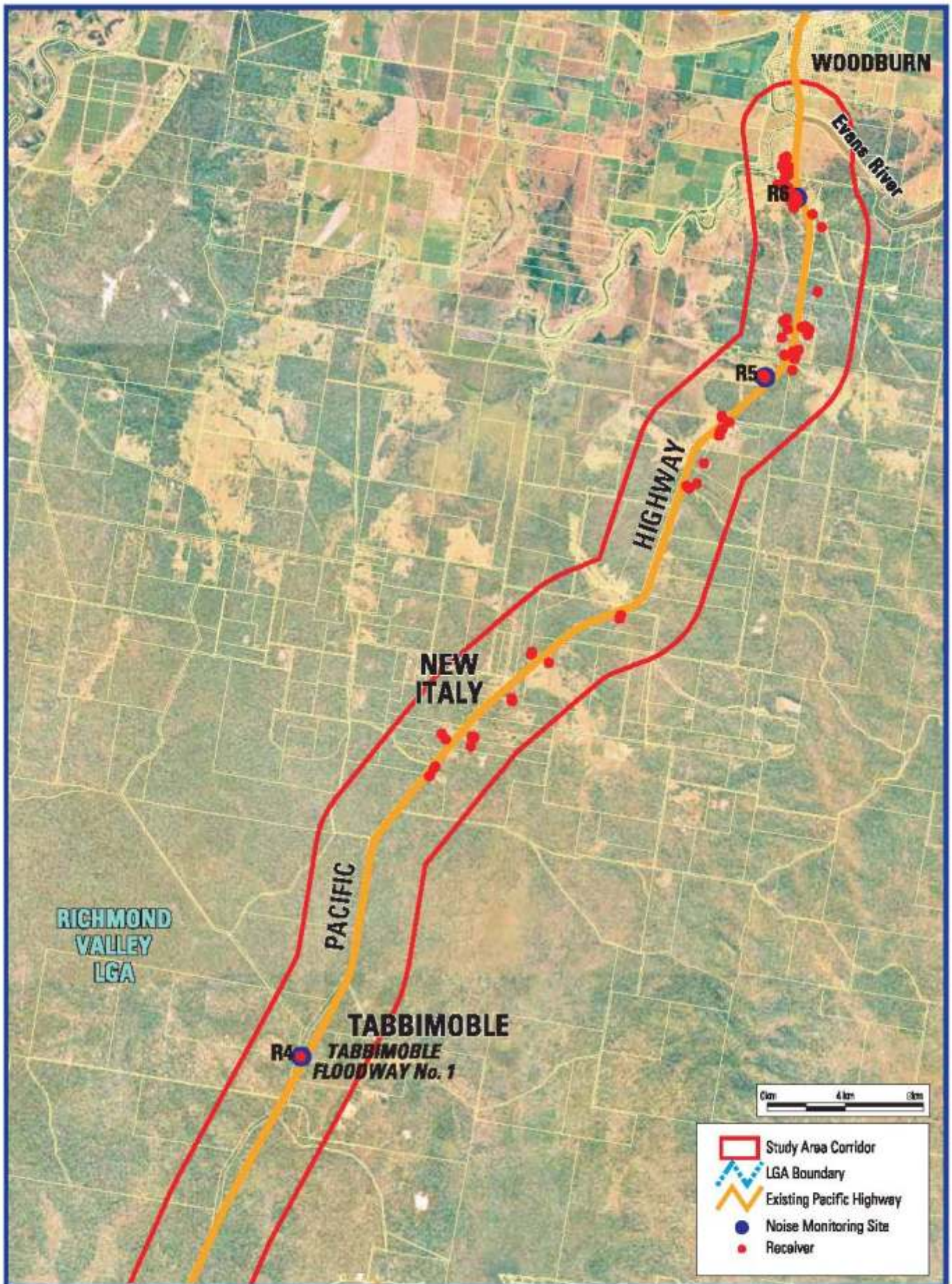


FIGURE 3.12 b
NOISE MONITORING LOCATIONS AND
DWELLINGS LOCATED WITHIN 300m OF
THE EXISTING/PROPOSED ROAD ALIGNMENT

Housing at the southern end of the highway corridor, in the Clarence Valley LGA, consists of very low density rural properties. The future development of this area is restricted by surrounding National Parks, nature reserves, State Forests and cane farms.

3.7.4 Employment

There are numerous sugar cane farms, cattle grazing farms and horse rearing businesses within the study area providing employment for the local community. Within the wider region the areas of employment include mainly manufacturing, agriculture, forestry, fishing, retail trade, and health and community services.

