Our Ref: 18WALK02E

28 November 2018

Walker Corporation Pty Limited
Level 21, Governor Macquarie Tower
1 Farrer Street
SYDNEY NSW 2000

Attention: Mr G Beasley

Dear Gerry

Re: Response to Council on Koala Issues for the Rezoning Proposal at Macquariedale Road, Appin

Travers bushfire & ecology has been requested to provide response to Wollondilly Shire Council email correspondence from Mark Ruddiman (dated 31st October 2018) outlining further matters that need to be addressed on Koala before the rezoning proposal for the above site is able to be sent for finalization.

These matters are provided in italics further below and a response is provided by *Travers bushfire & ecology* for each.

1. A revised Flora and Fauna Report is required which considers the following:

An Ecological Assessment report was prepared by *Travers bushfire & ecology* for the study area dated April 2013. This report has since not been revised however additional target survey and/or reporting on Koala has been undertaken in the interim (as cited directly below). The following additional information has been prepared:

- *Addendum Report to Flora and Fauna Assessment Biodiversity Certification Assessment for Macquariedale Road, Appin* (18 March 2015) – This provided further information relating specifically to Large-footed Myotis, Koala and Rosenberg's Goanna. The Koala response was to clarify survey effort undertaken for biodiversity certification purposes.

- *Koala Survey at Macquariedale Road, Appin* (18 March 2015) – This included target Koala survey in response to community comment as well as a detailed survey of surrounding residents including 6 residents that have lived adjacent to the site for over 30 years. The report also summarized Koala submissions from local residents to council. Although Koala was not recorded by observation or scats during survey, consistent scratches and previous infrequent observations lead us to believe that the site use by Koala was temporary and not core Koala habitat.

- *Addendum Koala Survey Report at Macquariedale Road, Appin* (3 May 2018) – This included updated and detailed target Koala survey following recent records of Koala within the study area collected for the Wollondilly Koala Conservation Project (WKCP). These records included an observation of a female with young to the north of the study area in 2017. The site survey recorded presence of Koala by scats at 3 of the 12 SAT points undertaken and scratches at 11 of these. Scats were not previously recorded in surveys in 2015 (and prior) however scratches were also notably more present (with two survey points undertaken in both years). The Addendum report investigated why

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records may have increased and concluded the study area now formed 'Core Koala Habitat' under the definitions of SEPP 44, thus requiring a Koala Plan of Management.

This addendum Koala report prepared in May 2018 and has been updated with the attached Koala survey report dated November 2018.

- *The significant number of koala sightings in the vicinity of Appin that have occurred since 2014;*

Response: The May 2018 Addendum Report (updated November 2018, is provided as Attachment 1) has provided discussion and mapping of all Bionet records within the study area since 2014. An updated Bionet search was undertaken and there are no new records which have since been identified to the site.

- *The sighting of a pregnant female on the development site which occurred shortly before the public exhibition of the Planning Proposal. This sighting qualifies the site as Core Koala Habitat under the definitions within the current version of SEPP 44.*

Response: The 2018 Addendum Report provides discussion on this record which supports the conclusion of 'Core Koala Habitat' (CKH) under the definitions of SEPP 44.

- *The koala project involving mapping and collaring of koalas that Council commenced participation in 2016 in partnership with OEH and the Australian Conservation Volunteers Trust.*

Response: The Addendum Report recognises the Wollondilly Koala Conservation Project (WKCP) as the recent Atlas records were submitted under this. Lachlan Wilmott and James Dawson (Illawarra Branch, Regional Operations Division, (OEH) were contacted at the time of the May 2018 survey to provide an update of our intended survey procedure and for any further information they deemed necessary. They indicated at this time that they had collected the scat results at two locations from site that contributed two of the four late 2017 Atlas records.

The final boundaries of the E2 Environmental Conservation zone lands will need to be sufficiently ecologically rigorous to ensure adequate connectivity for koala

Response: This comment is focused on maintaining connectivity as part of the conservation lands and assessed in a rigorous scientific manner. If habitat connectivity is maintained, high value foraging habitat is protected and the area of habitat sufficiently supports the existing koala use, the existing E2 conservation zone is justified.

The existing connectivity to the north and south will be maintained by the proposal. Habitat removal in the eastern vegetation extensions as part of the residential zoning will not isolate this remnant, connectivity along the entire north-south passage is unaffected and will not reduce the minimum connective width. Whilst Koalas have occurred within the residential areas of Appin to the east, these urban landscapes would naturally not constitute as adequate connectivity of reliable nature any more than new residential areas.

2. *The Biocertification Report is noted to have a deficit of credits for the koala which in broad terms, means that the impact to koala habitat on the site will be offset through improving koala habitat in another location. Council has some concerns over the ecological outcomes that would be achieved by this approach. The report should be based on updated surveys and may provide ecological grounds to adjust the boundaries of the development footprint and therefore reduce the credit deficit.*

Response: The Biocertification Report was prepared by Eco-Logical as a means of providing an offset for the expected loss in biodiversity values caused by the proposed rezoning and to identify adequate offset areas that would result in a maintain and improve outcome using the Biodiversity Certification Assessment Method (BCAM). This is an acceptable methodology under NSW legislation now covered under transitional arrangements of the BC Act 2016.

The BCAM method recognises that all suitable habitat for fauna is considered in the offset calculations and does not distinguish between higher and lower value foraging landscapes.

Travers bushfire & ecology have demonstrated that the Forest Red Gum habitat within the proposed residential areas does not provide 'important' habitat for Koalas utilising the site. This is based on our observations and data collected to date as provided in the attached addendum survey report (November 2018).

In this case, the deficit of habitat on site, which may in fact be made up of a community providing little value to support on site use, will be offset at a ratio to conserve a higher extent of this community at the offset site. The calculated offset for CWP containing Forest Red Gum is at 3.4:1. The offset ratio for SSTF containing Grey Gum (which is suspected of preference by the local Koala population) is greater at 4.4:1.

Therefore, the calculated loss on site should not be automatically recognized as a direct comparison of reduced site potential. Given that Koala has been recently recorded at the offset site by the Wollondilly Koala Conservation Project (on Bionet from 20/4/16 recorded from scratches on a large Grey Gum) then the proposal will not result in a deficit but rather conserve usable Koala habitat for the local population. The offset site has been equally mapped by OEH as a Secondary koala corridor and it will increase the area of land conserved for Koala habitat.

Council has also reviewed your advice dated 11 October, 2018 on the matter which advises that "there was evidence of koala occupation (scratches and scats). This evidence was largely within areas being proposed to be rezoned as E2 Conservation as a result if these observations and the recent Bio Net records we would suggest that a local Koala Plan of management would be needed as part of any future subdivision DA". Council is of the view that of the view that the response does not adequately address the issue surrounding koala habitat on the site based on the following:

- *The area has been identified by OEH as a Secondary koala corridor.*

Response: Primary Koala corridors mapped by OEH appear to be based off large areas of connectivity where numerous historical Koala records have been obtained and major connective forest habitat exists between these (eg east of Appin Road). Alternatively, the secondary habitat areas display only isolated Koala records in more fragmented landscapes where suitable habitat exists. Secondary Koala corridors are thus not fundamental in supporting the local population, but rather provide a contribution to maintain connectivity values where Koalas may move across the local landscape and where such population may support individuals.

