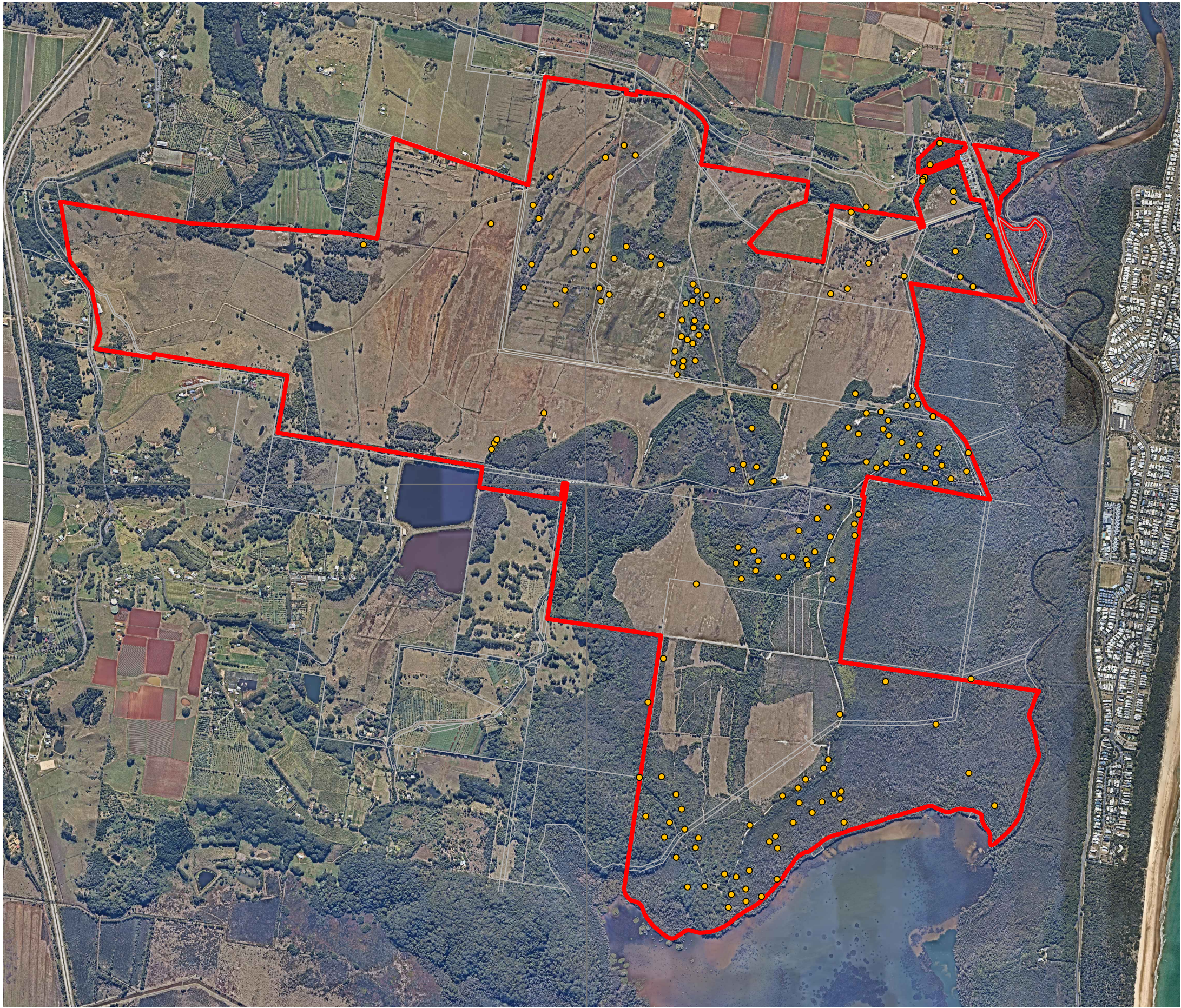




- LEGEND**
-  Koala
 -  Kings Forest Boundary

Note: Records shown on the Kings Forest site are since 1990 and include data collected during radio-tracking programs. The records shown include small-scale movements of Koalas over a number of days/nights.

