Koala survey within PEL 238, October/November 2016 and assessment of significance of impact

Ethical Ecology ABN: 57227012954| December 1, 2016

All information presented in this report is, to the fullest extent of my ability, a true and accurate account.

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Accredited Biobanking Assessor #0019

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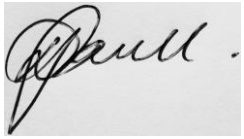

8 December 2016

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Terms & Abbreviations

Abbreviation	Meaning
FBA	Framework for Biodiversity Assessment (NSW)
ha	hectare
DoPE	Department of Planning and Environment
EIS	Ecological Impact Statement
TSC Act	Threatened Species Conservation Act 1995
EPBC Act	Commonwealth Environment Protection and Biodiversity Conservation Act 1999
TEC	Threatened Ecological Community
EP&A Act	Environmental Planning and Assessment Act 1979

1. Introduction

Ethical Ecology was engaged by Lock the Gate to undertake a review of data concerning the current status of the koala (*Phascolarctos cinereus*) within the PEL 238 (Santos), to conduct a survey within the PEL 238 and to undertake an assessment of the significance of impact from the proposed Narrabri Project production field would have on the koala.

Currently, the existing gas infrastructure is restricted to privately held land and state forest, though Pilliga East State Conservation Area is located to the south of the current project area on the eastern side of the Newell Highway and the Pilliga National Park is located to the west of the PEL.

The project area covers a substantial area of known koala habitat and the koala was identified by the Commonwealth as Matter of National Environmental Significance (MNES) affected by the Narrabri Project in their Referral Decision (EPBC 2103/6918). In addition, the Critically Endangered Ecological Community (CEEC) 'Yellow Box – White Box – Blakely's Red Gum Woodland and Derived Grassland', preferred Koala habitat, found in the project area, was also identified as another reason the referral was 'called in'. Of note is that neither was identified in the Referral by Santos as being MNES affected by their action.

2. Background

Records of Koalas from BioNet in the Pilliga are shown in Figure 1 along with distribution of veg communities containing food trees for the koala which are shown in a paler green. There are two clusters of historic records within the PEL 238. One in the north associated with Pilliga Box/ironbark woodlands (a), and another associated with the Bohena/Borah/Yaminbah Creek system to the south (b). The approximate Narrabri Project Area is indicated in yellow.

SUMMARY OF HISTORIC RECORDS AND SURVEYS IN THE PEL

There have been a number of surveys for Koalas in this study area in the last five years. All have indicated that low numbers of koalas have persisted in this area at least until recently:

Community Biodiversity survey in 2011. One old scat was located in the central part of the Bohena Creek above the X-Line Road crossing. This scat was very old and could have been in situ for more than a year.

OEH survey 2013/14. Part of an Environmental Trust grant to determine extent of decline of Koalas in the Pilliga. This data has not been published, though is in the preparation stage and records relevant to this study are indicated in the results. In total, four locations with koala scats were detected in the area of the northern population, one of which is located in the PEL while, one location was detected on Borah Creek, just to the south of the PEL. At this time this part of the creek system has large numbers of scats suggesting more than one animal was present at the time.

This results of this unpublished study by OEH has supported earlier evidence that the Pilliga meta-population has declined significantly over the last 15 years, to leave only a few isolated pockets of animals. This contention has been re-iterated by Paull and Hughes (2016) and Predavec (2016).

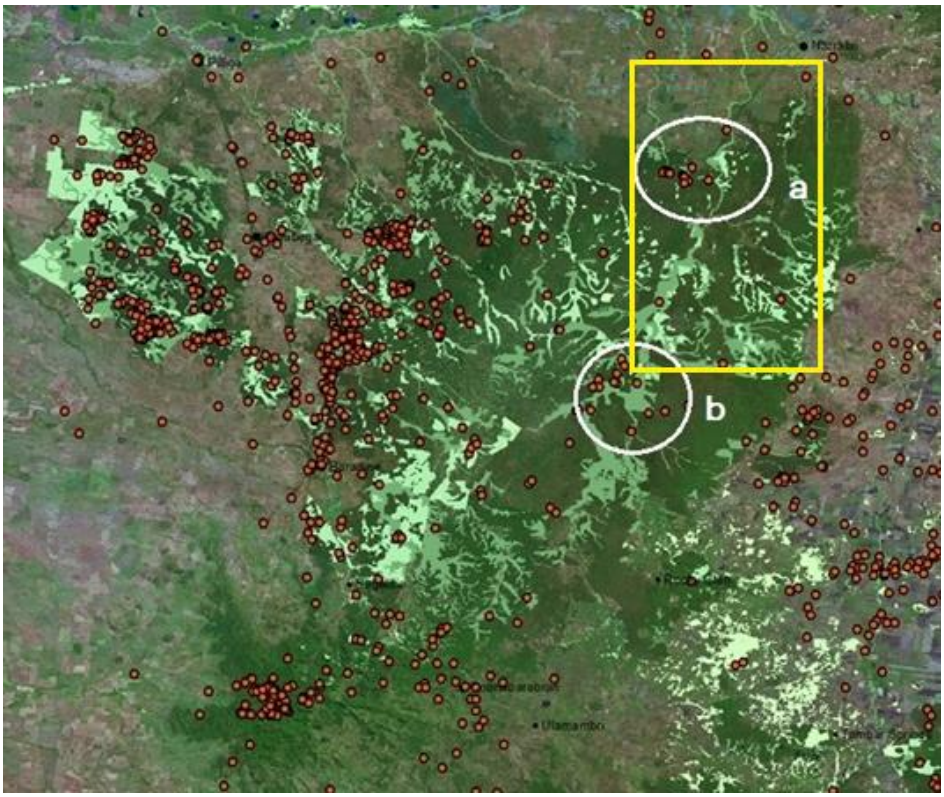

Figure 1. BioNet records of Koalas in the Pilliga Forests with extent of mapped Koala habitat.

Subsequently, there was a sighting of a koala at Cocoboy 2 Dam in August 2014 (M. Rowe NPWS, Coonabarabran, pers. comm.) near where all the scats were detected six months before during the OEH survey. This record has been submitted to the Atlas of New South Wales Wildlife. A photograph was supplied, showing the male animal in a Fuzzy Box tree.

