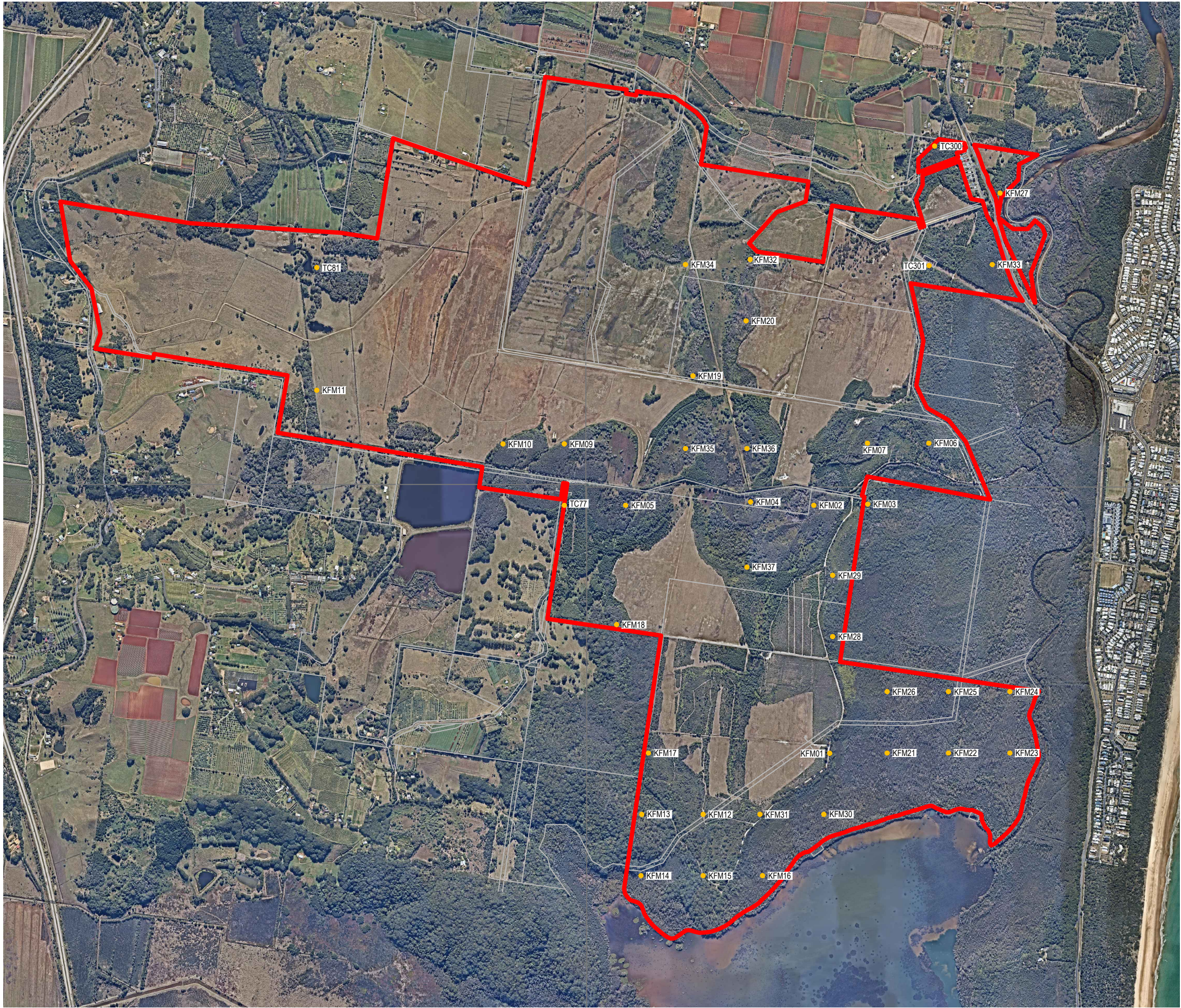




- LEGEND**
- Annual Koala Monitoring Location
 - Kings Forest Boundary

0 500m
1 : 20 000

SOURCE: Biolink (Ref: KF_Monitoring sites.jpg
Recd 18.12.15); Near Map 08/08/18 Aerial

SCALE: 1 : 20 000 @ A3

JWA PTY LTD
Ecological Consultants

CLIENT
Project 28 Pty Ltd
PROJECT
Koala Plan of Management
Kings Forest
Melaleuca Drive, Duranbah, NSW
Shire of Tweed

APPENDIX 7 FIGURE 1	TITLE ANNUAL KOALA MONITORING LOCATIONS
	PREPARED: BW DATE: 24 September 2018 FILE: N97017_KPOM.dwg

that offer statistical rigour plus all of the remaining 16 that contain PKFT's. A full SAT analysis (including transect searches) will be completed.

- New field sites, anchored to the same (original) sampling grid established by Biolink (2004) will be created over time¹⁸ in the compensatory habitat areas.

Sampling

In most cases, the central point of each field site that had been sampled during the Habitat Study (2010) and the Tweed Coast Koala Study (2015) should be readily identifiable (due to the centre of the site being marked with flagging tape in 2010 and 2015). Sites where the previous marked centre tree cannot be found will be located as close as possible to the identified coordinates. The central tree of each field site will be identified with a permanent peg in the ground and marked with the site number to enable future identification.

All sites will be sampled using a protocol identical to that used during the Habitat Study, being the Spot Assessment Technique (SAT) methodology of Phillips and Callaghan (2011). The spot assessment technique uses a 30-tree sample to provide a measure of koala activity based on the presence of koala faecal pellets.