It is recognised that the study area provides secondary corridor benefits to the local Koala population. We believe that such values will be maintained by the proposal and thus will remain as secondary corridor habitat. As stated above, the proposed rezoning layout supports continued use of this as a corridor. Furthermore, the corridor area providing this connectivity in perpetuity covers the habitat type that we feel is most suitable for Koala and will continue to support the lifecycle requirements for the individuals that currently utilize this habitat (likely not more than 2 individuals).

- *In December 2017 there was a confirmed sighting of a female koala with back young within 200m of Area 3, Figure 1. Is this koala still present on site? What is its range?*

  Response: The Addendum Report (Attachment 1) recognises the presence of this female however she was not observed during our further surveys. Our central-northern SAT site placed close to the female's recorded location did record activity by scats in March 2018. The Addendum report discusses that two separate areas of activity were recorded present at this time perhaps suggesting up to two individuals (one to the north and one to the south). The one to the north may therefore be this female. Scratches on older bark between these two activity areas suggest that Koala has also occupied areas of Grey Gum on site outside of the current recorded activity areas. Based on applying the SAT activity method (*Phillips & Callaghan* 2008) most of the site is transitory habitat. The south-western corner only is confirmed as a high use area.

  The report states the anticipated home range of local females (approx. 50 ha) and males (100 ha). In the locality this is of low carrying capacity by comparison to other populations due to the low fertility of soils, which subsequently contributes to the difficulty in detecting individuals. Koalas in northern NSW occupy smaller home ranges on higher fertility soils.

  This would suggest that the connective habitat including the study area west of Appin (to a total of approx. 150ha) would support no more than one male and two females, with overlapping home-ranges between sexes.

- *The green and turquoise areas on Figure 3 are higher quality koala habitat due to the presence of the primary food trees of Grey Box and Forest Red Gum on higher fertility soils, the purple areas contain Grey Gum on lower fertility soils. It is well known that koalas have a preference for food tree on soils with a higher clay content. The soil fertility degrades heading west from the proposed development sites to the proposed biobanking site.*

  Response: We refer to Figure 3 of the Macarthur Koala Corridors Maps prepared by OEH. The turquoise areas are Primary habitat and the green is Priority Restoration Habitat (generally adjacent to primary habitat). The green mapped areas of local Koala habitation actually do not represent Grey Box and Forest Red Gum on higher fertility soils.

  These areas are more so represented by shale-sandstone transitioning soils towards gully forests which support Grey Gum. Such soils which are lower fertility soils are well known to provide the fundamental habitat to support the local population. But it appears that the local Koala population will utilise Forest Red Gum in some areas but not to the same extent as Grey Gum.

  Elsewhere in the state and in the species Recovery Plan, Forest Red Gum is identified as a primary feed tree and Grey Gum as a Secondary feed tree, yet this is not demonstrated in the local Koala population. Furthermore, the Recovery Plan (DECC 2008) does acknowledge that Forest Red Gum is used as primary food tree when on nutrient rich soils but not when on nutrient deficient soils (Phillips 2000b). Both tree species are considered as equivalent feed trees under Schedule 2 of SEPP 44. Grey Box alternatively is not listed as a feed tree under SEPP 44 and is equivalent to Grey Gum as a Secondary Food Tree in the Recovery Plan for the NSW Central Coast Management Area (Newcastle to Wollongong).

  A scientific paper prepared by Koala experts *Stephen Phillips and John Callaghan* (2000) specifically established that Grey Gum (*Eucalyptus punctata*) and Blue-leaved Stringybark (*E. agglomerata*) when growing on shale-based substrates were most

preferred by koalas in the Campbelltown area, south-west of Sydney. As typical of Koalas and indicated in their Recovery Plan, where Koalas occur on lower fertility soils and where they are supported more so by secondary feed trees, they will occupy the habitat in a lower carrying capacity, thus they occur at lower density and are more difficult to detect.

The Grey Gums that occur within the study area occupy such shale transitioning soils which moderate into the higher sandstone influences closest to the creek. The southern recordings of Koala in the site recorded scats right up to the edge of the creek which is higher sandstone influence and lowest fertility point of the SSTF community on site. A recent transect at this location found scats consistently from the most eastern Grey Gums right across to the creek.

The population studied by *Phillips and Callaghan* is part of the same population that extends south of the Campbelltown LGA to Appin and including the study area. Our initial observations within the study area from recorded scats and scratches in March 2018 suggested similar Grey Gum and Stringybark preferences. The scratches observed on Grey Gums appeared absent on Forest Red Gum trees.

From this we have recently completed a detailed search of all 791 Forest Red Gum trees (>10cm DBH) within the subject site east of the proposed bypass for signs of use by scratches in November 2018. The complete details of methodology and results of this survey are provided in the Addendum report provided in Attachment 1.

In summary, only 9 (1.1%) Forest Red Gum trees in R2 areas displayed scratches consistent with Koala and only 2 of these showed high reuse scratches. Whilst it is noted that Forest Red Gum lose their bark, Koala scratches are deep and can normally be picked up if the trees have been used to any significant extent over the last year. No trees with scratches or any FRG tree located within the proposed development areas to date have had Koala scats located at the base. This includes the previous four SATs undertaken in March 2018 within (or on the edge of) development areas.

The November 2018 surveys have therefore demonstrated that Forest Red Gum communities located on higher shale (clay influence) soils of SSTF and CPW within the proposed R2 Low Density Residential areas do not provide current important feed tree or use habitat for Koala(s) utilising the study area. Whilst this habitat may still be viewed as a supplementary feeding opportunity, the lack of use recorded suggest that retention of Forest Red Gum is not warranted.

Only 1 of the 206 inspected Forest Red Gum trees outside of the proposed R2 areas was found to have 3 Koala scats at the base (located to the south of Gordon Lewis Oval). This was the only tree with scats in two overlapping SATs (60 trees) undertaken at this location indicating ‘low’ use which is likely to be transitory.

Alternatively, areas containing Grey Gum habitat (and in likely combination with other tree species such as Stringybark trees in the Grey Gum associated communities) demonstrated to support high Koala activity within the site. High use (or core activity) habitat containing Grey Gum is confirmed in the far south-western corner of the site. Based on SAT and transect results thus far, it is possible that this is the only current high use area and remaining Grey Gum areas are transitory habitat as well.

The paper by *Phillips and Callaghan* (2000) also indicates that a trend for use of larger Grey Gums was apparent in the Campbelltown population observations. This was also found to be the case within the study area which we may demonstrate in our current data given that we have recorded tree DBH for all trees in our SAT’s.