Photo 1: Male Koala at Cocoboy 2 dam in 2014 (M. Rowe).

OWAD survey 2016. conducted a sniffer dog survey in April this year (2016) in both historic population areas, with scats found on Crow Road to the west of the Newell Highway and a likely location on Bohena Creek in the southern end of the PEL. The sniffer dog indicated scat presence though could not be located and so may have perished. Again, this indicates that koala presence in this area has been recent.

Santos conducted a survey for Koalas in the Pilliga late in 2014 (R. Kavanagh, pers. comm.) though these results are not publicly available until the Environmental Impact Statement for the Narrabri Production Field EIS is submitted to the government.

At the time that this study was conducted, the Australian Wildlife Conservancy detected koala(s) in their project area to the west of the PEL in the northern part of the forest (http://www.australianwildlife.org/field-updates/2016/historic-partnership-launched-in-the-pilliga-forest.aspx).

3. Methodology

Two methods were employed for the field survey component of this study. There were targeted SAT searches and road transects. The locations of both are shown in Figures 2 and 3

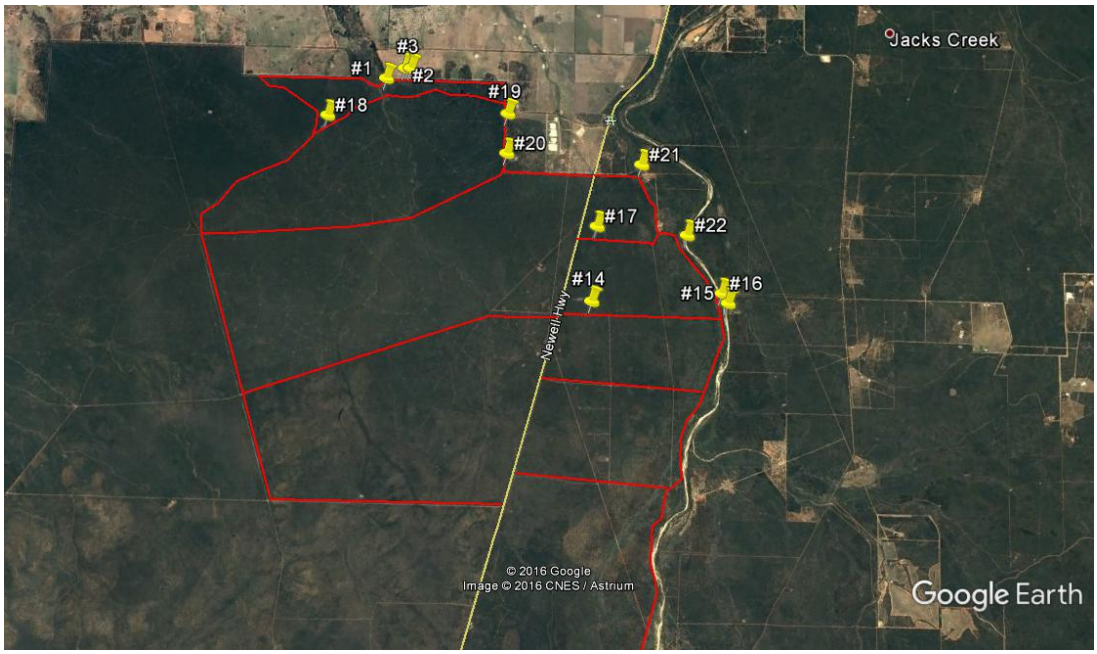

Figure 2. Survey effort northern population

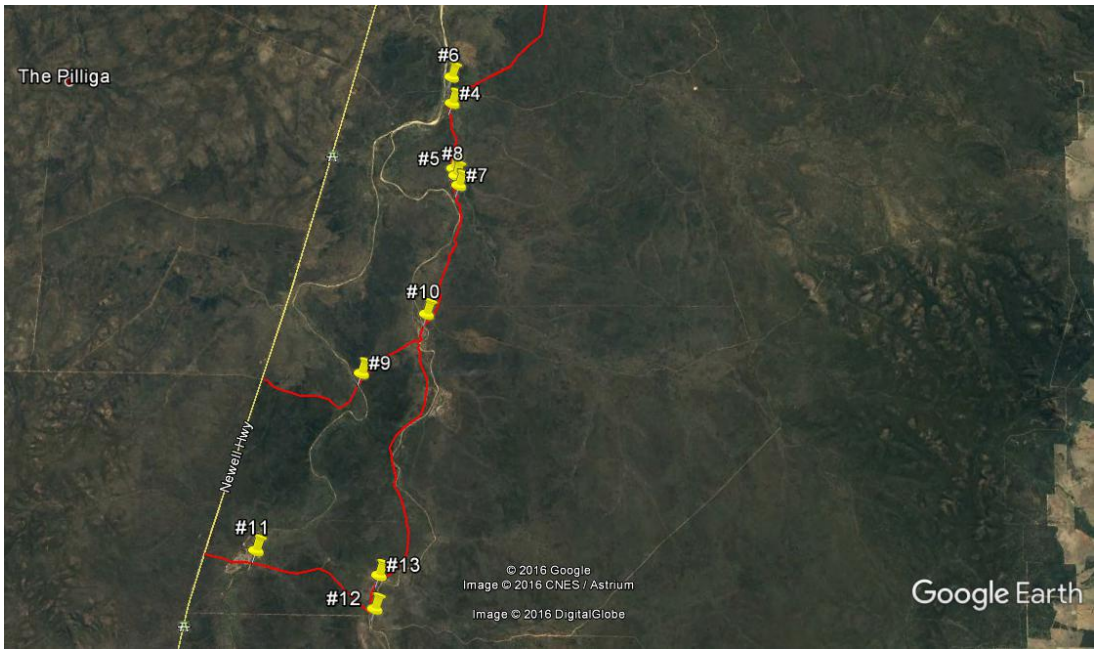

Figure 3. Survey effort in the southern area

TARGETED SAT SEARCHES

These survey generally follow the methodology as outlined in (Phillips and Callaghan 2011), with the following modifications. 22 sites were surveyed and were marked using a GPS.