Clarence Valley and Richmond Valley are typical of many rural areas in that unemployment is high for both males and females, particularly in the 15-24 year age group. Youth unemployment rates are close to double the rates for the overall population. Full time work is predominantly the domain of males, while part time work is conversely the domain of females.

3.8 Indigenous heritage

3.8.1 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 Ulgundahi 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 Bandjalang people from a wide geographical area.

3.8.2 Native title claims

A search of the Register of native title claims, the Register of Indigenous Land Use Agreements, the National Native Title Register and the Applications Summary was undertaken for the Richmond Valley and Clarence Valley LGAs on 4 May 2005. Advice provided by the National Native Title Tribunal indicates that at the time of the search there were two entries relevant to the study area. Both have been accepted for native title registration and are currently in mediation.

The first of these (NC96/16) has been lodged by 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 in the vicinity of New Italy.

The second entry (NC98/19) has also been lodged by Lawrence Wilson on behalf of the Bandjalang people. The application relates to a 3,315 km² area comprising all claimable land south from Broadwater Headland to Woody Bluff, inland to Naughtons 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 have to extinguish the relevant native title claims (if any) prior to acquiring the land.

3.8.3 DEC Aboriginal Heritage Register

Twelve Aboriginal sites have been registered to date on the DEC Aboriginal Heritage Information Management System within a 5 km radius of the study area. However, none of the DEC registered sites fall within the study area itself.

3.8.4 Other Aboriginal heritage registers

Searches of the relevant Commonwealth and State government heritage lists maintained by the Department of Environment and Heritage, and the NSW Heritage Register, revealed no listed Aboriginal sites within either the Richmond Valley or Clarence Valley LGAs. Four Indigenous places are registered on the National Estate database, all in the Richmond Valley Shire. These are located at Casino, Evans Head and Bora Ridge, a minimum of 10 km from the study area.

3.8.5 Unregistered Aboriginal sites

A field study was conducted on 31 May, 1-3 June and 11 August 2005 to identify previously unrecorded sites. The field survey was attended by representatives of the local Indigenous communities and was focussed 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 location shown on **Figure 3.13**.

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) are 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) are 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 (subject to DEC approval).

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 LALC, the precise location of the scarred tree has not been mapped or included in the survey results. 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.

