FLORA AND FAUNA ASSESSMENT

PROPOSED CREEK REHABILITATION & BULK EARTHWORKS, INCLUDING RELOCATION OF THE MT CARMEL ROAD CROSSING

WINDSOR ROAD & BOUNDARY ROAD,

BOX HILL

April 2014

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29th April 2014

Date

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1 INTRODUCTION

1.1 Background

This Flora and Fauna Assessment Report has been prepared to accompany an application to The Hills Shire Council for proposed creek rehabilitation and bulk earthworks across approximately 218 hectares of land at Box Hill, as shown on Figure 1, including relocation of Mt Carmel Road.

The site has been cleared of the majority of native vegetation, with several patches of remnant and regrowth native trees occurring mainly along creeklines. The site consists predominantly undulating open pastures, currently grazed by cattle and horses.

Two creeklines run through the site – approximately 0.8 km of the Killarney Chain of Ponds runs across the southern part of the site, and 1.7 km of a northern tributary to the Killarney Chain of Ponds crosses through the central part of the site, as shown on Figure 1. Lands bordering the creeklines are zoned E2 (environmental conservation).

The majority of the site has been biodiversity certified, and does not require further biodiversity assessment.

This report addresses non-certified lands which occur in the southern part of the site (refer to Figure 2). Within this area, the proposed works include:

- stabilisation of banks along the creeklines, with supporting rock structures installed to protect vulnerable eucalypt trees on undercut banks or with exposed roots;
- filling of low-lying lands outside of the E2 zone, involving some clearing of remnant and regrowth native trees;
- relocation of the Mt Carmel Road crossing across Killarney Chain of Ponds creekline;
- revegetation of sections of the riparian corridor.

A separate Vegetation Management Plan is being prepared to document vegetation management and revegetation works within the E2 Zone.

A comprehensive set of plans have been prepared by Cardno (Feb 2014 – Job: NA50613038) to detail cut and fill, sediment and erosion control, and creek rehabilitation works.

Figure 1 *Aerial view of the subject site (photo source – Dept Lands SIX Viewer).*

1.2 Definitions

Definitions used in this report:

- Subject site — Lands as shown by orange outline on Figure 1.
- Focus Area — Non-biodiversity certified lands within the subject site – these being the focus of this assessment report (shown on Figure 2).
- Vicinity — Lands surrounding the subject site, up to approximately 5km distance from the site (shown on Figure 3).
- Locality — Lands within a 10km radius of the subject site.
- Region — The central part of the Sydney Basin bioregion (IBRA), encompassing northwestern Sydney, from the Parramatta River to the Hawkesbury-Nepean River.
- Threatened — Refers to the listing of a species, population or ecological community as 'threatened' under the TSC Act and/or EPBC Act. Categories of 'threatened' include 'vulnerable', 'endangered' and 'critically endangered'.

1.3 Objectives

The objectives of this flora and fauna assessment are to:

- identify native flora and fauna species, populations and ecological communities known or likely to occur within the focus area;
- describe the condition of native vegetation and habitats present within the focus area;
- determine the legislative and conservation significance of species, populations and ecological communities known or likely to occur within the focus area, with reference to the Commonwealth EPBC Act, and the NSW TSC Act;
- identify and describe the impacts of the proposed works upon native flora and fauna species, populations and ecological communities, having regard to the local and regional context of the site;
- assess the significance of potential impacts of the proposed works upon threatened species, populations and ecological communities, pursuant to s.5A of the EP&A Act (commonly referred to as the 'seven-part test');
- consider whether the proposal should be referred to the Commonwealth Minister for Environment & Heritage under the EPBC Act;
- determine whether a Koala Plan of Management is required under SEPP 44;
- recommend appropriate environmental management measures that should be implemented to avoid, mitigate and/or compensate for impacts of the proposed works upon native flora and fauna and their habitats.

2 RESEARCH AND FIELD SURVEYS

2.1 Desktop Research and Review

Resources and information used in the preparation of this report include:

- aerial photography of the subject site and of the locality (obtained from the Department of Lands Spatial Information Exchange);
- vegetation maps of the region (Tozer *et al* 2010. *Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands. Cunninghamia* (2010) 11(3): 359-406);
- The Hills Shire Council Vegetation Cover Map – sheet 7, prepared in 2010 from photography flown in 2005 (on-line, accessed February 2014);
- Flora and Fauna Assessment report for proposed works along Killarney Chain of Ponds, 743-751 Windsor Road, Box Hill (Hayes Env, 2007);
- records held on the OEH Bionet database of threatened species occurring within 10km of the subject site (data first obtained 2007, updated April 2013);

- final determinations, NPWS/DECCW species profiles, and other available information pertaining to threatened species known to occur on the site and/or in the locality.

Threatened flora species known to occur within 10km of the subject site are listed in Appendix 1 of this report, along with known details of their distribution and habitat preferences.

Threatened fauna species known to have occurred within 10km of the subject site are also listed in Appendix 1 of this report, along with known details of their habits, habitat and foraging requirements, and distributions.

A site inspection was conducted by Ms Rebecca Hayes (BSc-*EnvBio* MEngMngt) on the 31st May 2013, to provide context to the desktop findings, and to confirm that previous vegetation and habitat descriptions for the site (Hayes, 2007) remain valid.

2.2 Stratification

Native vegetation within the focus area of the site was stratified into three vegetation units, on the basis of previous vegetation mapping (Hayes Env, 2007; The Hills Council; Tozer *et al* 2010), aerial photography and site inspection:

1. Monotypic stands of Casuarina;
2. Riparian eucalypt woodland;
3. Scattered paddock trees.

Stratification units within the focus area are reflected as the vegetation community mapping shown on Figure 2.