0 500m
1 : 20 000

SOURCE: Landpartners - Threatened Fauna
- Birds & Mammals; Near Map 08/08/18 Aerial

SCALE: 1 : 20 000 @ A3

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Koala Plan of Management
Kings Forest
Melaleuca Drive, Duranbah, NSW
Shire of Tweed

FIGURE 14

PREPARED: BW
DATE: 28 September 2018
FILE: N97017_KPOM.dwg

TITLE

KOALA
RECORDS

(15) Koalas. Phillips and Pereoglou (2004) estimated the population of seventy-six (76) Koalas in the wider Kings Forest area.

6.4 Koala Activity Levels and Habitat Occupancy Rates

6.4.1 Tweed Coast

The reassessment of the koala population on the Tweed Coast is one of the initial actions of the recently adopted Tweed Coast Comprehensive Koala Plan of Management. The aim of this study is to determine current occupancy rates and assess changes in the distribution and levels of koala activity in the five years since the Koala Habitat Study was prepared in 2011.

Koala activity remains widespread throughout the study area, however substantially less of the available habitat is currently occupied by resident koala populations than was reported in 2011 (Tweed Shire Council 2015a). Koala activity levels have declined significantly overall and indicate ongoing decline of the Tweed Coast koala population as a whole. Decline is most notable in the north of the study area, between Kings Forest and Koala Beach, while activity levels and the distribution of resident populations appear stable between Koala Beach and Black Rocks.

According to the analysis of occupancy rate, areas supporting resident populations (that is, areas supporting the majority of the koala population; animals occupying stable home ranges and breeding females) appear to have substantially contracted in the northern part of the study area. Data collected during the 2011 Habitat Study resulted in an estimated occupancy rate for resident populations of approximately 30% within the area of interest in this study. The current occupancy rate, estimated at 15%, is approximately half that of the previous survey's estimate.

It has been suggested (Phillips *et al.* 2011, Hopkins and Phillips 2012) that an occupancy rate of 50% is optimal for koala populations on the east coast. This means that at any one time, 50% of the available habitat is occupied by resident koala populations. The results of this study suggest that the trend of decline is continuing, and that koala populations on the Tweed Coast continue to exist at an occupancy rate that is well below the optimal level of 50%. As a result, populations are highly susceptible to ongoing and well-known threats, particularly stochastic events such as wildfire that have the potential to significantly impact small and fragmented sub-populations.

When they were sampled in 2010, 10 of the 21 sites (48%) returned evidence of koala activity. Eleven of these sites (52%) were active in 2015, however only three (14%) of these sites returned significant activity in 2015, half the proportion used by resident populations in 2010. These data indicate that the amount of habitat occupied by resident populations has reduced by approximately half since the previous survey, whilst occasional use by koalas still occurs throughout a similar proportion of habitat to that recorded in 2010 (Tweed Shire Council 2015a).

Phillips *et al.* (2011) state that “there is a need to consider the localised extinction of Koalas south of the Tweed River to be a foreseeable event within the next 2-3 decades, sooner if those factors currently impacting upon the population such as fire and unsustainable levels of incidental mortality are not addressed.” The Kings Forest development will provide threatening

process management strategies such as dog control, fencing, underpasses and will provide over 60,000 Koala food trees over the life of the project with over 10,000 trees being planted in the first stage of the development (Appendix 6 - TABLE 2). No other stakeholder on the Tweed Coast is providing anywhere near the potential for revival of the Koala population that is being offered by the Kings Forest development.

6.4.2 Kings Forest

Phillips and Pereoglou (2004) utilised SAT (Spot Assessment Technique) analysis to produce an empirical index of koala “activity”, the measure of which was simply obtained by dividing the number of trees that had koala faecal pellets recorded beneath them by the total number of trees sampled in each site. Evidence of koalas was found not to be uniformly distributed throughout the study area. Koala faecal pellets were recorded in 56 of the 87 SAT sites, with activity levels ranging between 3.33% and 93.33%. The mean activity level (active sites only) was $25.54\% \pm 20.20$ (SD). Approximately 23% (31/136) of the SAT sites returned Medium (normal) and High Use activity levels.

During 2015 Koala activity was assessed as being widespread throughout the eastern portion of the Kings Forest IKPoM area and adjacent Cudgen NR (Tweed Shire Council 2015a). Overall activity levels had declined however since the Phillips *et al.* (2011) assessment, and the previously modelled contiguous area of significant activity had contracted to two smaller cells, within which activity levels were similar to those recorded previously (**FIGURE 15**). The northern cell straddles Depot Road and extends south into Cudgen NR. The southern cell is associated within a large area of swamp sclerophyll forest between the Cudgen Paddock and Cudgen Lake. Active low use sites occurred to the north, west and southwest of this cell. A number of additional sites within the Kings Forest property were recorded as ‘inactive’ (**FIGURE 15**).