- *From a fauna and particularly a koala perspective the Elladale road site does not appear to be connected to the biocertification area and therefore does not provide a functional connected habitat corridor.*

  Response: The Elladale Road offset site is also mapped as Secondary habitat on the Macarthur Koala Corridors Maps prepared by OEH, and therefore holds an equivalent value as a similar corridor value as the Maquariedale Road site. The area between has also not been mapped by OEH as a priority restoration area therefore linkage between the two is not recognised as priority in terms of value to the overall population.

  Having said this the two vegetated areas are separated by a single main gap of no more than 680m across a cleared rural landscape. This passage would be an easy passage for a dispersing Koala and far less impeded than through the Appin township on the other side to the east of the site to get to Primary habitat.

  There is also a record of Koala from the Elladale offset site in 2016 from scratches on a large Grey Gum by the Wollondilly Koala Conservation Project. This record obviously confirms use of the offset site by Koala but more notably by an individual that would be recognised as being part of the same population. The Koala, if resident, demonstrates the value of the offset in terms of core habitat but if it is only a temporary individual, this additionally demonstrates that the offset is also accessible to the local population across the rural landscapes.

The information above addressing the koala habitat should be provided in particular to clarify the following matters:

1. *Confirm that the E2 Environmental Conservation Zone boundary is in the most suitable location;*

   Response: The E2 Environmental Conservation Zone is based on the residual area to the east of the proposed Appin bypass. The determination of this extent of the development and conservation area is logical from a planning perspective.

   When considered however on its own merit we feel that based on the information above and findings to date we would currently support the location of the E2 zone with respect to maintaining important Koala habitat for existing and future individuals. We feel that the extent of residual habitat identified for conservation not only supports the preferred habitat but also to an extent that will sustain the current individuals and carrying capacity, whilst also not diminishing existing connective values.

2. *Confirm that the land identified for conservation, and the land identified to be removed through the biodiversity certification process is accurate and accurately reflects the constraints and areas of core koala habitat across the site.*

   Response:

   The Attachment 1 addendum survey report provides a detailed account of survey methodology and results undertaken to date. Survey results indicate that the identified development and conservation areas are most suitable for retaining high use and transitory habitat. This includes the comparative analysis of scratches between 2015 and 2018 which indicates more recent activity levels and most notably the confirmed high use core habitat area in the south-west. This also includes a detailed search for activity on all Forest Red Gum trees in the development areas.

   The classification of core Koala habitat is a trigger for the preparation of a KPoM. Based on the updated survey results in 2018 as provided it indicates that the existing land for conservation protects the priority quality Koala habitat within the conservation

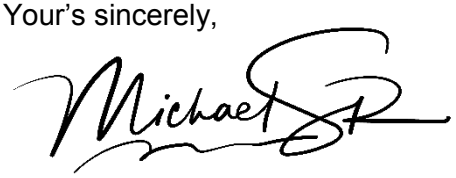
area based on its foraging value and provides sufficient area and connective width to support the existing individuals using the conservation lands.

Concluding comments

Travers bushfire & ecology agrees that the site has sufficient Koala use to be classed as Core Koala Habitat as a result of activity levels within the site. A Koala Plan of Management (KPoM) is therefore required for the study area under the provisions of *SEPP 44 - Koala Habitat Protection* before development consent can be granted for a subdivision application. The koala plan of management can result in a proactive conservation outcome for the site through the implementation of Koala management strategies.

Travers bushfire & ecology is also satisfied that the Forest Red Gum communities located within the proposed R2 Low Density Residential areas do not provide important habitat for Koala(s) utilising the study area. Based on observations to date and also on the extent of retained Grey Gum habitat proposed in conservation areas we feel that the proposed rezoning areas are appropriate to maintain existing important Koala habitat. This habitat will be retained to the extent that will not likely cause a significant reduction in the existing Koala carrying capacity.

Your's sincerely,



Michael Sheather-Reid | *Managing Director*
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ADDENDUM KOALA SURVEY REPORT AT MACQUARIEDALE ROAD, APPIN (November 2018)

Background

The site area to which previous ecological surveys were undertaken includes Lot 201 DP 749272, Lot 1 DP 209779, Lot 2 DP 558807 and Lot 1 DP 1000355 located immediately west of the existing Appin township. These combined lots are referred to as the 'study area'. The following mapping is provided:

Figure 1 – Denotes Koala records surrounding the study area (Source: *Bionet* 2018)
Figure 2 – An example of local male and female home ranges
Figure 3 – Provides the Koala survey effort and result to date

Figure 3 shows the proposed development areas which includes the planning proposal area and the Appin north-south bypass road through the study. The residential portion of planning proposal area study to the east of the proposed bypass is subject to proposed R2 Low Density Residential rezoning with associated APZ's and these areas are referred to as the 'subject site'. The remaining western portions of the site area are proposed for Environmental Conservation as part of a biodiversity offsets strategy.

Figure 3 also depicts identified vegetation communities throughout the site area and survey effort undertaken relevant to Koala to date.

Fauna Survey history

Travers bushfire & ecology initially undertook fauna survey across the planning proposal area in November 2012. Eleven (11) threatened fauna species were recorded within the site area at this time, not including Koala. This survey incorporated searches of all trees for the presence of large hollows and other significant habitat features which contributed to Koala search effort, as well as general nocturnal survey including spotlighting and Koala call-playback methods. Additional targeted owl survey in 2015 also included additional nocturnal effort.

A well-known Koala population is located along the Georges River to the east of the Appin township and extending north through St Helens Park to Kentlyn. This population has been studied for over 25 years by Dr Robert Close from the University of Western Sydney. Wollondilly Shire Council previously requested comment from Dr Close who indicated in 2015 that he did not have any records from the study area and he stated then that his "feeling is that the area would be a transit area rather than breeding site". Records provided by Dr Close are provided as an insert on Figure 3.

Target survey for Koala was undertaken in 2015 in adjacent connective open forest, particularly to the south, and the total area covered during these Koala surveys are referred to as the 'Koala study area' (also shown on Figure 3).

This survey was undertaken by *Travers Bushfire & Ecology* in response to an additional record to the south by local Koala expert Dr Robert Close as well as submissions by local residents. Most local submissions of Koala at this time were from the well-known habitat area east of Appin Road.

One submission (*Submission 70*) indicated that a Koala was seen in the area of the Appin AIS sports ground (Gordon Lewis Oval) to the direct east of the study area. Submission 70 prompted a SAT point to be undertaken in Forest Red Gum on either side of the oval (see

Figure 3 for location). No Koala scats were recorded and furthermore no scratches consistent with Koala were observed on these smooth-barked trees.