3.9 European heritage

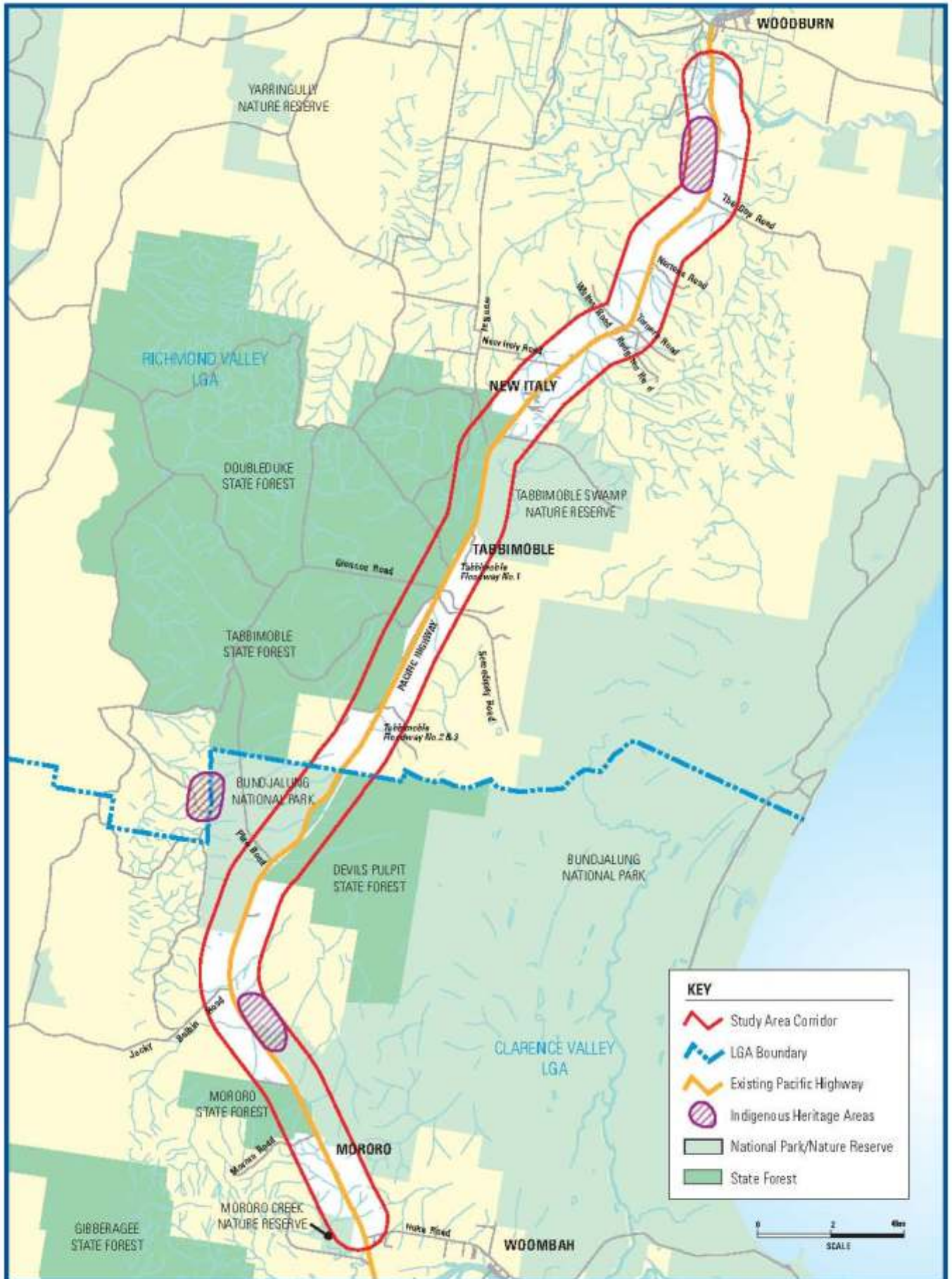
3.9.1 Identified heritage items

There is little published historical information relating directly to the Iluka Road to Woodburn area, however, it is known and understood that 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 RRLEP, the MLEP and the NSW Heritage Office State Heritage Inventory for local and state significant heritage items have identified the following heritage items/places within the general project area:

- New Italy Settlement; and
- Vineyard Haven, New Italy.



KEY	
	Study Area Corridor
	LGA Boundary
	Existing Pacific Highway
	Indigenous Heritage Areas
	National Park/Nature Reserve
	State Forest



FIGURE 3.13
INDIGENOUS HERITAGE
AREAS

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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.

A description and statement of significance for each of the sites/items identified is provided below and the location of each heritage item relative to the proposed highway upgrade is illustrated in **Figure 3.14**. During the preliminary European 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 European settlement will be undertaken during the environmental impact assessment phase of the project.

3.9.2 New Italy Settlement

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. 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; and
- more recent pavilion, restaurant, hall, display hall and Aboriginal art gallery buildings.

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 New Italy Settlement covers an area of 485.62 hectares (1200 acres) and represents an unusual phase of settlement in NSW. It is the only known settlement of its type in NSW. The physical condition of the site is considered fair to good and the archaeological potential of the school site together with the surrounding New Italy landscape is high.

No specific information has been found regarding an identified curtilage for the New Italy Settlement site, however for the purposes of this report, it has been assumed that the original 1880's settlement boundary forms the curtilage of the site. The approximate 1880's boundary is defined by the NSW Heritage Office State Heritage Inventory and is reproduced approximately in **Figure 3.14**.

3.9.3 Vineyard Haven, New Italy Settlement

'Vineyard Haven', although within the area defined as the New Italy Settlement, is listed as a separate 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. For the purposes of this report, the site boundary as identified by the NSW Heritage Office State Heritage Inventory has been adopted and is reproduced approximately in **Figure 3.14**.

3.10 Visual amenity

The Clarence Valley and Richmond Valley regions in northern NSW are existing natural and cultural environments whose beauty and unique assets are attractive for both local residents and visitors.

The presence of the mountains, the great rivers that meander across the coastal plain, the eucalypt forests broken up by meadows and pasture lands and the small settlements and interspersed farmsteads are constant features along the highway. Variation is in the main provided by vegetation and the agricultural land use.

The overarching urban design vision for the Pacific Highway upgrade is outlined in the RTA's Pacific Highway urban design framework (March 2005):

'a sweeping, vegetated highway, providing panoramic views to the Great Dividing Range and rivers, forests, farmlands and coastline of the Pacific Ocean. Sensitively designed to fit into the landscape and be unobtrusive. Characterised by simple, attractive road infrastructure.'