6.5 Preferred Koala Food Trees

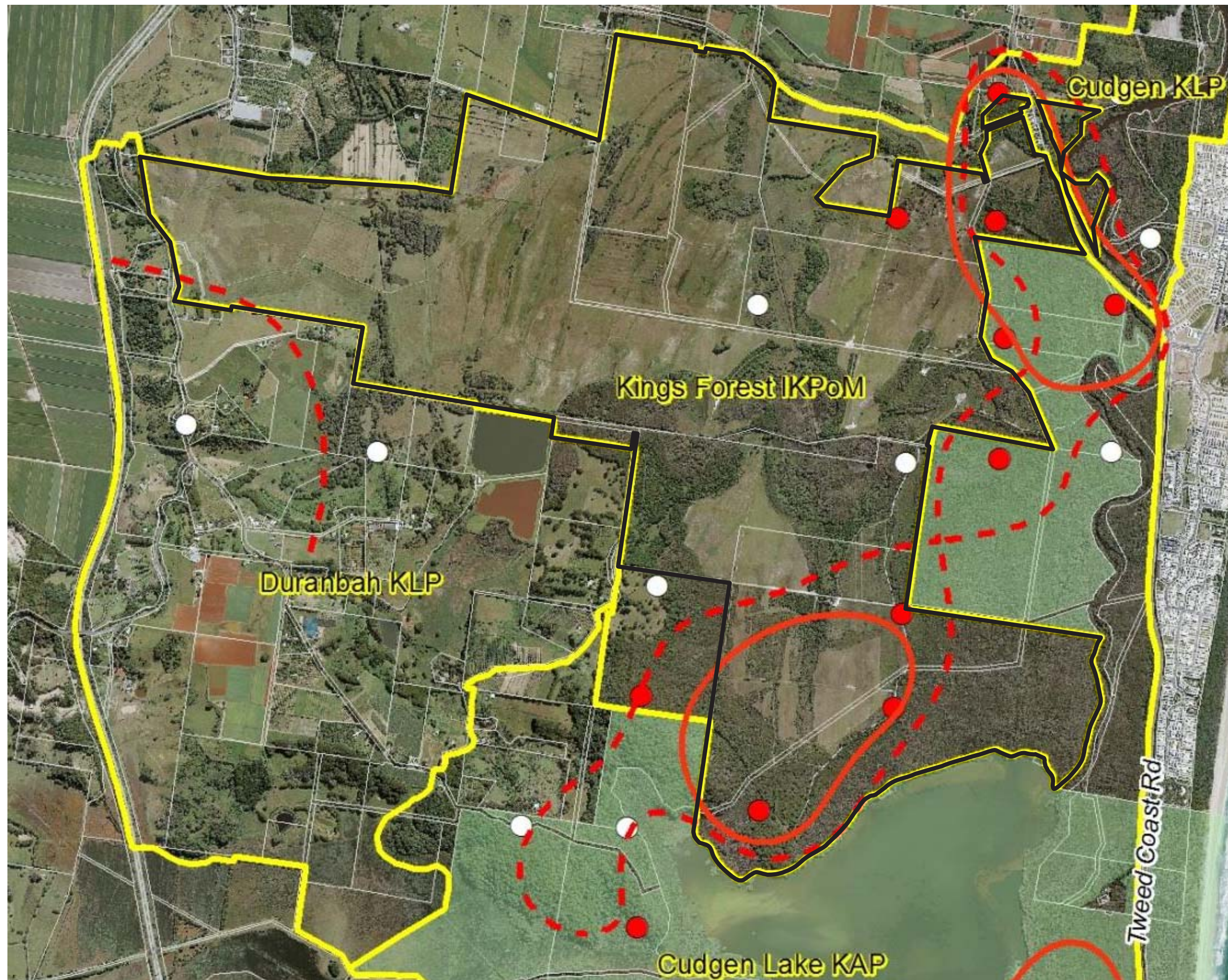
6.5.1 Introduction

There are numerous documents that have been prepared by Commonwealth, state and local government agencies that identify and list tree species considered as preferred food sources for the Koala. The following sections provide a summary of recognised Koala food tree species in the following areas:

- NSW;
- North Coast Region of NSW;
- Tweed Coastal Strip; and
- Kings Forest site.