(a) Sites were selected according to presence of known koala food trees, where these species formed a dominant component in the canopy, confirmed by field inspection. Four koala food trees were identified, Pilliga Box, Yellow Box, Blakely's Red Gum and Fuzzy Box (Date and Paull 2000; Kavanagh and Barrott 2001; Kavanagh *et al.* 2007; NSW Recovery Plan for the Koala, NPWS 2008). Sites were selected from each of the communities, though number of sites dominated by Fuzzy Box and Yellow Box were fewer due to their limited distribution in the study area (2 sites each), compared to the other two species (9 sites each for Pilliga Box and Blakely's Red Gum).

(b) Sites were two hectares in size. All trees greater than 10 cm in diameter and found 50m either side of central transect 200m long. were searched for koala scats. As the emphasis was on the location of more recent scats, no disturbance of the ground was undertaken, just a visual inspection of the area around the base of the trunk in a 2m diameter circle. Searches were undertaken by a team of trained searchers.

(c) Within each site, all trees were also searched for individuals in the canopies and branches.

ROAD TRANSECTS

Taking into account the distribution of previous records, roads were surveyed during daylight hours for individuals, shown in red in Figures 2 and 3. In a forest with little traffic, koalas seem not to avoid roads. However more intense activity, such as logging, will prompt animals to leave particular areas for varying amounts of time (Kavanagh, Stanton and Brassil 2007).

Roads were surveyed by a slow-moving vehicle first along one side of the road and then along the other side. All trees, where possible, were searched for koalas.

4. Results

VEGETATION COMMUNITIES

Four vegetation communities were surveyed during the study, each dominated by a different Koala food tree. White Cypress Pine (*Callitris glaucophylla*) and Bull oak (*Allocasuarina leuhmannii*) often occur as sub-dominant canopy species in all these communities.

- **Pilliga Box (*Eucalyptus pilligaensis*)** is a common species in the western and northern areas of the forest, preferring heavier clayey soils. It also grows with Brigalow (*Acacia harpophylla*) to the north of the Pilliga Forest on the heavier gilgaed soils which retain water well, though in the state forest it occurs either in pure stands or in association with Narrow-leafed Ironbark (*Eucalyptus crebra*). It generally occurs as a grassy woodland, with scattered shrubs, though shrub cover and be higher in more sandy areas.

  Pilliga Box is mapped as 'Pg' in the Lindsay Type mapping for forest (Lindsay 1967), though is distributed much more widely in areas dominated by Narrow-leaf Ironbark where it can occur as a sub-dominant.

Photo 2. Pilliga Box Woodland

- **Blakely's Red Gum (*Eucalyptus blakelyi*)** is another common species in the Pilliga forests, often found in riparian zone associations with Rough-barked Apple (*Angophora floribunda*). This red gum can also occur in mixed associations with both Pilliga Box and Narrow-leaf Ironbark as well as dominating areas of 'sand monkey' and other alluvial features. It occurs as

grassy to shrubby woodland, in riparian areas sometimes forming dense midstorey patches of tea-tree and bottlebrush.

Where it forms a dominant in the canopy and has a grassy understorey this community fits the definition of the Box Gum CEEC at either the State or Commonwealth levels.

Photo 3. Blakely's Red Gum – Rough-baked Apple woodland, Bohena Creek

- **Fuzzy Box (*Eucalyptus conica*)**

Seems to be restricted to sections of the Bohena Creek and major tributaries below X-Line Road and extending down into the state conservation area. It often grows in pure stands or with Yellow Box and Blakely's Red Gum, within the flood zone of the creek where it forms a grassy woodland.

This community matches the description of the NSW endangered ecological community 'Fuzzy Box Woodland on alluvial soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South bioregions'.

Photo 4. Fuzzy Box woodland, Bohena Creek

- **Yellow Box (*Eucalyptus melliodora*)** is also found throughout the Bohena Creek system, as scattered trees or forming tall Yellow Box-woodland in the southern end of the state forest and adjacent parts of the state conservation area in relatively small patches. It is a grassy woodland, growing on the alluvial soils like the Fuzzy Box.

Photo 5. Yellow Box woodland, Bohena Creek

Where it forms a dominant in the canopy and has a grassy understorey this community fits the definition of the Box Gum CEEC at either the State or Commonwealth levels.

CONDITION OF BOHENA CREEK

The condition of all sites appeared to be good, both in the understorey and the overstorey, particularly since the above average rainfall this winter had contributed to a large amount vegetation growth across the forest. However large lengths of tree dieback were noticed along Bohena Creek, mostly in the larger red gum trees, though other areas showed less tree death but widespread evidence of crown die-back both in the younger and older trees.

The area affected seems to commence with crown die-back in the vicinity of Oil Well Road, to areas where most of large trees have died along the creek bank. In some of the affected areas, recent rains have encouraged good understorey growth, though does not seem to have benefitted the trees.

Th extent of the dieback seems to extend from Oil Well Road to Maude's Road Crossing some 17 km to the north.

Photo 6. Dead red gums on Bohena Creek, south of Maude's Road crossing

What is the cause of this dieback, is it drought? It is difficult to understand why certain sections of the creek appear to be dying back while other areas remain healthy, particularly the section of the creek at Garlands Crossing and to the south of here and the creek at the Newell Highway bridge and going north. Drought would surely create a more uniform effect, if reduced surface flow and rainfall were the main factor for this dieback.

Predavec (2016) in his case study paper to the NSW Chief Scientist and Engineer, suggests that sanding up of the creeks in the Pilliga could be important for reducing habitat suitability for the koala. While creeks have been subject to increased sand movement from agricultural and forestry operations in and around the forest, the peak times of disturbance in the forest was in the early 20th century. It is known that the creeks have been carrying larger volumes of sand for many decades,

first noted in Rolls' historic novel, 'A Million Wild Acres'. During the last period when large numbers of koalas existed in the Pilliga (1990s), creeks have been carrying increased sand loads for some time, while still allowing flow during periods of high rainfall (pers. obs., 2016)

Bohena Creek is mapped as a groundwater dependent ecosystem (GDE) in the Australian GDE Atlas, one that is 'moderately dependent' on surface discharge of groundwater. There are springs and semi-permanent water holes still found in some of the creeks in the Pilliga, both are also present in the PEL. These features are typical of very shallow alluvial aquifers.