2.3 Subject Species

Subject species are threatened flora and fauna species (or endangered populations) known or predicted to occur in the locality, and for which suitable habitat occurs within the focus area.

A list of 'subject species' was identified on the basis of information presented in Appendix 1 of this report (see Chapter 3.4.3).

Targeted surveys have been conducted for subject species, as described in Chapters 2.4 and 2.5.

Subject plant species for this report and assessment are:

- *Epacris purpurascens var. purpurascens* (shrub)
- *Grevillea juniperina* ssp *juniperina* (shrub)
- *Pimelea spicata* (shrub)

Subject fauna species for this report and assessment are:

Birds

- Spotted Harrier *Circus assimilis*
- Little Eagle *Hieraaetus morphnoides*
- Square-tailed Kite *Lophoictinia isura*
- Gang Gang Cockatoo *Callocephalon fimbriatum*
- Glossy Black Cockatoo *Calyptorhynchus lathami*
- Little Lorikeet *Glossopsitta pusilla*
- Turquoise Parrot *Neophema pulchella*
- Flame Robin *Petroica phoenica*

Amphibians

- Green & Golden Bell Frog *Litoria aurea*

Invertebrates

- Cumberland Plain Land Snail *Meridolum corneovirens*

Mammals

- Grey-headed Flying-fox *Pteropus poliocephalus*
- Yellow-bellied Sheath-tail Bat *Saccolaimus flaviventris*
- Eastern Freetail Bat *Mormopterus norfolkensis*
- Large-eared Pied Bat *Chalinolobus dwyeri*
- Little Bent-wing Bat *Miniopterus australis*
- Eastern False Pipistrelle *Falsistrellus tasmaniensis*
- Eastern Bent-wing Bat *Miniopterus schreibersii oceanenis*
- Southern Myotis *Myotis macropus*
- Greater Broad-nosed Bat *Scoteanax rueppellii*

2.4 Flora Surveys

A detailed botanical field survey was conducted across the the subject site by Ms Sandra Morse (AssocDipAppSc-*Landscape,* GradDip-*LandRehab*) on the 30th January 2007. Surveys were designed and conducted with reference to the DEC Threatened Biodiversity Survey and Assessment Guidelines (in draft 2004).

Each creekline was walked and all native plant species observed were recorded. Each stand of native trees was inspected, and all native plant species recorded.

Opportunistic searches were conducted in areas of appropriate habitat for the three threatened plant species/populations identified as 'subject species' (see Chapter 2.3 above).

Plant identifications conform to nomenclature in Harden (1990-1993) and to recent reclassifications and name changes listed in *Cunninghamia* and *Telopea*.

Ecological communities have been identified and described with reference to the vegetation maps and descriptions in Tozer *et al* (2010), and with reference to vegetation descriptions included in Final Determinations to list threatened communities under the TSC Act and the EPBC Act.

The conservation significance of species, populations and ecological communities recorded during the survey was established with reference to the EPBC Act in the national context, and to the TSC Act in the state context.

An inventory of all plant species recorded is provided in Appendix 2.