6.5.2 NSW

A review of Koala food tree preferences across NSW was undertaken during the course of preparing the NSW Koala Recovery Plan, the results of which specified all Eucalypt species



- LEGEND**
- Koala Populations 2015
 - Koala Populations 2011
 - Active Field Sites
 - Inactive Field Sites
 - KPoM Management Precincts
 - Nature Reserve
 - Property Boundary
 - Kings Forest Boundary



SOURCE: Tweed Shire Council Tweed Coast
Koala Study 2015 - Figure 4
SCALE: 1 : 20 000 @ A3

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FIGURE 15

PREPARED: BW
DATE: 05 September 2018
FILE: N97017_TSC 2015 Field.cdr

TITLE
**2011 & 2015
INDICATIVE
POPULATION
BOUNDARIES**

known to be preferentially utilised by Koalas in the form of Primary, Secondary and Supplementary food tree species (DECC 2008) (**APPENDIX 5**).

Furthermore, Schedule 2 within SEPP 44 includes a list of Koala feed tree species applicable to the implementation of the SEPP (**APPENDIX 5**).

6.5.3 North Coast Region of NSW

The Tweed LGA is located in the North Coast Koala Management Area (KMA) for purposes of the approved Koala Recovery Plan (DECC 2008). The North Coast KMA extends from the Hunter Valley to the NSW-QLD border and is bounded in the west by higher elevations of the Great Escarpment which otherwise limit the distribution of the North Coast KMA's indicative preferred food tree species Tallowwood (*E. microcorys*). Additional to Tallowwood, a further five (5) Primary, thirteen (13) Secondary and five (5) Supplementary food tree species are known to occur in the North Coast KMA (**APPENDIX 5**).

6.5.4 Tweed Coastal Strip

Phillips *et al.* (2011) established that four (4) species - Forest red gum, Swamp mahogany, Tallowwood and Grey gum - were the most preferred species within the Tweed Coast Study Area. All four (4) of these species were confirmed as Primary food species when growing on high nutrient soil landscapes as mapped by Morand (1996). Biochemical volatility (implied by size-class dependent levels of use) relegated Tallowwood and Grey gum to the status of Secondary food tree species when growing on the lower nutrient Neranleigh-Fernvale soil landscapes.

Narrow-leaved scribbly gum (*E. racemosa*), Red mahogany (*E. resinifera*), Grey ironbark (*E. siderophloia*), Blackbutt (*E. pilularis*) and thick leaved and/or white mahogany (*E. carnea/acmenoides*) in addition to Coastal cypress pine (*Callitris columellaris*), Broad-leaved paperbark (*Melaleuca quinquenervia*), Brushbox (*Lophostemon confertus*), Swamp Box (*L. suaveolens*), Pink bloodwood (*Corymbia intermedia*), Red bloodwood (*C. gummifera*) and Swamp Oak (*Casuarina glauca*) were identified by Phillips *et al.* (2011) as non-preferential and/or opportunistically browsed food tree species.

6.5.5 Kings Forest Site

Records of Koalas at Kings Forest are primarily associated with vegetation communities that contain the preferred food trees species Swamp mahogany (i.e. PCT 1230: Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion / TVMS 305: Coastal Swamp Mahogany Open Forest to Woodland). Based on cuticle scale analysis of Koala faecal pellets, Swamp mahogany comprises nearly half (46%) of the dietary intake. The remainder is comprised of a mix of more opportunistically browsed species including Swamp box and other non-eucalypt species such as Brushbox and Broad-leaved paperbark (JWA 2000).

Scribbly gum is a notable omission in the various studies of food tree use by the Kings Forest Koalas. While Scribbly gum is a commonly occurring tree species on the Kings Forest site, it has not been recognised as a preferred food tree species in either the cuticle scale analysis work completed by JWA (2000), or other site-specific assessments (Phillips and Callaghan 1996;

Phillips and Pereoglou 2004; Phillips *et al.* 2011). Moreover, Scribbly gum is also not recognised as either a Primary, Secondary or Supplementary food tree species by the Approved Recovery Plan. On this basis, the value of Scribbly gum as a preferred Koala food tree on the Kings Forest site has been disregarded for the purposes of this KPoM.

6.6 Resource Availability

6.6.1 Introduction

The following sections discuss the availability of forage resources for the Koala within the Tweed Shire and within the Kings Forest site.