Rather than any reduction of conditions upon the surface, such as reduced flow, it seems more likely that such extensive tree death is due to prolonged drops in groundwater level. What else could cause the death of deeper rooted trees while still maintaining a native understorey which is much more dependent on surface water and maintaining healthy sections of creek upstream and downstream?

When the extent of the dieback zone is compared to the distribution of well sites thee is a fairly strong correspondence.

Figure 4. Extent of dieback on Bohena Creek

Further studies are being undertaken by Ethical Ecology to compare the structure and species composition of the native plants from different locations along Bohena Creek. It is evident from studies undertaken so far that there are also differences in the understorey, particularly loss of some species and greater growth of others within the creek-bed in areas affected by dieback compared to other areas which appear healthy.

Besides being an impact upon a listed CEEC, whatever the status of the local koalas in the study area, the death and decreasing condition of a large proportion of food trees for the koala is likely to

restrict movement and dispersal of this species along Bohena Creek, thereby reducing and fragmenting its habitat.

FIELD SURVEY RESULTS

Koalas were detected at only two locations during the surveys, scats were detected at site #12 on Borah Creek and an individual was sighted during a road transect on the northern boundary of the forest on Dog Proof Fence Road. Locations of koala records in and near the PEL recorded during this study or within the last three years are indicated in Figure 4.

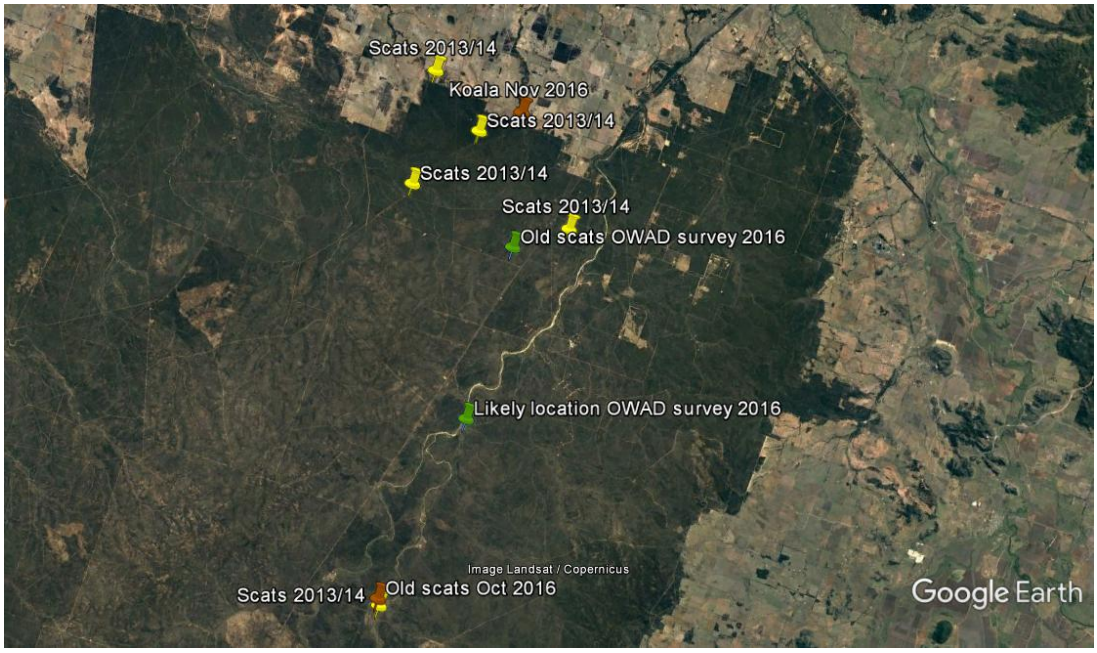

Figure 5. Locations of koala observations (2013-2016)

Photo 7. Probable koala scats, site 12.

A pile of old scats within the size range for koala (up to 3 cm long) were found near a Rough-barked Apple tree on the riverbank of the creek (lat -30.860843 long 149.519351). They could have been a year or more old, judging by their highly weathered condition. Nonetheless traces of the longitudinal ridges can be seen on some of the scats (Photo 7).

A male individual was observed during a road transect on Dog Proof Fence Road on the western side of Bundock Creek (lat -30.477659 long 149.566677)which flows into the Namoi River to the north. He was situated low in a Blakely's Red Gum, was probably asleep when first approached (cover shot and Photo 8).

Photo 8. Koala at Bundock Creek

5. Discussion

Considering both the data from this study and the review of current information from a number of sources outlined in the preceding sections of this report, the following statements can be made about the current status of the koala in the Pilliga forests generally and within the area covered by the PEL in particular.

All historic areas where populations of koalas existed in the Pilliga and Warrumbungles, have declined such that only very low numbers of animals are still to be found in a few refuge areas (Paull and Hughes 2016; Predavec 2016). Factors that have contributed to this decline include:

- Long period of below average rainfall and record number of heatwaves during the 2000s,
- Historic and ongoing disturbance in the forest, mainly from logging which has reduced canopy cover,
- Large fires in the south, east and Warrumbungles,

- Dog attack and vehicle collisions account for some recent deaths (S. Brookhouse. Pers. comm.)

Disease seems to be on the rise in the Liverpool Plains (P. Spark, pers. comm.) though Pilliga animals still seem healthy despite population crash. But overwhelmingly, the population crash of the Pilliga meta-population seems to be chiefly related to the dry period during the 2000s, which presumably has adversely affected tree health and overall habitat conditions for koalas, in similar ways as described for the Liverpool Plains (Lunney et al. 2012).