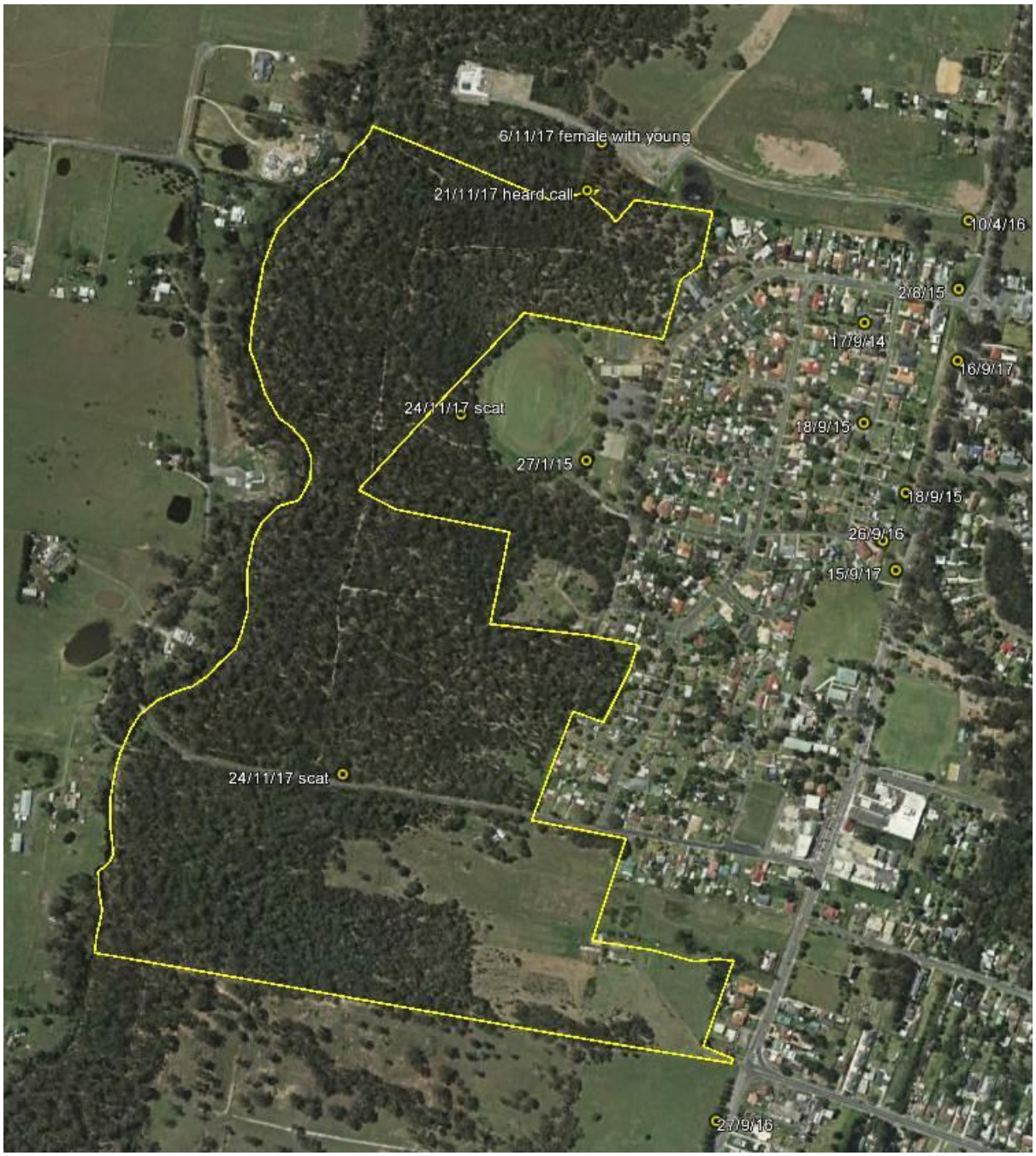

Figure 1 - Koala records west of Appin Road (*Bionet* 2018)

Koala survey undertaken in 2015 included a total of six (6) Koala Spot Assessment Technique (SAT) survey points within the study area, one (1) additional SAT to the north, two (2) further SAT's to the south, additional call-playback stations and spotlighting throughout the Koala study area. This was supported with a survey of residents living immediately adjacent to the bushland portions of the site area (as well as the Dr Close K14 record to the south) requesting information on any past Koala sightings.

This survey recognised the suitability of habitat within the study area for Koala as well as previous use based on comments from residents living around the perimeter of the site. Most long-standing local residents, many up to 30 years, knew or had seen Koalas from the well-known population area occurring on the eastern side of Appin Road. Only two residents however reported previous Koala activity in the study area itself.

The scat searches (SATs), call-playback and spotlighting undertaken within the study area in 2015 did not record any Koala activity at that time. Scratches consistent with Koala on old bark plates of Grey Gum suggesting current or previous activity was noted. The Common Brushtail Possum (*Trichosurus vulpecula*) was recorded by several individuals and Lace Monitor (*Varanus varius*) was also recorded, scratches from these species may be consistent with Koala. Based on community and target survey results the previous assessment concluded that use of the study area was likely periodic and transitory.

More recent Koala records from November 2017 for the Wollondilly Koala Conservation Project (WKCP) included a female with young as well as a calling male to the immediate north of the study area as well as scats collected from two locations within and immediately adjacent to the study area a few days later. These records, as well as all *Bionet* (2018) records west of Appin Road, are depicted on Figure 1.

Updated survey 2018 by Travers bushfire & ecology

Methods - March 2018

Based on the 2017 records, target Koala survey was undertaken in March 2018 to review the current extents of use and activity levels within the site. Diurnal survey during fine weather was undertaken on the 7th, 8th, 14th & 15 March 2018 and included scat searches using the SAT technique. Nocturnal survey was undertaken on the 7th & 14th March 2018 and included spotlighting and call-playback.

Spot Assessment Technique (SAT) (*Phillips & Callaghan* 2008[1]) is a survey measure of Koala 'activity' for the Australian Koala Foundation. It involves the selection of 30 trees with a DBH (diameter at Breast Height) of 10cm+ from a central tree of significance to Koala. This tree may be a recorded use tree (observed or pellets) but may also be a tree species of known food value to Koala. Activity levels are calculated from the proportion of trees showing signs of Koala use as indicated by the presence of scats as well as consideration to site location along the Australian east coast. An analysis of other secondary signs of presence (specifically pock marks and scratches on smooth-barked trees) was also undertaken.

A 250m grid survey including eleven (11) SAT points within the study area was undertaken consistent with methods advised by Koala expert Dr Steve Phillips (author of the SAT method). This primary grid has been aligned to allow a resurvey of three previous SATs, all of which are closest to the recent recordings, to allow for a comparison to 2015 notes on tree scratches.

Nocturnal survey included quiet listening during and after dusk for calling males advertising their territory. Following this, call-playback techniques were deployed supported by spotlighting along trails and forest edges throughout the Koala study area.