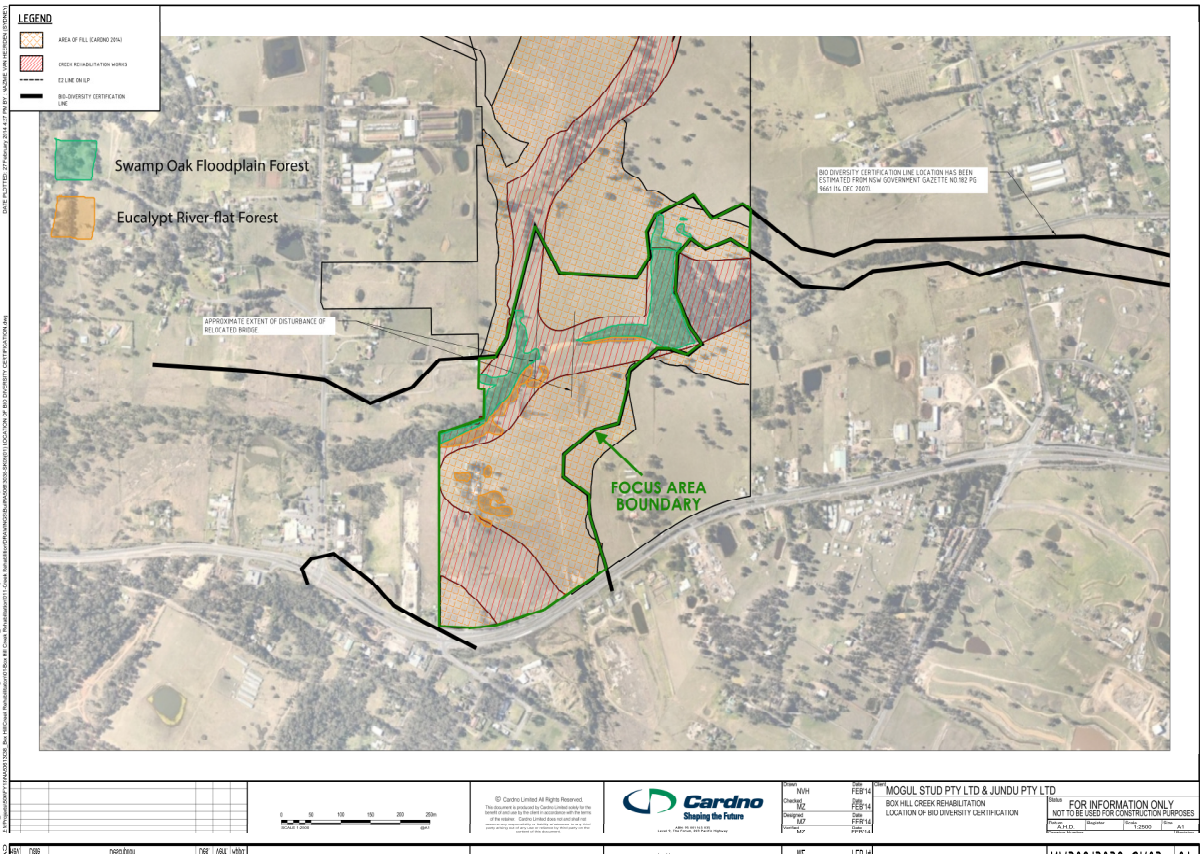

Figure 2 *Native vegetation communities within the Focus Area.*

2.5 Fauna Surveys

A fauna habitat assessment including searches for indirect evidence of native fauna (*eg* scats, chew marks, scratches, diggings, dens, nests *etc*) was conducted by Ms Rebecca Hayes (BSc-*EnvBio* MEngMngt) in January 2007, and on the 31st May 2013.

The purpose of the survey was to identify habitats and features of potential relevance for threatened fauna species known to occur in the locality (Bionet).

A fauna survey was conducted within the study area on the 10th and 11th of January 2007 by Mr Michael Welsh (BAppSc -Applied Ecology Hons). Fauna survey techniques included:

- general diurnal surveys including targeted surveys for birds and herpetofauna, habitat assessment and evaluation of habitat features (total of 5 person-hours);
- nocturnal spotlighting using hand-held spotlights, focussed on dams and vegetation along creeklines;
- passive dusk survey, including stag-watches commencing 30 mins before dark and continuing up to 1 hour after dark (total of 1.5 person-hours);
- call playback for owls (Powerful, Barking, Masked, Sooty) and for the Yellow-bellied Glider and Koala. Each call was broadcast for 5 mins, followed by 5 mins of passive listening;

- Anabat detection of the ultrasonic echolocation calls of microchiropteran bats. An Anabat II unit was set in a stationery position before dusk, set on voice-activation, and collected the following morning.

Fauna surveys were conducted with reference to the DEC Threatened Biodiversity Survey and Assessment Guidelines (in draft 2004), and with reference to OEH species profiles.

Opportunistic sightings of all fauna species were recorded throughout the survey period. A list of fauna species recorded is provided in Appendix 3.

The conservation significance of native fauna was established with reference to the EPBC Act in the national context, and to the TSC Act in the state context.

Weather conditions during the fauna survey were warm and sunny, up to 40°C during the day and around 25°C during the evening, with clear skies and little to no wind. Surveys during the hottest part of the day were focussed around water points where fauna would be expected to come to drink.

2.6 Survey Limitations

Flora and fauna field surveys were limited by the short duration of the surveys, and the hot weather conditions during the surveys.

This limitation has been addressed through:

- consideration of flora and fauna species known to occur in the locality;
- consideration of habitat resources present on the site and connectivity to other areas of habitat in the locality;
- searches for indirect evidence of fauna, which can persist on a site for some years; and
- adoption of a precautionary approach – see Chapter 2.7 below.

2.7 Precautionary Approach

Where the focus area contains potential habitat for threatened fauna species known to occur in the locality, and where survey methods and effort employed are not sufficient to demonstrate absence or a low likelihood of occurrence, it has been assumed on a precautionary basis that such species do utilise the focus area.

3 EXISTING ENVIRONMENT

3.1 Local and Regional Context

The subject site is located within a broad stretch of undulating agricultural land in northwestern Sydney. The majority of these lands have been cleared of native vegetation, with small stands of trees scattered through the landscape, and narrow corridors of riparian vegetation retained along some creeklines. Refer to Figure 3.

The site is surrounded by small acreages to the north, east and west. The southern boundary of the site is Windsor Road.

Much of the local area is intended for residential development, with native vegetation to be retained along major riparian corridors, and in various National Parks and Council reserves.

Figure 3 *Aerial view of the subject site in the local context (photo source – Dept Lands SIX Viewer).*

3.2 General Description

The subject site is approximately 223 hectares in size, and consists of gently undulating predominantly cleared pasture land, with a general slope down to the south.

Approximately 0.8 km of the Killarney Chain of Ponds creekline runs across the southern part of the site, draining to the west, with approximately 1.7 km of a northern tributary draining from the northeastern corner of the site, south to the Killarney Chain of Ponds.

The majority of the site has been previously cleared of all native vegetation for grazing use and establishment of pastures. Narrow strips and small stands of remnant trees occur along some stretches of the creeklines, and there is a one quite large stand of Casuarina (approximately 4.8 ha in size) along the Killarney Chain of Ponds creekline.

There are no intact areas of native vegetation within the site, and no native shrub layer in any of the small stands of trees. The groundcover consists of close grazed grass, with very few fallen logs or other shelter features for fauna.