Recent records of animals in the northern part of the forest from both this study and the recent studies by the AWC indicate that koalas are still present here, and though currently at low numbers, may be dispersing, given above average rainfall experienced this year. Suitable habitat for the koala exists across the northern part of the PEL, from the Pilliga National Park across to Jacks Creek in the east, and their increasing presence in this area cannot be discounted.

The current status of the southern population associated with the Bohena Creek and tributaries is much less clear. While an animal and numerous scats were observed in 2013/14 in this area, subsequent surveys in 2016 has only yielded old scats. While some animals may be persisting in the upper reaches of this system where standing water can be found, the poor condition of Bohena Creek itself due to tree death is likely to lessen the probability of population surviving and re-colonising this area.

6. Assessment of significance of impact according to NSW assessment processes

The Assessment of Significance refers to the factors that must be considered by decision-makers to assess whether a proposal is likely to have a significant effect on threatened biodiversity. These mechanisms are contained in s5A of the EP&A Act and s94 of the TSC Act.

When undertaking a development under Part 4 of the EP&A Act, it is the responsibility of the applicant to provide the consent authority with an Assessment of Significance (as required by Schedule 1 of the Environmental Planning and Assessment Regulation 2000). However, a subsequent regulation has deemed that the assessment of significance should only be given due 'consideration' and decisions should not be bound by whatever outcome may be indicated in this.

Nonetheless an assessment according to s5A EP&A Act 1979 and s94 TSC Act 1995 has been given below. Significant effect on threatened species, populations or ecological communities, or their habitats has been indicated. The same 7 Part test is undertaken for both ecological communities, species and endangered populations. Questions not relevant to the entity being considered have been omitted.

In terms of assessing impact under the current state framework, the Framework for Biodiversity Assessment (FBA) has essentially replaced the Assessment of Significance. In theory, all ecosystems and species credits generated by the impact can be 'retired' by applying offsets or supplementary measures unless intervention by the Minister is triggered because the matter is a 'matters of further consideration' and whose impact cannot be mitigated. The test for matters for further consideration have also been considered here.

WHITE BOX RED GUM YELLOW BOX WOODLAND

Assessing the impact of CSG operations in the Narrabri Project Area should be treated with caution, particularly when dieback impacts upon Bohena Creek are taken into consideration. The link between CSG activities and the deterioration in the condition of the riparian vegetation along Bohena Creek cannot be proven at this stage, though could warrant application of the precautionary principle.

Often known as the Box Gum Woodland EEC, this community is listed as 'endangered' in NSW.

(c) In the case of an endangered ecological community or critically endangered ecological community whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

Given current extent of damage to this ecological community possibly from indirect impacts of the CSG operations, further expansion of the well field and associated underground activities may adversely affect the extent of this ecological community.

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction. the population is likely to be significantly compromised,

Modification of the ecological community was noticed in areas badly affected by dieback, including the loss of some understorey species, such as tea tree and bottlebrush, penetration of terrestrial species into the creekbed and loss of canopy.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed

There will be small direct impacts of the Narrabri Project upon riparian vegetation through the construction of pipelines, though indirect effects which may contribute to dieback have affected over 15 km of creekbed along Bohena Creek.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action

Yes, if current trends in riparian dieback continue, upstream habitats in the Bohena/Borah and Yaminbah creek systems will be fragmented from similar these habitats lower downstream outside the state forest.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

If the locality is taken to mean the area covered by the proposed production field, then quite large scale impact upon the main stream in the project area is likely to continue, jeopardizing the survival of this community into the future.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

Not relevant

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

Activities which may cause significant indirect impact upon endangered ecological communities is not consistent with the objectives of the National Recovery Plan for Box Gum CEEC (DECC 2010).

"Matters for further consideration' under the Framework of Biodiversity Assessment outlined the following matters which need to considered:

(a) impacts on landscape features, being: (i) impacts that will reduce the width of vegetation in the riparian buffer zone bordering significant streams and rivers, important wetlands or estuarine areas in accordance with Subsection 9.2.3, or (ii) impacts that will prevent species movement along corridors that have been identified as providing significant biodiversity linkages across the state in accordance with Subsection 9.2.3, and

This criterion may be relevant to this ecological community as Bohena Creek is a 4th/5th order stream and so any direct impact upon the buffers from the proposed gas field could trigger this criterion. It would depend entirely upon the layout of the field. There are no identified corridors as yet in NSW.

(b) impacts on native vegetation that are likely to cause the extinction of an EEC/CEEC from an IBRA subregion or significantly reduce its viability in accordance with Subsection 9.2.4

The study area straddles two adjacent subregions, the Pilliga Outwash and the Pilliga subregions. Both cover extensive areas of the Brigalow Belt South Bioregion. This community has a wide distribution in this area and so it is unlikely that any impact on this community in the project area would trigger this criterion.

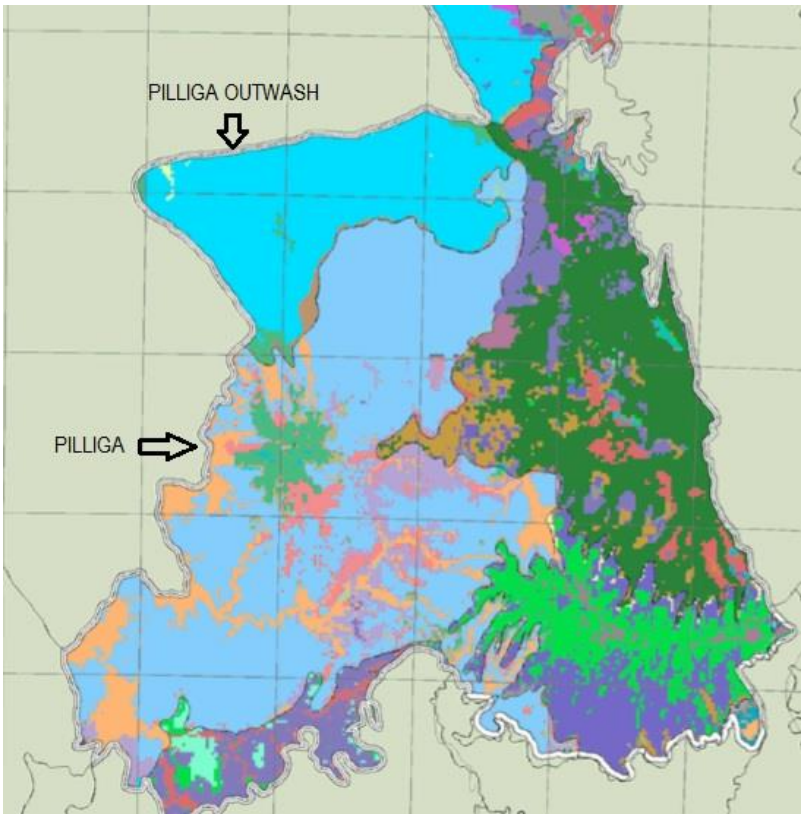

Figure 6. Subregions of the BBS bioregion

Section 9.2.4.1 of the FBA, Impacts on native vegetation, states that:

Impacts on native vegetation that require further consideration include impacts on: (a) any CEEC, unless the CEEC is specifically excluded by the SEARs (b) an EEC specifically nominated in the SEARS as an EEC that is likely to become extinct or have its viability significantly reduced in the IBRA subregion if it is impacted on by development.

This community is listed as an Endangered Ecological Community in NSW while being critically endangered under the EPBC Act. If the state accepts the EPC Act listing under the terms of the Assessment Bilateral Agreement, then this community should be triggered as a matter for further consideration.

There are no matters for further consideration identified in the SEARs (SSD 14_6456) though if this criterion is to be applied, then clearly criterion (b) is not triggered.

KOALA

Assessing the impact of CSG operations in the Narrabri Project Area should be treated with caution, particularly when dieback impacts upon Bohena Creek are taken into consideration. The link between CSG activities and the deterioration in the condition of the riparian vegetation along Bohena Creek cannot be proven at this stage, though could warrant application of the precautionary principle.

The koala is listed as 'Vulnerable' under the TSC Act 1995.

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Given the extent to which habitat would be fragmented increasing vehicle traffic and predator activity, the unknown removal of koala habitat to accommodate the new gasfield, the possible ongoing damage to the Bohena Creek environment and the very low numbers of animals in the project area, equivalent to an endangered or critically endangered status, it is more than likely that the action will jeopardise the survival of these populations.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed

It is not known the extent of direct removal of koala habitat until the EIS is handed in, though koala habitat has been removed with the existing well field.

The tree dieback along Bohena Creek, one of the most important thoroughfares for the koala in the eastern side of the Pilliga has affected by modifying about 1.7 sq km (17km x 100m) of riparian forest. It Is not now how this dieback will continue to progress given the increase in wells that a production field would see.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action

Koala habitat in the project area is distributed through the forests in the north and mainly along the creeks and associated alluvial areas in the south. All these will lie within the project area and will be fragmented by extra roading, fencing and infrastructure placement. Increased traffic in the forest will see greater risk of vehicle collision. Precise details are not yet known.

Further deterioration of the condition of the riparian vegetation will also increase levels of internal fragmentation within the forest, inhibiting dispersal for this species and leading to greater genetic isolation.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

For the populations on the eastern side of the Pilliga, further habitat fragmentation and loss of habitat condition could jeopardise these populations' chances of recovery and survival. Bohena Creek is the main source of habitat for the southern population which is at most risk, as it is uncertain if any individuals are currently in that area. Though any upstream animals must be consider part of this population.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

Not relevant.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

The NSW Koala Recovery Plan (2008) states that its objectives include:

1. To conserve koalas in their existing habitat, and
2. To rehabilitate and restore koala habitat and populations.

Given the level of threat the gas field poses to both the extent and condition of koala habitat on the study area and the possible impact this may have on populations with an extremely low population size, the action would not be consistent with these objectives.

"Matters for further consideration' under the Framework of Biodiversity Assessment outlined the following matters which need to considered:

(c) impacts on critical habitat or on threatened species or populations that are likely to cause the extinction of a species or population from an IBRA subregion or significantly reduce its viability in accordance with Subsection 9.2.5.

As mentioned above, the project area straddles two very large subregions. This area contains many historic koala populations from Moree to Gilgandra. Paull and Hughes (2016, Figure 7) identified each historic population and its current status based on the best available information. According to this scheme, the Pilliga Meta-population (B) contains 10 sub-populations, five of which can be considered to have a "uncertain status" due mostly to lack of records within the last 20 years, while the other five should be regarded as populations in significant decline. Three other isolated populations to the south, within the Pilliga subregion (#34, 35 and 36) also have their continued presence as being uncertain.

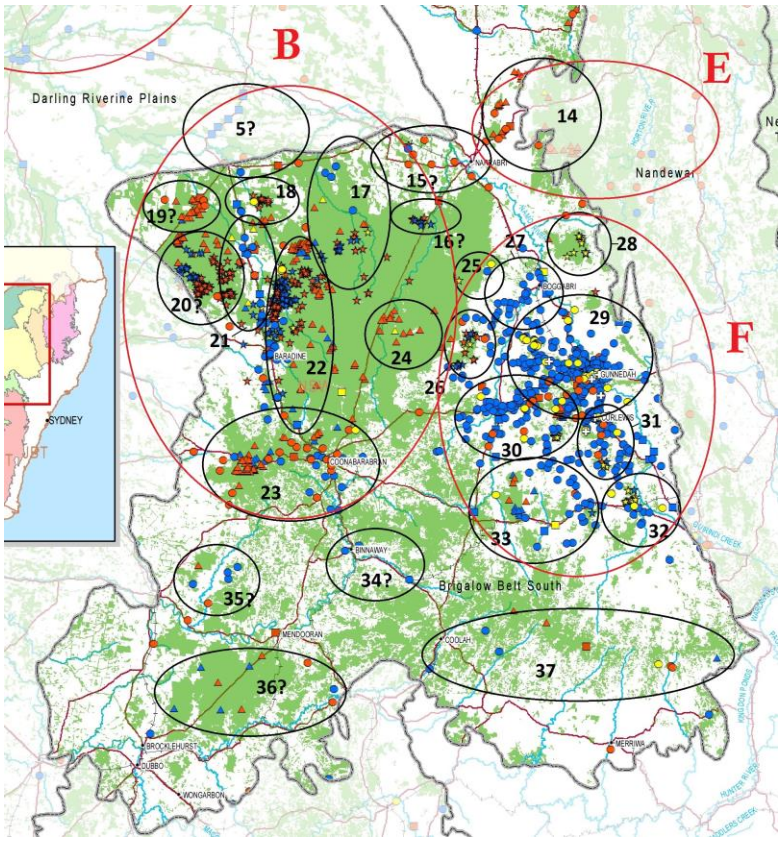

Figure 7. Koala populations in the Pilliga and surrounds (Paull and Hughes 2016)