Call-playback involves broadcasting recorded male Koala calls through a 15 watt Toa amplifier to evoke a response from males in the locality. Sometimes males will respond to the presence of another male either vocally or they will move into close range of the rival (the emitting speaker). Recent studies by *Ellis et al* (2011[2]) also indicate that male vocal signals function more to attract females than repel males.

Therefore calls are emitted for 5 minutes and followed by quiet listening and spotlighting for half an hour surrounding each point. The loud bellowing Koala calls can be heard several

[1] Phillips, S. & Callaghan, J. (2008) The *Spot Assessment Technique*: a tool for determining levels of localised habitat use by Koalas *Phascolartos cinereus*. Australian Koala Foundation. Australian Zoologist, Volume 35 (3) **p774-780**.

[2] Ellis, W. A. H., Bercovitch, F. B., FitzGibbon, S., Roe, P., Wimmer, J., Melzer, A. and Wilson, R. (2011). Koala bellows and their association with the spatial dynamics of free-ranging koalas. Behav. Ecol. 22, 372-377.

hundred meters away on a still night such that the Survey Guidelines (DECC 2004[3]) indicates only 2 call-playback sites are required on a survey night per stratification unit up to 200 hectares in size.

Nocturnal survey incorporating spotlighting and call playback was undertaken for a total 6 hours, 55 minutes over two nights after dusk. Spotlighting transects and call-playback locations from recent 2017 as well as previous 2015, 2012 and 2013 surveys are shown on Figure 3.

Results – March 2018

No Koalas were recorded by direct observation during the 2018 updated diurnal or nocturnal survey. This is typical of Koala populations where the density of Koalas is low or transient within the site or may not be resident all year round.

Scats

Koala was recorded by scats confirmed at three (3) of the SAT survey points. The locations of these are indicated with a K(s) on Figure 3.

The central-northern SAT1 (close to recent sightings) provided a 6.6% activity rating which falls in the 'low' activity level in the low population density east coast area. The central-south SAT12 provided a 10% activity rating which falls in the 'medium' (or normal use) activity level and the south-western SAT10 provided a 16% activity rating which falls in the 'high' activity level. 25 scats were found below a branch fork in a Grey Gum within SAT10 however no scats were found in the search area surrounding the trunk of this tree, therefore these scats did not contribute to the calculated high activity. The inclusion of these scats would not change the activity level for this SAT.

Phillips & Callaghan (2008) indicate that "where the results of a SAT site returns an activity level within the low use range, the level of use by *P. cinereus* is likely to be transitory. Conversely, where a given SAT site returns an activity level within the prescribed range for medium (normal) to high use - the level of use is indicative of more sedentary ranging patterns and is thus within an area of major activity".

Scats that were slightly aged / decomposed or in close size / shape but considered not to be Koala were sent to Dr Steve Phillips for confirmation. These results did not alter the activity levels.

Following the recorded activity at SAT's 10 & 12, a search of activity within the proposed adjacent development area to the east was undertaken. This was preliminary survey to determine the importance of the development areas. The search area is indicated as a lighter grey cross-hatching on Figure 3. This included searches for scratches on all smooth-barked Forest Red Gum trees >10cm DBH (diameter at breast height). No other smooth-barked tree species occurred in this search area and Forest Red Gum also represented the only primary Koala feed tree in this area.

Of the 417 Forest Red Gum trees checked only 5 had scratches. Scratches were discrete and old and not conclusively Koala on three of these trees along the narrow southern boundary strip of vegetation. The two other trees however, both very large and mature trees, showed high use Koala scratch marks (locations shown on Figure 3). Neither of these two trees however had koala scats around the base.

[3] DEC (2004) *Threatened Species Survey and Assessment: Guidelines for developments and activities (working draft),* New South Wales Department of Environment and Conservation, Hurstville, NSW.

Comparison of scratch results

SAT surveys undertaken in 2015 represented at nine locations (6 in the study area) did not record any Koala activity from scats. Scratches were however noted on smooth-barked trees at this time. These were generally on Grey Gums within the three SAT's containing Grey Gum as the dominant trees. Only SAT 5 recorded scratches on the majority of Grey Gum trees observed. The scratches were not confirmed to be Koala as many were also consistent with Common Brushtail Possum and Lace Monitor.

Comparison of locations where SAT's were undertaken in both 2015 and 2018:

- In the 2015 SAT1, **4** of the 13 (31%) Grey Gums sampled showed scratch marks. In 2018 SAT4 was at this same location where **8** out of 25 (32%) Grey Gums sampled showed scratch marks.

- In the 2015 SAT2, **2** of the 9 (22%) Grey Gums sampled showed scratch marks. In 2018 SAT1 was at this same location where **5** out of 10 (50%) Grey Gums sampled showed scratch marks.

- In the 2015 SAT5, **8** of the 17 (47%) Grey Gums sampled showed scratch marks. In 2018 SAT6 was at this same location where **10** out of 16 (62%) Grey Gums sampled showed scratch marks.

Comparison of remaining SAT's:

- In 2015 scratches on smooth-barked trees were recorded on:
  - **0** of the 28 Forest Red Gum in SAT3,
  - **0** of the 18 Forest Red Gum and **0** of the 2 Grey Gum in SAT4,
  - **0** of the 17 Forest Red Gum and **1** on the only Grey Gum in SAT6,
  - **2** (20%) of the 10 Grey Gum in SAT7,
  - **0** of the 17 Grey Gum in SAT8, and
  - **3** (19%) of the 16 Grey Gum in SAT9

- In 2018 scratches on smooth-barked trees were recorded on:
  - **5** (38%) of the 13 Grey Gum and **0** of the only Forest Red Gum in SAT2,
  - **5** (71%) of the 7 Grey Gum in SAT3,
  - **9** (38%) of the 24 Grey Gum in SAT5,
  - **11** (52%) of the 21 Grey Gum in SAT7,
  - **0** of the 10 Forest Red Gum and **3** (38%) of the 8 Grey Gum in SAT8,
  - **13** (59%) of the 22 Grey Gum in SAT9,
  - **8** (100%) of the 8 Grey Gum in SAT10,
  - **0** of the 26 Forest Red Gum in SAT11, and
  - **5** (56%) of the 9 Grey Gum in SAT12,

Analysis of results

Whilst scratches recorded in 5 of the 9 SAT's undertaken in 2015 may have been from active Koalas present at this time, no scats were recorded in any of these 9 SATs undertaken.

By comparison 11 of the 12 SAT's undertaken in 2018 recorded scratch marks. Three of these 12 SAT's undertaken recorded Koala scats. Furthermore, a higher percentage of smooth-barked trees showed the presence of scratches in 2018. This includes the three SAT locations that were undertaken in both years.

It is also apparent that scratches have been observed in significantly higher representation on Grey Gum by comparison to Forest Red Gum. This may be contributed to bark plates being retained for up to 4 years on Grey Gum whilst Forest Red Gum tends to shed the entire bark area each year.