3.3 Flora

3.3.1 Vegetation Communities

Two separate but intergrading native vegetation communities were recorded within the focus area (refer to Figure 2):

- Swamp Oak Floodplain Forest occurs as a moderate sized patch in the east of the focus area, and as a narrow corridor along the Killarney Chain of Ponds creekline;
- River-flat Eucalypt Forest occurs as a narrow strip bordering the southern edge of Swamp Oak Floodplain Forest along the Killarney Chain of Ponds creekline, and as an isolated patch adjacent to an existing residence in the southwestern part of the focus area.

3.3.2 Structure and Floristics

Swamp Oak Floodplain Forest

The canopy is moderate to very dense, and is dominated by Swamp Oak *Casuarina glauca* to approximately 20m in height, with infrequent occurrences of Cabbage Gum *Eucalyptus amplifolia* ssp *amplifolia*.

The shrub layer is generally absent, and consists of occasional small patches of sparse Blackthorn *Bursaria spinosa* and the exotic weeds Paddy's Lucerne *Sida rhombifolia* and African Olive *Olea europaea* ssp *cuspidata*, up to approximately 5m in height.

The groundcover varies from moderate density to very sparse, to an approximate height of 30cm. Common native species include Scurvy Weed *Commelina cyanea*, Kidney Weed *Dichondra repens*, *Cyperus gracilis*, Lesser Joyweed *Alternanthera denticulata*, *Einadia polygonoides*, Fishweed *Einadia trigonos*, *Oxalis perennans* and *Juncus usitatus*.

There are heavy infestations of the exotic weed Salvinia *Salvinia molesta* in parts of the drainage lines.

River-flat Eucalypt Forest

The canopy is moderate to sparse in density, and dominated by Cabbage Gum *Eucalyptus amplifolia* ssp *amplifolia* to approximately 20m in height, with infrequent occurrences of Swamp Oak *Casuarina glauca*.

The shrub layer varies from very sparse to moderate density, to approximately 1m in height, and is dominated by the exotic weeds Olive *Olea europaea* ssp *cuspidata* and Paddy's Lucerne *Sida rhombifolia*. The native Blackthorn *Bursaria spinosa* occurs sporadically.

The groundcover is of moderate density, to approximately 30cm in height. Common native species recorded include Weeping Meadow Grass *Microlaena stipoides* var *stipoides*, Scurvy Weed *Commelina cyanea*, Saloop *Einadia hastata*, Fishweed *Einadia trigonos*, *Paspalidium distans* and Paddock Lovegrass *Eragrostis leptostachya*. Common exotic species recorded include Couch *Cynodon dactylon* and Paspalum *Paspalum dilatatum*.

3.3.3 Conservation Significance

Threatened Species

No plant species listed as "*threatened*" under either the TSC Act or the EPBC Act were recorded within the focus area.

Targeted searches have been conducted for three subject plant species (identified in Chapter 2.3). None of these species were recorded.

Endangered Populations

No flora species being part of any relevant "*endangered population*" listed under the TSC Act were recorded within the focus area.

Ecological Communities

Both native vegetation communities occurring within the focus area (Swamp Oak Floodplain Forest and River-flat Eucalypt Forest) are listed as endangered ecological communities under the TSC Act. Neither community is listed under the EPBC Act.

3.4 Fauna

3.4.1 Habitat Assessment

Features and resources

Habitat types present within the focus area include:

- extensive areas of cleared, grazed open pasture, providing some potential foraging habitat for common and disturbance-tolerant farmland birds (*eg* Welcome Swallow, Magpie-lark, Richard's Pipit, Sulphur-crested Cockatoo), but generally of minimal value for most native fauna;
- a moderate-sized almost monotypic patch of Swamp Oak *Casuarina glauca*, with occasional eucalypts containing small and medium-sized hollows;

- narrow strips and small patches of eucalypts providing isolated pockets of foraging and shelter habitat for mobile fauna species, *ie* birds and bats. None of the stands provide good arboreal mammal habitat, due to their isolation, small size, and lack of flowering shrubs;
- ephemeral creeklines which were generally dry during the survey. The creeklines are very eroded and degraded by cattle, and would generally be of extremely limited value for native fauna. Riparian vegetation is limited to narrow strips of trees;
- an existing dam located mid-way along the Killarney Chain of Ponds creekline provides a water resource for native fauna in the study area, and fairly degraded habitat for amphibians and aquatic/wading birds. The dam is not likely to be of significant value for amphibians due to disturbance by cattle, the presence of Plague Minnow *Gambusia holbrookii*, an exotic fish which preys on amphibians, and due to the lack of surrounding habitat such as long grass, logs and debris *etc*.

Local context and linkages

Habitats within the focus area are generally discontinuous and isolated. Existing links along Killarney Chain of Ponds are narrow and of poor quality, and are not likely to be functioning as a wildlife corridor.

The site currently does not contain any known wildlife corridors or linkages.

3.4.2 Fauna Species

A list of fauna species recorded within the subject site, and of species known to have occurred within 2km of the site (DEC Atlas, 2007), is provided in Appendix 3.

There is a strong presence of foxes and rabbits across the site, which would reduce its value for most terrestrial native fauna through either competition, or predation.

Threatened fauna species known to have occurred within 10km of the site in the last 20 years (Bionet database, April 2013) are listed in Appendix 1, along with a discussion as to their likelihood to occur in the focus area and/or be affected by the proposed works.

3.4.3 Conservation Significance

Species

39 fauna species listed as threatened under the TSC Act and/or EPBC Act are known to occur in the locality (Bionet database).