The two local or sub-populations in question which are directly affected by the production field, will have their viability adversely affected through increased habitat fragmentation with greater intensity of habitat removal, roading and fencing, as well as possible impacts on the creek environment and further decline in the condition of this habitat, if it can be shown that gas infrastructure and usage has contributed to the poor condition of the creek and its endangered ecological community.

While the proposed action will have direct and indirect impacts on these two populations, the lack of certainty about the remaining populations in the subregions indicate that this action will contribute to the loss of this species in the subregions if threatening processes associated with the Narrabri Project are allowed to proceed.

Section 9.2.5.1 of the FBA, 'Impacts on threatened species', states that further consideration of the impacts of development is considered where it affects:

(a) on any critically endangered species, unless the critically endangered species is specifically excluded in the SEARs

The koala is not critically endangered.

(b) on a threatened species or population that is specifically nominated in the SEARS as a species or population that is likely to become extinct or have its viability significantly reduced in the IBRA subregion if it is impacted on by the development, or

No matters for further consideration were mentioned in the SEARs. However, if the advice mentioned above is taken into consideration, then this may be seen to be an omission primarily by the OEH.

(c) where the survey or expert report undertaken in Section 6.6 confirms that a threatened species is present on the proposed development site, and the threatened species has not previously been recorded in the IBRA subregion according to records in the NSW Wildlife Atlas.

This criterion is shamefully hard to meet. While it does take into account new records and extension ranges, criterion (c) has nothing to do with a species vulnerability to likely impacts or key threatening processes. The koala has been known from the Pilliga as a main stronghold for this species in NSW for a considerable time, with hundreds of historic records and so cannot meet this criterion.

KEY THREATENING PROCESSES

The following NSW-listed threatening processes that have been identified for the koala will be exacerbated by the proposed gas production field.

- Loss, modification and fragmentation of habitat
- Vehicle strike
- Predation by roaming or domestic dogs
- Intense prescribed burns or wildfires that scorch or burn the tree canopy
- Heat stress through drought and heatwaves
- Human-induced climate change
- Inadequate support for fauna rehabilitation
- Poor understanding of sources of trauma and mortality
- Poor understanding of population distribution and trend
- Poor understanding of animal movements and use of habitat

7. Assessment of significance of impact according to the Commonwealth Environmental Protection and Biodiversity Conservation Act 1999

WHITE BOX-YELLOW BOX-BLAKELY'S RED GUM WOODLAND AND DERIVED NATIVE GRASSLAND

This ecological community is listed as being critically endangered in Australia. An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:

• reduce the extent of an ecological community

The precise configuration of the gas production field is not yet known and so direct impacts cannot be calculated. Past well placement has impinged on this ecological community. Ongoing tree death along the Bohena Creek is a major impact on this CEEC and may be attributable to indirect effects of the existing gas field.

• fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines

New roads and gas infrastructure have the potential to increase fragmentation of this CEEC.

• adversely affect habitat critical to the survival of an ecological community

Habitat removal, fragmentation and modification of the project has already affected habitat critical to the survival of the Koala.

• modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns

Depressurisation of aquifers is a major risk of coal seam gas production and pilot well operations as they both use the same methods for accessing underground gas. This has been identified in both the referral by Santos to the Commonwealth and in recent assessments by GISERA of the project. It is suggested by the author that current levels of tree death along Bohena Creek may in part be due to existing aquifer damage as a result of past impacts of the pilot-well projects in the area.

• cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting

Die-back along Bohena Creek represents a significant change in the structure and species composition of the CEEC. As well as tree death, differences in the species composition along the banks of Bohena Creek have been noticed such as the loss of some species (tea tree and bottlebrush) in the worst affected areas and the increase spread of terrestrial species in the creek-bed. These changes seem to signal long-term changes in the vegetation of this community.

Currently studies are being undertaken by Ethical Ecology to quantify the spread and specific changes in the dieback affected area when compared to healthy sections of creek both upstream and downstream.

• cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to: - assisting invasive species, that are harmful to the listed ecological community, to become established, or - causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or

There have been a number of water related incidents as a result of activities by gas producers such as aquifer contamination and contamination of surface water environments. Aquifer contamination cannot readily be corrected, while rehabilitation efforts by the proponent of spill sites (of which about 20 exist in the Pilliga) show that these areas have been conduits to the spread of weeds such as Galvanised Burr and Blue Heliotrope in the forest.

• interfere with the recovery of an ecological community.

Direct and possibly indirect impacts that are expected by a production gas field (up to 800 individua wells and associated infrastructure)are not consistent with the objectives of National Recovery Plan for White Box-Yellow Box-Blakely's Red Gum Woodland and Derived Native Grassland

KOALA

This species is listed as being vulnerable in Australia. Given the criteria listed below (page 24), populations in this region should be considered as 'important populations'. An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

• lead to a long-term decrease in the size of an important population of a species

Given the points made below, the action is likely to lead to a long-term decrease of the size of the affected populations, such that their continued presence is uncertain. It is important that the action be placed within the context of a more general population decline in the BBS due mainly to drought though with possible climate change effects. The additional actions of habitat modification, loss and fragmentation may affect important recovery processes for the koala.

• reduce the area of occupancy of an important population

An unknown amount of direct habitat loss is expected as a result of construction of infrastructure for the Narrabri production field. Tree death along Bohena Creek has already resulted in significant loss of habitat for this species. If this phenomenon is linked to gas field activities, this loss is expected to increase.