In addition to the SAT analysis demographic attributes of the koala population will be determined via targeted searches of:

- a) 25 m fixed radius (0.196 ha); and
- b) 250 m x 40 m (1 ha) line transect (*sensu* Dique *et al.* 2003/4) at each field site. The line transects will be permanently erected at each survey site and three ecologists will search along the transect observing koala occurrence.

The following information relating to each Koala sighting should be collected:

- Age class: Adult, sub-adult (2-4 kg) or juvenile (less than one (1) year old, less than 2 kg, not yet independent);
- Reproductive status: the presence of a pouch young, back young, or no young associated with an adult female;
- Health status: healthy, or showing signs of Chlamydia such as cystitis (wet, stained bottom) and/or conjunctivitis (red swollen eyes discharging pus), or other indicators of poor health such as discharges from nose or mouth, wasted or emaciated appearance etc.; and
- Koala location: using a map and/or GPS unit, the location of each Koala should be plotted on a map to gain an overall distribution of Koalas on the site.

Field sampling will be carried out between May and November by a three person team of ecologists experienced in koala faecal pellet identification, koala survey and tree species identification.

¹⁸ Typically 3-5 years following planting.

Data Analysis

Koala Activity

Koala ‘activity’ at each site will be determined by dividing the number of trees with a koala faecal pellet by the number of trees searched in the site (a minimum of 30). Activity thresholds of Phillip and Callaghan (2011) will be used to describe the results of field sites. This threshold allows interpretation of the activity level at each site in order to determine its relative importance to the koala population. The key measures on the east coast are summarized below in **TABLE 1**.

TABLE 1
SUMMARY OF ACTIVITY CATEGORIES AND THEIR INTERPRETATION

Activity Category	Activity Level	Interpretation
Significant activity	$\geq 22.52\%$	Site is regularly used by one or more koalas as part of normal ranging behaviour.
Low activity	0% - 22.51 %	Occasional or transitory use of the site by (for example) dispersing animals not yet displaying established home ranging movement patterns.

The terms “significant activity” and “low activity” are used throughout this report to describe the above scenarios.

Habitat Utilisation / Occupancy rates

Baseline Habitat Utilisation rate will be estimated on the basis of the numbers of sampled field sites in which koala faecal pellets were recorded, while the Baseline Koala Occupancy rate will be the subset of these sites that had koala activity levels > 23%. The first provides a measure of what proportion of available habitat is currently utilised by koalas in any way, the second indicating what proportion of habitat is occupied by resident populations.

A Baseline koala density estimate will be determined by dividing the total number of koalas sighted within the 0.196ha radial assessments or 1 ha transect searches associated with each SAT site, by the total area covered by this assessment process over the sampling period. A population estimate will then be obtained by extrapolating the density estimate over a total habitat area where each SAT site represents the centre of a habitat grid cell of 6.25 ha or, in the case of the Depot Road sites, 1.56ha.

Biennial Koala Monitoring

Introduction

Dr S. Phillips (*pers. comm.* 1 May 2018) has indicated that Koala monitoring should, ideally, be completed on a biennial (every two years) basis (as a responsibility of the Proponent), from the date of commencement of works. Biennial surveys will commence across the Kings Forest site at the commencement of works and continue thereafter until development works across all precincts are completed. If, for commercial or other reasons, the project is stalled for a lengthy period or is finalised prior to the completion of all Precincts then Project 28 (or subsequent owners) will inform the Commonwealth Department of Environment, NSW DoPE,

NSW OEH and Tweed Shire Council in writing advising that monitoring will cease five (5) years (2 monitoring events) after the notification.

Methodology

Background

The methodology for the following components of the biennial monitoring will be as described for the Baseline Monitoring:

1. distribution and levels of koala activity;
2. occupancy rates; and
3. koala population demographics.

Additional monitoring requirements to be completed during the biennial monitoring program are discussed in the following sections.

Koala Habitat Condition Assessment

Habitat assessments will be standardised so that measurable changes over time can be observed.

A 20m x 20m survey plot will be permanently established at each monitoring point discussed above. Habitat monitoring will utilise a standardised proforma to be developed prior to commencement of baseline monitoring. Criteria to be assessed will include the following:

- Tree species composition (including juvenile specimens);
- Proportions of each species;
- General vigour of vegetation (excellent, very good, good, poor, very poor);
- Extent of new growth (percentage cover);
- Age structure of vegetation by species (even age, multi age, senescent, dead); and
- Presence and degree of infestation of potentially damaging weed species (percentage cover of each weed species).

Photo Monitoring

- Monitoring points will also be used as permanent photo stations for photographic monitoring;
- Four (4) photos are to be taken from each photo point to the north, south, east and west;
- Photos should be labelled with:
 - Photo point code;
 - Direction of view; and
 - The date and time.

- Photos must be supplied in the monitoring report in the form of prints no smaller than 4" x 6" and must be colour.

Usage of Underpasses

Sand tray monitoring will be completed to assess the usage of underpasses. Sand tray monitoring will be completed as follows:

- Sand trays will be approximately 2.4 m wide, 1 m long and 5 cm deep trays filled with sand. One (1) tray will be installed at each end of all fauna underpasses, approximately 1 m inside the entrance and covering the entire width of the underpass; and

Sand trays will be monitored every four (4) months for the first two (2) years following installation of the underpass and every six (6) months for the following three (3) years. Each sand trap monitoring event will involve checking for signs of footprints and then brushing smooth each morning over a four (4) day period (by a suitably qualified ecologist). This method is in accordance with that described in AMBS (2012).

Camera traps located in or at koala crossing points (or culverts) may also be utilised in addition to, or instead of, sand trays.

Koala Monitoring After Fire

Koala monitoring will also be completed after any bush fire on the Kings Forest site by a suitably qualified ecologist. This will be completed in accordance with the methodology provided in the sections above to monitor the impacts of fire on the local Koala population.