These species are listed in Appendix 1 of this report, along with known details of their habits, habitat and foraging requirements, and distributions, and consideration of their likelihood to occur within the focus area or be affected by the proposed works. On the basis of information present in Appendix 1, 19 of these species were identified as 'subject species' (see Chapter 2.3).

The list of subject species has been refined on the basis of detailed habitat assessment, searches for indirect evidence, and consideration of likely impacts of the proposed works, as set out in Table 1.

In summary of Table 1, 5 threatened microchiropteran bat species could potentially be affected by the proposed works.

A number of bird species listed as migratory under the EPBC Act are known to occur in the locality. Many of these would be expected to occur within the focus area on occasions.

Endangered Populations

No fauna species being part of any relevant "*endangered population*" listed under the TSC Act were recorded, or are likely to occur within the focus area.

Table 1 *Consideration of Subject Species.*

Species	Consideration	Likely to be affected
Spotted Harrier	A wide-ranging species. Not recorded and no nests recorded in the focus area. The proportion of foraging habitat that would be affected to that in the locality is negligible.	No
Little Eagle	A wide-ranging species. Not recorded and no nests recorded in the focus area. The proportion of foraging habitat that would be affected to that in the locality is negligible.	No
Square-tailed Kite	A wide-ranging species. Not recorded and no nests recorded in the focus area. The proportion of foraging habitat that would be affected to that in the locality is negligible.	No
Gang Gang Cockatoo	Potential low quality winter habitat. Would not breed in the focus area. Not recorded. The extent of eucalypt woodland that would be removed to that in the locality is negligible.	No
Glossy Black Cockatoo	Potential low quality habitat. No suitable nest sites. Not recorded. No indirect evidence recorded (*ie* chewed cones). Virtually all of the Casuarina resource within the focus area will be retained.	No
Little Lorikeet	Potential low quality habitat. Not recorded. No regular nest sites recorded. The extent of eucalypt woodland that would be removed to that in the locality is negligible.	No
Turquoise Parrot	Potential low quality habitat. Not recorded. No regular nest sites recorded. The extent of eucalypt woodland that would be removed to that in the locality is negligible.	No
Flame Robin	Unlikely habitat. Not recorded. No nests recorded. The extent of eucalypt woodland that would be removed to that in the locality is negligible.	No
Grey-headed Flying-fox	A wide-ranging species. Not recorded. No camp's known to occur nearby. The extent of eucalypt woodland that would be removed to that in the locality is negligible.	No

Species	Consideration	Likely to be affected
Yellow-bellied Sheath-tail Bat	Not recorded, but insufficient field surveys to confirm absence. Could roost in hollows in the focus area. Extent of foraging habitat to be affected is negligible.	**Possible**
Eastern Freetail Bat	Not recorded, but insufficient field surveys to confirm absence. Could roost in hollows in the focus area. Extent of foraging habitat to be affected is negligible.	**Possible**
Large-eared Pied Bat	Not recorded, but insufficient field surveys to confirm absence. However, would not roost in focus area, and the extent of foraging habitat to be affected is negligible.	No
Little Bent-wing Bat	Not recorded, but insufficient field surveys to confirm absence. However, would not roost in focus area, and the extent of foraging habitat to be affected is negligible.	No
Eastern False Pipistrelle	Possible recording by call. Could roost in hollows in the focus area. Extent of foraging habitat to be affected is negligible.	**Yes**
Eastern Bent-wing Bat	Not recorded, but insufficient field surveys to confirm absence. However, would not roost in focus area, and the extent of foraging habitat to be affected is negligible.	No
Southern Myotis	Not recorded, but insufficient field surveys to confirm absence. Could roost in hollows in the focus area. Extent of foraging habitat to be affected is negligible.	**Possible**
Greater Broad-nosed Bat	Possible recording by call. Could roost in hollows in the focus area. Extent of foraging habitat to be affected is negligible.	**Yes**
Green & Golden Bell Frog	Theoretical habitat. Not recorded. Presence of *Gambusia holbrookii* would prevent breeding.	No
Cumberland Plain Land Snail	Not recorded. Very limited habitat features present. Vegetation communities in focus area not typical for this species.	No

4 PROPOSED DEVELOPMENT & POTENTIAL IMPACTS

4.1 Overview

A comprehensive set of plans have been prepared by Cardno (Feb 2014 – Job: NA50613038) to detail cut and fill, sediment and erosion control, and creek rehabilitation works within the subject site.

A separate Vegetation Management Plan is being prepared to document vegetation management and revegetation works within the E2 Zone.

The proposed works include:

- stabilisation of banks along the creeklines, with supporting rock structures installed to protect vulnerable eucalypt trees on undercut banks or with exposed roots – refer to section drawings prepared by Cardno (Feb 2014);
- filling of low-lying lands outside of the E2 zone, involving some clearing of remnant and regrowth native trees (refer to Figure 4);
- revegetation of sections of the riparian corridor, as indicated on the Landscape Masterplan (Scott Murray Associates, 1647-DA-08);
- relocation of the proposed Mt Carmel Road crossing across Killarney Chain of Ponds creekline (new location shown on Figure 4).

The proposed works within the focus area would result in loss of approximately 0.82ha of native vegetation for filling and bridge works (comprised of 0.45ha of Eucalypt River-flat Forest and 0.37ha of Swamp Oak Floodplain Forest).

It is possible that occasional trees may also be lost along the creek banks, where these are irretrievably compromised, and in situations where the loss of an individual tree can ensure greater protection for a higher quality stand of trees. There would be no loss of extent of native vegetation within the focus area for creek stabilisation works.