• fragment an existing important population into two or more populations

Increased levels of gas infrastructure, particularly fencing associated with sites and associated clearing is likely to fragment and disrupt normal koala patterns of usage and dispersal in the forest.

It is possible that tree death along the Bohena Creek as already affected koala dispersal and usage in this area.

• adversely affect habitat critical to the survival of a species

Using the criteria outlined in the Interim Advice concerning significant impact on the koala (DSEWPaC 2012), all the habitats identified in this study may be considered to be 'habitat critical to the survival' of the koala.

• disrupt the breeding cycle of an important population

Interruptions to the dispersal and habitat use of a species is likely to impact on successful breeding by the koala due to more obstacles for koala to find partners and more obstacles to finding suitable habitat or refugia ie. drinking water in drought.

• modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

It is highly likely that a production field developed to the extent that is indicate din the referral to Commonwealth, will have the effect of modifying, destroying and isolating habitat such that the low numbers of koalas surviving in the area may fail to increase. The population in the Pilliga would certainly qualify as an 'endangered population under the TSC Act criteria.

• result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

This is not easy to prove or disprove.

• introduce disease that may cause the species to decline, or

No evidence of this so far.

• interfere substantially with the recovery of the species.

Given the recovery actions for this species identified under the NSW Koala Recovery Plan (NPWS 2008) are likely to be affected, the proposed production field is likely to substantially interfere with the re3covery of this species.

What is an important population of a species? An 'important population' is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

• key source populations either for breeding or dispersal

Recent surveys and populations assessments of the Pilliga koalas show that only five sub-populations out of 10 in the Pilliga and surrounds have small remnant numbers of individuals surviving at present. These must be considered source populations for future breeding and dispersal in the region. While some doubt remains about the persistence of Koalas in the Bohena Creek area, recent evidence shows that Koalas in the north of the forest are surviving and dispersing including into areas covered by the PEL 238. Recent scat evidence (this study and

OWAD survey 2016) suggest that some koalas may be persisting in some parts of the upper tributaries of the Bohena Creek.

- populations that are necessary for maintaining genetic diversity, and/or

These remnant populations must be considered to be necessary and important for maintaining genetic diversity.

- populations that are near the limit of the species range.

Given the grievous decline of koalas in the darling Riverine Plains and Brigalow Belt South bioregions, particularly those west of the Pilliga, the remaining Pilliga animals may represent the current western limit of this species distribution n NSW.

8. Conclusions

Existing data has been compiled with the results of this study. Information on koala status in the study area suggests that:

1. Koalas are currently present in the northern part of the Pilliga forest, both outside and within the PEL. Significant koala habitat exists in this area in the form of at least four different vegetation communities.
2. Koalas were known to be present until recently in the Bohena Creek system, though recent surveys have found only old scats. Koalas may still be present in the upper tributaries of this system, though it is equally likely that this population may have become locally extinct in the last few years. Use of the precautionary principle would suggest that this population should be regarded as being still present when undertaking impact assessments.
3. Significant tree die-back along Bohena Creek has resulted in a highly modified riparian woodland in some parts. Others are being affected by a more recent crown die-off suggesting an on-going phenomenon. This is also a considerable loss of koala habitat in the PEL. Potential causes for this worsening condition of the riparian woodlands, such as possible effects of aquifer depressurization and /or drought, warrant urgent investigation.

An assessment of the potential impact of a production field upon the Box Gum CEEC and koala show that:

4. Under the NSW legislation, there may be grounds for strong cases for a 'significant impact' upon these listed matters using the 'assessment of significance' pursuant to s5A of the EP&A Act and s94 of the TSC Act.
5. However, testing whether these two matters can be considered to be 'matters for further consideration' under the FBA, in a large part rests with any connection between the tree dieback and past gas field operations.
6. Under the FBA, there may be direct impacts on important streams depending on where the gas infrastructure is to be located.
7. Under guidelines within the EPBC Act, there is likely to be a significant impact upon both the Box Gum CEEC and the koalas a result of any production-scale gas field. This does not take into account any mitigating or offsetting actions the proponent wishes to pursue.

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Appendix 1. Sites Register

Site	Tree association	Location	Lat (-)	Long (+)
1	E. blakelyi/A. floribunda	Dog Proof Fence Road	30.480316	149.574195
2	E. pilligaensis	Dog Proof Fence Road	30.478475	149.579739
3	E. pilligaensis	Dog Proof Fence Road	30.478662	149.581354
4	E. blakelyi/A. floribunda	Borah Creek Road	30.714915	149.566877
5	E. melliodora	Borah Creek Road	30.735112	149.564432
6	A. floribunda/E. blakelyi	Borah Creek Road	30.706723	149.567867
7	E. conica/E. blakelyi	Borah Creek Road	30.740387	149.565515
8	E. conica/E. blakelyi	Borah Creek Road	30.737337	149.564886
9	E. blakelyi/A. floribunda	Delwood Road	30.792691	149.524022
10	E. blakelyi/A. floribunda	Creaghs Road	30.777787	149.548754
11	E. blakelyi/A. floribunda	Kerringle Road	30.839746	149.481685
12	E. blakelyi/A. floribunda	Borah Creek Road	30.860843	149.519351
13	E. melliodora/E. blakelyi	Borah Creek Road	30.851583	149.522005
14	E. pilligaensis/E. crebra	Plumb Road	30.540673	149.622656
15	E. blakelyi/A. floribunda	Borah Creek Road	30.545459	149.659684
16	E. pilligaensis/E. crebra	Borah Creek Road	30.542965	149.658424
17	E. pilligaensis/E. crebra	Sawpit Road	30.523078	149.627016
18	E. pilligaensis/E. crebra	Cherry Road	30.487494	149.556641
19	E. pilligaensis/E. crebra	Dog Proof Fence Road	30.492973	149.606673
20	E. pilligaensis/E. crebra	Dog Proof Fence Road	30.502608	149.604898
21	E. pilligaensis/E. crebra	Old Mill Road	30.509702	149.641671
22	E. blakelyi/A. floribunda	Borah Creek Road	30.528087	149.651318