Methods - November 2018

Given the survey findings from March 2018 suggesting Forest Red Gum was not being utilized as a feed tree within the site, further survey was undertaken in November 2018 to investigate this in detail. Diurnal survey during fine weather was undertaken on the 19th, 20th, & 21 November 2018 and included checking all remaining Forest Red Gum trees within the site and adjacent areas to the east of the proposed bypass for signs of use by Koala. Where any scats were found SATs were undertaken at these locations to determine activity levels. Two transects checking activity at Grey Gums at previous recorded locations was also undertaken for comparison of scratches and scats.

Forest Red Gum Activity Searches: All Forest Red Gum trees >10cm DBH within the site and other adjacent areas to the east of the proposed bypass road were checked for Koala activity. Although scat searches are a more reliable method to determine presence and activity levels (as other fauna also create similar scratches on the trees) such scat searches are time consuming if implemented for 3 minutes at all trees and therefore were only undertaken at trees where scratch marks were present. This method of Koala presence survey has been confirmed by Dr Stephen Phillips in personal discussion as being an appropriate more rapid approach.

The search areas included the vegetation communities mapped on Figure 3 containing Forest Red Gum which are depicted as 'light green' for Forest Red Gum Forest / Woodland (Cumberland Plain Woodland EEC) and 'yellow' for Forest Red Gum / Ironbark Forest (Shale-sandstone Transition Forest EEC low sandstone influence). The recent survey found that Forest Red Gum extended further than previously mapped in the middle subject site and less for the patch in council lands south of Gordon Lewis Oval. Therefore the boundary of these areas were remapped. Other very large free standing Forest Red Gum around the eastern edges of this oval and available to Koala were also included in the search area. Search areas within the proposed R2 areas are shown as an opposite direction cross-hatching to areas outside R2 areas on Figure 3.

The data collected within each search area included the following counts:

- Forest Red Gum trees (>10cm DBH),
- The number of these trees with scratches consistent with Koala,
- The number of these trees with scratches indicating likely 'reuse' (more than a single climb), as well as 'high use'. These are depicted as red or black dots respectively on Figure 3. and
- A count of trees with scratches that also have Koala scats at the base confirming use.

In any of the search areas a SAT was undertaken where Koala scats were found to determine activity levels according to *Phillips & Callaghan* (2008). Scats were found below one Forest Red Gum tree in the council lands to the south of Gordon Lewis Oval. A SAT (No.13) undertaken at this location made sure that all available Forest Red Gum in this patch were counted in the SAT. This amounted to 24 trees (>10cm DBH), the remaining 6 trees selected to complete the SAT were trees that were not Grey Gum.

For a direct comparison at this location a second SAT (No.14) was undertaken counting the nearest 24 Grey Gum trees and then 6 additional trees species. Whilst the SAT technique is not intended to be selective, all 60 trees in both SATs could be included as a combined two SATs then averaged to determine actual non tree species bias activity levels.

Grey Gum Activity Searches: An additional search for activity was undertaken within Grey Gum habitat of known Koala activity for comparison. This involved using similar scratch then scat search methods (mentioned above) on Grey Gums but along a transect until 30 trees

were checked. Transects were run east-west and placed at the two recorded activity locations from March 2018. This transect ran for approximately 225m at both locations.

In the north, the transect was centered on the SAT1 which previously recorded low activity in March. In the south, the transect commenced at SAT12 which recorded moderate activity and finished at SAT10 which recorded high activity in March. This southern transect almost accounted for the entire gradient of communities containing Grey Gum from the higher (more fertile SSTF) areas in the east down to the edge of the creek in the west.

Results - November 2018

Forest Red Gum

Of the 791 FRG trees located in proposed R2 areas only 9 (1.1%) displayed scratches consistent with Koala. Five (5) of these showed 'reuse' scratches and only 2 showed 'high use' scratches. No trees with scratches or any FRG tree located within the proposed development areas to date have had Koala scats located at the base. This includes the previous four SATs undertaken in March 2018 within (or on the edge of) development areas.

Of the 206 FRG trees searched outside of the proposed R2 areas, 1 tree located to the south of Gordon Lewis Oval was found to have 3 Koala scats at the base. This tree was relatively small showing only single use. There were other FRG trees immediately surrounding this tree with scratches also consistent with Koala with 4 of these showing reuse scratches and one showing high use scratches. This tree was difficult to identify and may have been a Grey Gum (capsules of both at the base). Of note, Forest Red Gum trees observed in the ecotone between the two separate communities sometimes appeared to be in poor condition and this tree was counted as such.

The SAT undertaken at the recorded scat location did not record any other scats below the remaining Forest Red Gum trees or additional 6 trees selected to complete the SAT. The overlapping SAT selecting Grey Gum trees and 6 additional trees did not record any scats. Therefore the activity level where the scat was recorded is 'low' use according to *Phillips & Callaghan* (2008) and use by Koala is likely to be transitory. Nine (9) of the 24 Forest Red Gum trees showed scratch marks and 19 of the 24 nearby Grey Gum trees showed scratch marks.

Grey Gum

Along both of the transects, where previous Koala use was recorded in March, 24 of the 30 trees checked showed scratch marks. These scratches were more confidently identified as Koala. The northern transect, where use was 'low' and transitory in March, did not record any Koala scats below the 30 trees checked. The southern transect (where use was 'medium' and 'high' in March) recorded Koala scats below 13 of the trees checked. This confirmed the previous activity results and most notably the current importance of the south-western corner of the site for core Koala habitat use.

Discussion

State Environmental Planning Policy 44 – Koala Habitat Protection defines 'Core Koala Habitat' (CKH) as *"an area of land with a resident population of Koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population"*. Under this definition and based on the recent residents' observations of a female with young and a calling male to the north (both in November 2017) combined with scat survey confirming current presence, it may be concluded that the study area satisfies the definition of Core Koala Habitat under SEPP 44.

Travers Bushfire & Ecology concluded that the study area did not satisfy these definitions after target survey in 2015. It is difficult to determine if Koalas were in fact resident within the study area the whole time (and recent decades) or if the area was previously transitory and more recently colonised by one (or more) individual. The suitability of habitat present was noted in 2015 and that Koala had been previously recorded within the site. Based on the absence of scats however, or any direct observation, it was concluded then that use of the study area was likely periodic and transitory. This was also supported from notes provided by local expert Dr Close.

It is recognised that local habitat supports the Georges River Koala population(s) in very low carrying capacity, such that they can be difficult to locate during spotlighting surveys. Females occupy a home range of approximately 50ha and males up to 100 ha in this area. This would suggest that the total connective habitat including the study area immediately west of Appin would support no more than one male and two females, with overlapping home-ranges between sexes. This may suggest why a single individual was not recorded by scats or observation in the 2015 survey but two or more Koalas present at this time would unlikely be missed. An example of home range sizes for a male (black) and female (blue) in respect to the site is depicted in Figure 2.