Approximately 2.5ha of Eucalypt River-flat Forest would be retained within the focus area, and 2.6ha of Swamp Oak Floodplain Forest, a total area of approximately 5.1ha of native vegetation.

17.38ha of land is protected as E2 Zone within the Focus Area for this report. Cleared areas of land within this zone would be revegetated, as documented within the separate Vegetation Management Plan.

4.2 Avoidance, Mitigation and Compensation of Impacts

4.2.1 Avoidance

The proposed development has been designed to avoid loss of native vegetation to the greatest extent practicable.

The proposed new location for the Mt Carmel Road crossing substantially reduces the extent of native vegetation required to be removed. The previous planned (but not formed) location would pass through the middle of the upstream large remnant patch of Swamp Oak Forest.

Bulk earthworks do not extend into the E2 Zone within the Focus Area for this report (as shown on Figure 2), although some re-shaping and filling of land will be required for construction of the Mt Carmel Road bridge over the Killarney Chain of Ponds creekline.

Where mature eucalypt trees are located on the fringe of bulk fill earthworks, the boundary of the fill will be modified at the time of the works, such that the tree can be retained, with no filling beneath the tree canopy.

It is intended that all eucalypt trees along the creeklines shall be retained, with supportive works as shown on Cardno drawing 'Typical Details' Ref: NA50613038-CRD-030, Treatment Type C, implemented where appropriate.

It is intended that the majority of casuarina trees along the creeklines shall also be retained, with priority given to stable and healthy individuals.

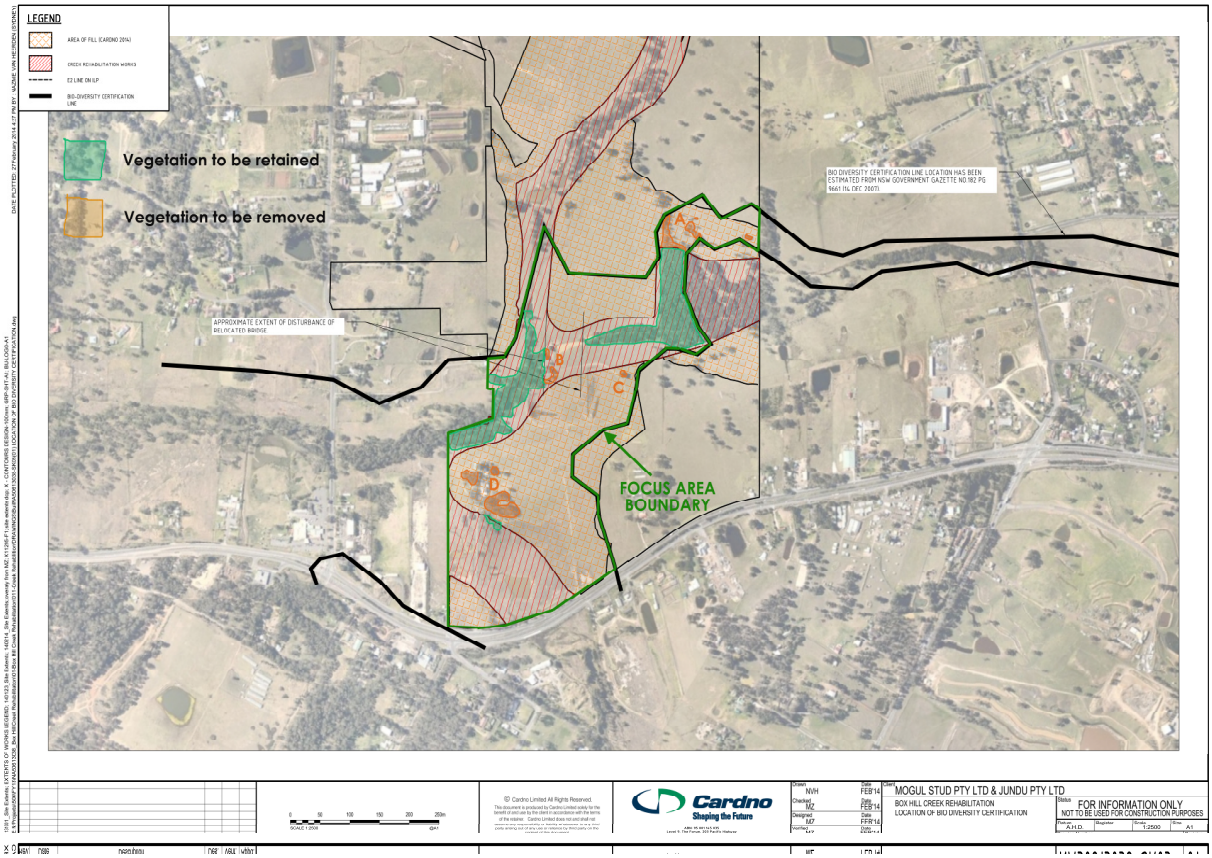

Figure 4 *Proposed extent of fill and proposed bridge crossing, showing areas of vegetation to be retained and removed.*

4.2.2 Mitigation

Sediment and erosion control features shall be installed to protect vegetation and habitats within the E2 zone of the site, in accordance with current engineering standards. Features shall be installed prior to commencement of earthworks on the site, and shall not be removed until affected areas are stable.

Induction procedures for contractors working within the E2 zone shall emphasize the significance and importance of existing native vegetation. The project manager shall inspect each section of the creekline with the relevant contractors prior to commencement of works, to discuss how tree retention will be maximised.