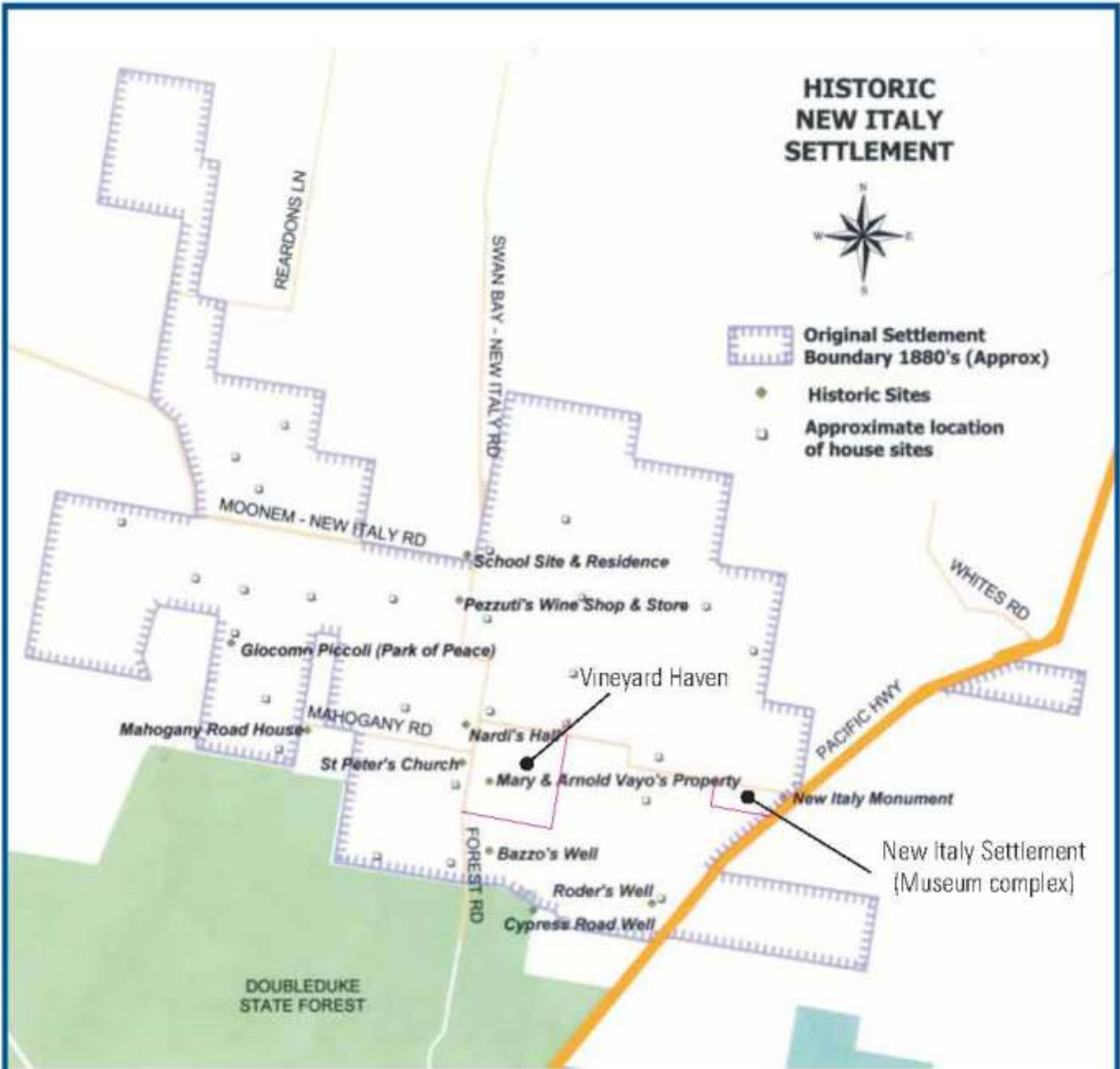
3.10.1 Existing important characteristics

Important natural and built features of the study area include:

- Chatsworth Hill;
- Mororo Creek and Nature Reserve;
- Mount Doubleduke;
- Tabbimoble Creek;
- Tabbimoble Floodways;
- State Forests/National Parks (Mororo, Devils Pulpit, Doubleduke, Bundjalung);
- Tabbimoble Swamp Nature Reserve;
- New Italy community; and
- Tuckombil Canal.

Generally, the landscape in the study area comprises floodplains cut by a variety of rivers and 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 around the drainage lines of Mororo Creek. Extensive dense forests of eucalypt and melaleuca line the highway for considerable lengths.

New Italy provides regional cultural landscape interest. Though close to the existing road corridor, the New Italy Museum Complex is in a pleasant garden courtyard setting, of a scale that is welcoming and restful for travellers. An earth embankment next to the road edge combined with a stand of significant existing eucalypts, and the separation between the rest area and the highway itself, provide an essential green foil to the roadway, an effective acoustic screen, and a pleasant entrance to the New Italy Museum Complex. It is considered an important urban design and landscape objective to use the Pacific Highway upgrade project as an opportunity to enhance the visual and landscape amenity of the New Italy Museum Complex.



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