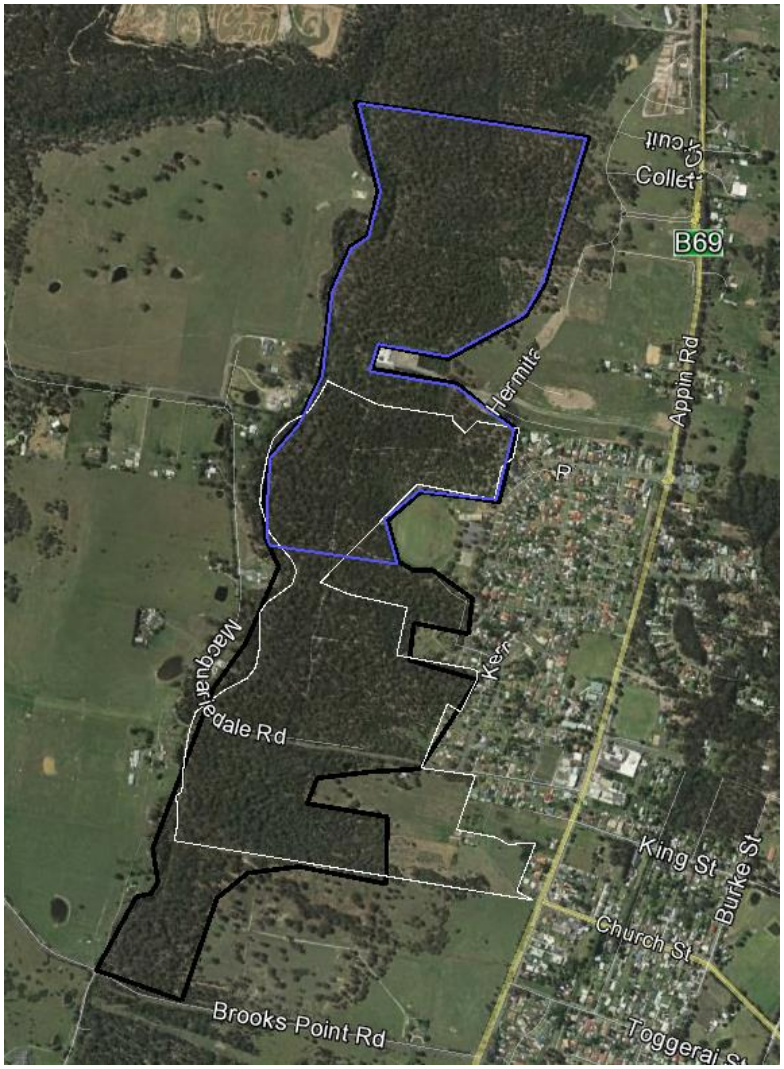

Figure 2 – An example of local male and female home ranges
(Note: this map is indicative of home range size only and not a predicted or apparent range)

The potential that Koala has increased its site dependence in the last three years is also plausible given responses provided in the survey of residents living on the edge of bushland surrounding the study area in 2015 as well as the comparison of scratch mark activity on Grey Gums between 2015 and 2018.

Historically there is no doubt that the site would at least occasionally have been used by transient individuals (particularly dispersing young males) from the well-known population east of Appin, particularly prior to recent development to the north which has now reduced this potential. Although Koala still has not been directly observed during survey, recent observations by local residents including a calling male as well as a female with young indicate the combined habitat west of Appin has home range value for at least two individuals. This may also explain the separation of recorded fresh scat locations between the north and south during the March 2018 surveys. A calling male and a female with young would also now recognize the connective forest habitat incorporating the site as Koala breeding habitat.

The question is raised, does the three proposed R2 Low Density Residential areas located to the east of the proposed bypass road contain important habitat for Koala such that site presence, use and current behavior, could be significantly impacted? The most notable feature of the proposed rezoning is that the R2 areas will remove the majority of Forest Red Gum habitat communities available which has been given high value to Koala elsewhere in the state.

In fact, the Recovery Plan for Koala breaks down the state into broad management areas and goes into detail to identify primary, secondary and supplementary food tree species within each area. Of the tree species recorded within the study area Forest Red Gum (FRG) is the only primary food tree identified by the plan. The recorded Grey Gum and Red Mahogany are secondary food trees and Thin-leaved Stringybark and Narrow-leaved Stringybark are supplementary species.

The November 2018 surveys were undertaken to determine the value of Forest Red Gum to Koala on site by evidence of activity. This was undertaken given that previous SAT surveys in the Forest Red Gum communities did not record any Koala activity (including old scratches) and detailed searches of all Forest Red Gum trees south of Macquariedale Road (where the highest level of Koala activity on site was recorded in Grey Gum habitat) found very few trees with scratches. As Forest Red Gum is a smooth-barked tree the November 2018 survey completed checks of all remaining Forest Red Gum trees (>10cm DBH) east of the proposed bypass road and accessible to Koala.

Within the proposed R2 areas very few FRG trees had scratches consistent with Koala and no scats have been recorded. The November 2018 surveys have therefore demonstrated that Forest Red Gum communities located within the proposed R2 Low Density Residential areas do not provide current important feed tree or use habitat for Koala(s) utilizing the study area. Whilst this habitat may still be viewed as a supplementary feeding opportunity, the lack of use recorded suggest that protection of the Forest Red Gum is not warranted for Koalas.

Whilst one FRG tree outside of the proposed R2 areas (located to the south of Gordon Lewis Oval) was found to have Koala scats at the base, SAT results in this location indicate 'low' use which is likely to be transitory. The Common Brushtail Possum also contributed to scratch counts at this location, therefore activity here is best gauged by the SAT method alone.

Alternatively, some areas containing Grey Gum habitat in likely combination with other tree species in the Grey Gum associated communities, are demonstrated to support high Koala activity within the site. The specific areas of important high use or core activity habitat containing Grey Gum has not been detailed throughout the site but such important habitat is confirmed in the far south-western corner. Based on SAT and transect results thus far it is possible that this is the only current high use area and remaining Grey Gum areas are transitory.

Survey Deficiency

The Grey Gum community is also present within residual portions of two out of the three proposed R2 areas. Similar detailed investigations of Koala activity within these areas have not been undertaken to date however this area represents only 3.83 ha (9.4%) of the total 40.81 ha Grey Gum Forest available within the site. The nearest 3 SATs to these two areas undertaken in March 2018 were placed partially within and accounted for some R2 area trees. All 3 of these SATs recorded old scratches on Grey Gum (5 in SAT2, 9 in SAT7 & 3 in SAT8) but no scats. Ideally a finer search grid is applied around SAT locations where there is recorded activity by scats to determine the finer activity area (pers com Stephen Phillips). In this case only the northern portions of the subject site would require further survey. Such survey is not considered to be warranted to determine impacts based on current records of low activity in the north and the total extent of usable habitat.