Potential impacts on native fauna due to removal of trees shall be minimised through implementation of a 'Tree Removal Protocol' (Table 2).

Table 2 *Tree Removal Protocol*

Step	Action
1	Removal of mature eucalypt trees shall occur during the period from February to April, to avoid the winter hibernation/torpor period of microchiropteran bats, and avoid the spring/summer breeding period of bats and parrots.
2	Trees shall initially be 'bumped' using machinery to encourage any resident fauna to evacuate on their own accord. 'Bumping' shall be repeated at 1 minute intervals for approximately 5 minutes per tree. Care shall be taken to place the machinery such that it is not likely to be hit by falling branches.
3	Trees should be removed approximately 5-10 minutes after the 'bumping'.
4	Removal of trees with hollow trunks or limbs shall occur in a manner that allows either the whole tree, or hollow sections of the tree, to be placed gently (*ie* not free-fall) on the ground.
5	Hollow-bearing and habitat trees should be left on the ground until the next working day before stacking or removal, to provide further opportunity for microchiropteran bats sheltering within them to evacuate. Hollow sections of trees or limbs should then be re-located entire and placed along contours within the E2 zone.
6	In the event that a microchiropteran bat is observed sheltering within felled vegetation, the bat should be left where it is, and work relocated to another area until the following day (by which time the bat should have moved on). Bats carry lethal diseases and should not be handled by untrained and unvaccinated persons.
7	Any injured native fauna shall be rescued and transferred to the care of WIRES or an equivalent wildlife rescue agency. In the event that native fauna requires medical treatment by a vet, or long-term care by a wildlife rescue agency, all costs shall be covered by the proponent for the development.
8	Native vegetation cleared from the site should be mulched for re-use in revegetation works within the riparian corridor.

4.2.3 Compensation

Loss of trees and vegetation on the site would be compensated through:

- implementation of the Vegetation Management Plan, which documents revegetation works within currently cleared parts of the E2 Zoned riparian corridor, to improve connectivity of vegetation and habitats, and to increase the extent of habitat and resources for native flora and fauna within the site. The total extent of the E2 Zone within the Focus Area for this report is 17.38ha;
- installation of nest-boxes within the riparian corridor, to compensate for loss of tree-hollows elsewhere within the site. Nest-boxes shall be installed at the rate of 1 box per 10m length of creekline. Boxes should be suitable alternately for microchiropteran bats, and for parrots.

4.3 Impacts on Threatened Biodiversity

4.3.1 Threatened fauna

Five threatened microchiropteran bat species could be affected by the proposed works:

- Yellow-bellied Sheath-tail Bat *Saccolaimus flaviventris*;
- Eastern Freetail Bat *Mormopterus norfolkensis*;
- Eastern False Pipistrelle *Falsistrellus tasmaniensis*;
- Southern Myotis *Myotis macropus*; and
- Greater Broad-nosed Bat *Scoteanax rueppellii*.

The proposed works within the focus area would result in loss of approximately 0.82ha of native vegetation for filling and bridge works. It is possible that occasional additional trees may also be lost along the creek banks.

Approximately 5.1ha of native vegetation would be retained within the focus area.

The loss would be mitigated and compensated through:

1. avoidance of loss of mature trees, particularly hollow-bearing trees, to the greatest extent practicable;
2. adherence to a Tree Removal Protocol for all tree clearing within the focus area, to minimise risk of injury to individual animals present;
3. revegetation of currently cleared land within the riparian corridor, to achieve a total extent of vegetated E2 corridor of 17.38ha (refer to the separate Vegetation Management Plan);
4. installation of nest-boxes within the riparian zone, at a rate of 1 box per 10m of creekline, alternately parrot boxes and microchiropteran bat boxes.

Assessments of the significance of potential impacts of the proposed works upon these threatened microchiropteran bat species have been conducted as required, pursuant to s.5A of the EP&A Act. Refer to Chapter 5.

Assessment of the significance of impacts upon species listed under the EPBC Act has also been considered. Refer to Chapter 6.

4.4 Key Threatening Processes

A range of Key Threatening Processes have previously occurred, or are currently occurring, within the subject site. These are listed in Table 3 with an indication of the likely effect of the proposed works upon them.

Table 3 *Key Threatening Processes previous, existing or likely to occur within the focus area.*

Key Threatening Process (TSC Act)	**EPBC listed**	**Likely increased impact by proposal**
Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands		See discussion below
Anthropogenic climate change	✓	
Bushrock removal		
Clearing of native vegetation	✓	✓
Competition and grazing by the feral European rabbit (*Oryctolagus cuniculus*)	✓	
Competition from feral honey bees (*Apis mellifera*)		
Herbivory and environmental degradation caused by feral deer		
Infection by psittacine circoviral (beak and feather) disease affecting endangered psittacine species and populations	✓	
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis	✓	
Infection of native plants by *Phytophthora cinnamomi*	✓	
Invasion and establishment of exotic vines and scramblers		
Invasion of native plant communities by African Olive *Olea europaea* L. subsp. *cuspidata*		
Invasion, establishment and spread of *Lantana camara*		
Invasion of native plant communities by exotic perennial grasses		
Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants	✓	✓
Loss of hollow-bearing trees		✓
Loss or degradation (or both) of sites used for hill-topping by butterflies		
Predation by the European red fox (*Vulpes vulpes*)	✓	
Predation by the feral cat (*Felis catus*)	✓	
Predation by *Gambusia holbrooki* Girard, 1859 (plague minnow or mosquito fish)		
Removal of dead wood and dead trees		✓

Current flow regimes within the subject site are the result of previous in-line creek works, including construction of farm dams. The proposed creek stabilisation works will alter these flow regimes. The effect of the proposed works has been modelled and carefully designed, to allow natural flows without causing significant downstream flooding.