6.6.2 Tweed Shire

Tweed Shire vegetation mapping describes forty-six (46) vegetation communities for consideration as Koala habitat within the Tweed LGA (Kingston *et al.* 2004). All of these vegetation communities have been categorised by Phillips *et al.* (2011) into three (3) habitat categories.

These habitat categories are recognised by the approved Koala Recovery Plan (DECC 2008) and are described as follows:

- **Primary Habitat** - areas of forest and/or woodland wherein primary food tree species comprise the dominant or co-dominant (i.e. $\geq 50\%$) overstorey tree species (most often associated with breeding habitat).
- **Secondary (Class A) Habitat** - areas of forest and/or woodland wherein primary food tree species are present but not dominant or co-dominant and usually (but not always) growing in association with one or more secondary food tree species.
- **Secondary (Class B) Habitat** - areas of forest and/or woodland wherein primary food tree species are absent, habitat containing secondary and/or supplementary food tree species only.

Areas of each habitat category within the Tweed LGA have been calculated as follows:

- Primary Habitat is limited to 200 ha (1.04%) of mapped vegetation and consists of communities that are dominated by *Eucalyptus robusta* and/or *E. tereticornis* $\pm$ *E. microcorys* growing on TAEBAS⁴ soil landscapes.
- Secondary (Class A) Habitat comprises the bulk of potential Koala habitat, encompassing 2,300 ha (12%) of mapped vegetation communities growing on TAEBAS soil landscapes wherein on average *E. robusta* and/or *E. tereticornis* $\pm$ *E. microcorys* are sub-dominant elements.

⁴ TAEBAS refers to those of transferral, alluvial, estuarine, beach, aeolian and swamp (TAEBAS) landscapes respectively.

- Secondary (Class B) Habitat comprises 1,315 ha (6.8%) of mapped vegetation communities containing *E. microcorys* and/or *E. propinqua*⁵, growing on NFM⁶ soil landscapes.

Koala habitat occurring in the wider Tweed locality is shown in **FIGURE 16**.

6.6.3 Kings Forest

The distribution and area calculations for Koala habitat [Primary, Secondary (Class A) and Secondary (Class B)] occurring on the Kings Forest site are provided in **FIGURE 17** and **TABLE 6**. It should be noted that the original Koala habitat mapping, completed by Phillips *et al.* (2011) has been refined during the completion of more recent assessments. Existing koala habitat on the Kings Forest site covers a total area of approximately 214.05 ha and is comprised of three (3) habitat categories:

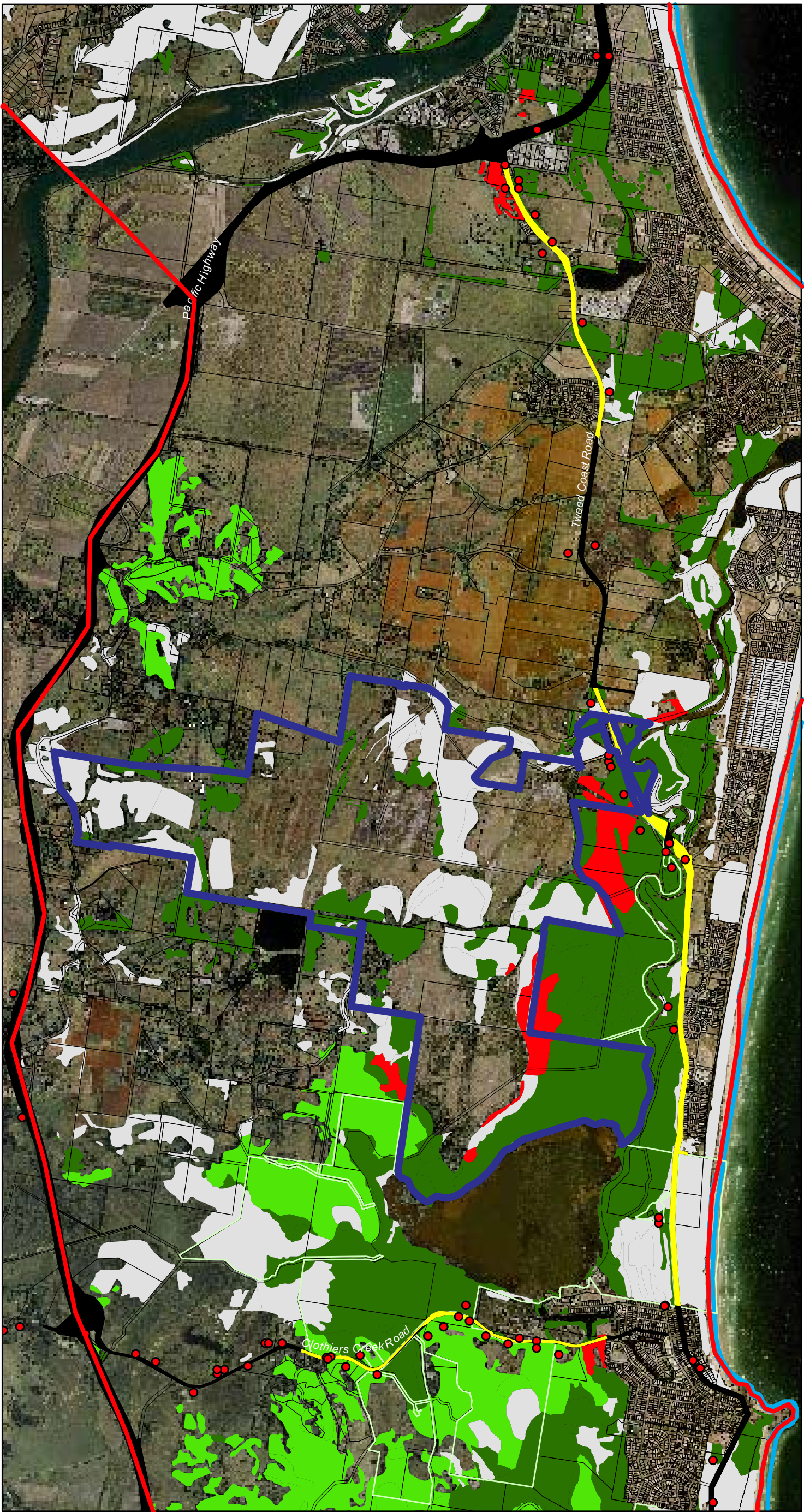
- **Primary Habitat** - predominantly comprised of Swamp mahogany (i.e. PCT 1230: Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion / TVMS 305: Coastal Swamp Mahogany Open Forest to Woodland).
- **Secondary (Class A) Habitat** - predominantly comprised of Broad-leaved paperbark in low-lying areas with minor occurrences of Swamp mahogany (i.e. PCT 1064: Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion / TVMS 401: Broad-leaved Paperbark Closed Forest to Woodland). There are also some occurrences of Narrow-leaved scribbly gum in more elevated areas.
- **Secondary (Class B) Habitat** - predominantly comprised of Blackbutt with minor occurrences of Tallowwood (i.e. PCT 690: Blackbutt - Tallowwood dry grassy open forest of the central parts NSW North Coast Bioregion / TVMS 201: Blackbutt Open Forest Complex).

TABLE 6
EXISTING KOALA HABITAT ON KINGS FOREST SITE

Habitat Type (PCT* / TVMS#)	Existing Area
Primary Habitat (PCT 1230 / TVMS 305)	32.63 ha
Secondary (Class A) Habitat (PCT 1064 / TVMS 401)	169.17 ha
Secondary (Class B) Habitat (PCT 690 / TVMS 201)	12.25 ha
TOTAL	214.05 ha
*Relevant Plant Community Type (PCT) descriptions which were accessed via the NSW Office of Environment & Heritage (OEH) database (i.e. the BioNet Vegetation Classification System).	
#Refer to Tweed Vegetation Management Strategy (Kingston <i>et al.</i> 2004)	

⁵ Apparent inconsistency in statement that Secondary (Class B) habitat should not contain any Primary habitat trees.

⁶ NFM refers to sites on all erosional/residual landscapes (i.e. Neranleigh-Fernvale Metamorphics).



- LEGEND**
- Blackspots
 - Koala Records
 - Habitat Category
 - Primary
 - Secondary (A)
 - Secondary (B)
 - Other
 - Major Roads
 - Nature Reserve
 - Tweed Coastal Strip
 - Tweed LGA Boundary
 - Kings Forest Boundary

0 750m
1 : 30 000

SOURCE: Biolink Ecological Consultants - Tweed Coast Koala Habitat Study (2011)
SCALE: 1 : 30 000 @ A3

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FIGURE 16

PREPARED: BW
DATE: 05 September 2018
FILE: N97017_Phillips Khabitat.cdr

TITLE

**KOALA
HABITAT
IN LOCALITY**