The presence of Common Brushtail Possum also in the area south of Gordon Lewis Oval (two individuals recorded by spotlight in March and scats below several trees during November searches) highlights the difficulty in identifying differences where scratches are found. Given the low number of scratches on Forest Red Gum elsewhere in the site this separation was not necessary. The searches for scratches proved more effective to determine areas where there has been no recent activity.

Also it is recognised that a greater bias of scratch results is likely on Grey Gums given that plates of bark are retained for about 3-4 years whereas Forest Red Gum sheds its entire bark each year. Therefore, Grey Gum trees are more likely to show use by scratches for longer and are more likely to be counted. Larger Forest Red Gum trees do retain a sock of old bark at the base. Besides this overall bias on scratch counts, the search for scratches on all Forest Red Gum trees remains effective to determine trees not used over approximately the last year. The presence of scratches was also a means to prompt further searches for scats. In this case the methods proved effective as an indicator of use in its own right.

Conclusion

As the land is now considered to comprise ‘Core Koala Habitat’ under the provisions of *SEPP 44 - Koala Habitat Protection,* a Koala Plan of Management (KPoM) is required for the study area before development consent can be granted for a subdivision application. The Plan of Management is to comply with Part 3 of SEPP 44 which requires consultation and approval from the Director General of NPWS (now Chief Executive of OEH) and approval from Council.

The KPoM would need to address issues such as connectivity, fencing, dog control, and restoration of primary and secondary feed tree species. We advise that this KPoM is prepared for subdivision DA’s such that it could be used as an overarching document for the whole site.

Travers bushfire & ecology is satisfied that the Forest Red Gum communities located within the proposed R2 Low Density Residential areas do not provide important habitat for Koala(s) utilising the study area. Based on observations to date and also on the extent of retained Grey Gum habitat proposed in conservation areas we feel that the proposed rezoning areas are appropriate to maintain existing important Koala habitat. This habitat will be retained to the extent that will not likely cause a significant reduction in the existing Koala carrying capacity.

TOTAL Trees Checked for Koala Activity (>10cm DBH)

Forest Red Gums

791 - Forest Red Gums in R2 proposed areas
9 - of these with scratches consistant with Koala (1.14%)
5 - of these with 'reuse' scratches
2 - of these with 'high reuse' scratches
0 - of the trees with scratches having koala scats at base

206 - outside of proposed R2 areas
(not including area west of proposed bypass)
20 - of these with scratches consistent with koala (9.7%)
5 - of these with 'reuse' scratches
1 - of these with 'high reuse' scratches
1 - of the trees with scratches having koala scats at base

Grey Gums (within SATs or transects)

2015 SATs
46 - Grey Gum in all SATs
6 - of these with scratches (13%)
0 - of these with scats

2018 SATs
112 - Grey Gum in all SATs
59 - of these with scratches (53%)
7 - Grey Gums with scats (6%)

2018 Transects
60 Grey Gums along both transects
48 of these with scratches (80%)
13 of these with scats (22%)

Transect: 30 Grey Gum trees
24 with scratches (80%)
0 of these with scats

6 Forest Red Gum trees
1 of these with scratches (17%)
0 with reuse sratches
0 scratch trees with scats

155 Forest Red Gum (R2) trees
5 of these with scratches (3.2%)
3 with reuse scratches (1.9%)
0 scratch trees with scats

115 Forest Red Gum trees
16 of these with scratches (14%)
5 with reuse scratches (5.2%)
1 scratch tree with scats (6%)

6 Forest Red Gum trees
0 of these with scratches

122 Forest Red Gum (R2) trees
2 of these with scratches (1.6%)
1 with reuse scratches (old)
0 scratch trees with scats

11 Forest Reg Gum trees
0 of these with scratches

97 Forest Red Gum (R2) trees
0 of these with scratches

68 Forest Red Gum trees
3 of these with scratches (4.4%)
1 with reuse scratches (1%)
0 scatch trees with scats

417 Forest Red Gum (R2) trees
5 of these with scratches (1.2%)
2 with reuse scratches (<1%)
0 scratch trees with scats

Transect: 30 Grey Gum trees
24 with scratches (80%)
13 of these with scats (54%)

Counts of Forest Red Gum not undertaken but this area suffering up to 50% dieback from Bell Miner

SATs surveyed beyond study area in 2015

Local Koala Records (BioNET: 2018)

Dr Close Records (2015)

Legend

- Site boundary (Study Area)
- Koala study area
- Available Onsite Biodiversity Offset Area
- R2 Low Density Residential
- Future Appin Bypass
- Asset Protection Zone

Vegetation Communities

Containing Primary Koala food tree species
- Forest Red Gum Forest / Woodland (CPW)
- Forest Red Gum Forest / Woodland (canopy only)(CPW)
- Forest Red Gum / Ironbark Forest (SSTF)

Containing Secondary Koala food tree species
- Grey Gum / Blackbutt / Rough-barked Apple Forest (SSTF)
- Grey Gum / Blackbutt Forest (SSTF)
- Grey Gum Forest (SSTF)

Koala Survey Effort (2012)
- Koala call - playback

Koala Survey Effort (2013)
- Spotlighting transect

Fauna Survey Effort (2015)
- Koala call - playback
- Spotlighting transect

Koala Survey Results (2015)
- Approx location of resident koala sighting
- K14 Koala record submitted to Dr Close - 2011

Spot Assessment Technique point - (30 trees with DBH >10cm as per Phillips & Callighan (2008))

Koala Survey Effort (March 2018)
- Koala call - playback
- Song meter
- Spotlighting transect
- Spot Assessment Technique point - (30 trees with DBH >10cm as per Phillips & Callighan (2008))
- Search area for Koala scratches (inside development area) total of 417 Forest Red Gums checked 5 had Koala scratches, none with scats

Koala Survey Effort (Nov 2018)
- Search KS inside prop R2
- Search KS outside prop R2
- Transect (30 Grey Gum) search for scratches

Koala Survey Results (2018)
- K(s) Koala (recorded by scats -March)
- K(s) Koala (recorded by scats - November)
- FRG with "high use" scratches
- FRG with reuse scratches

Aerial source: Nearmap

Travers bushfire & ecology

PROJECT & MXD REFERENCE	DATE & ISSUE NUMBER	SCALE & COORDINATE SYSTEM
Macquariedale Road, Appin (Rezoning) A18029_FA002	26/11/2018 Issue 1	1:4,750 @ A3 GDA 1994 MGA Zone 56

TITLE

Koala Survey Efforts & Results

Document Path: N:\GIS STORAGE\N Drive\A18029_MacquariedaleRd_Appin\MXDs\A18029_FA002.mxd

Disclaimer: The mapping is indicative of available space and location of features which may prove critical in assessing the viability of the proposed works. Mapping has been produced on a map base with an inherent level of inaccuracy, the location of all mapped features are to be confirmed by a registered surveyor.

Figure 3 - Koala survey effort & results to date