The extent of loss of native vegetation, hollow-bearing trees and dead wood and dead trees is minimal. Approximately 0.82ha of vegetation would be removed from the focus area, with approximately 5.1ha of vegetation retained.

The proposed works would include revegetation of cleared parts of the E2 Zoned riparian corridor, to increase the extent and connectivity of vegetation within the focus area. The E2 Zone within the Focus Area for this report is 17.38ha. There would be a net increase in extent of native vegetation within the Focus Area.

The proposed works would prepare the site for future residential development. Such development would increase the potential for escaped garden plants to invade retained and regenerated native vegetation. This impact would be managed through implementation of vegetation management activities determined at the time of future development applications.

4.5 Cumulative Impacts

The proposed works are part of the ongoing development of the northwestern Sydney area, and thus contribute to the ongoing cumulative impact on native vegetation.

However, virtually all of the native vegetation present within the focus area would be retained intact and protected.

Extensive revegetation works are proposed in currently cleared parts of the riparian corridor, such that the biodiversity and ecological values of the site would be maintained in the long term.

The proposed works would have a negligible contribution towards the cumulative impact of development in the locality.

4.6 Corridor Impacts

The proposed works would not isolate any areas of habitat, nor fragment any existing wildlife corridor.

The proposed works would be likely to increase the connectivity of habitats within the site.

5 NSW THREATENED SPECIES CONSERVATION ACT 1995

The *NSW Threatened Species Conservation Act 1995* (TSC Act) modifies the *NSW Environmental Planning & Assessment Act 1979* (EP&A Act) by including in Section 5A seven factors which are to be considered when determining "*whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats*".

These seven factors "*must be taken into account*" by a consent or determining authority when considering a development proposal or Development Application, particularly in administering Sections 78, 79 and 112 of the EP&A Act.

5.1 Relevant Threatened Biota

5.1.1 Species

No threatened plant species would be affected by the proposed works.

Five threatened microchiropteran bat species may be affected by the proposed works (Yellow-bellied Sheath-tail Bat *Saccolaimus flaviventris,* Eastern Freetail Bat *Mormopterus norfolkensis,* Eastern False Pipistrelle *Falsistrellus tasmaniensis,* Southern Myotis *Myotis macropus, and* Greater Broad-nosed Bat *Scoteanax rueppellii);*

The impacts of the proposed works upon these communities have been assessed, pursuant to s.5A of the EP&A Act. Details of the assessment are in Appendix 4, and summarised below.

5.1.2 Populations

No flora or fauna species being part of an "*endangered population*" listed under the TSC Act were recorded within the subject site, nor would be affected by the proposed works.

5.1.3 Ecological Communities

Both native vegetation communities occurring within the focus area (Swamp Oak Floodplain Forest and River-flat Eucalypt Forest) are listed as endangered ecological communities under the TSC Act.

The impacts of the proposed works upon each of these communities have been assessed, pursuant to s.5A of the EP&A Act. Details of the assessment are in Appendix 4, and summarised below.

5.2 Assessment of Significance of Impacts

5.2.1 Microchiropteran bats

(Yellow-bellied Sheath-tail Bat *Saccolaimus flaviventris,* Eastern Freetail Bat *Mormopterus norfolkensis,* Eastern False Pipistrelle *Falsistrellus tasmaniensis,* Southern Myotis *Myotis macropus, and* Greater Broad-nosed Bat *Scoteanax rueppellii*)

In summary of the detailed assessment in Appendix 4:

(a) the proposed works would not be likely to affect the life cycle of any of the five microchiropteran bat species, such that the population would be placed at risk of extinction;

(b) not applicable;

(c) not applicable;

(d) the extent of vegetation that would be removed or modified (0.82 ha) is minor in relation to the extent of vegetation that would be retained within the focus area (5.1 ha). The proposed works would not cause an area of habitat for microchiropteran bats to become isolated from other areas of habitat for these species. The vegetation that would be affected is not likely to be of particular importance for any of the five microchiropteran bat species – no significantly large hollow-bearing trees would be removed, no areas of intact good quality foraging habitat would be removed, no ecologically functional dams or ponds would be removed;

(e) there is no declared "*critical habitat*" of relevance to the focus area. The proposed works would not affect any areas of "*critical habitat*";

(f) there are no Recovery Plans prepared or in preparation for any of the five microchiropteran bat species. No threat abatement plans are of specific relevance to the proposed works;

(g) 'Clearing of native vegetation', 'Loss of hollow-bearing trees', and 'Removal of dead wood and dead trees' are listed as Key Threatening Processes under the TSC Act, and are of relevance to the proposed works and microchiropteran bats. The increase in effect of relevant key threatening processes would be minor, and would be compensated in accordance with current best practice.

5.2.2 Swamp Oak Floodplain Forest

In summary of the detailed assessment in Appendix 4:

(a) not applicable;

(b) not applicable;

(c) the proposed works would result in loss of 0.37 ha of Swamp Oak Floodplain Forest from a local occurrence of approximately 8 ha (a loss of 4%). The proposed works would not modify the composition of retained areas of this community. Retained vegetation would be protected through land zoning, and through implementation of vegetation management activities. The proposed works would not be likely to place the local occurrence of Swamp Oak Floodplain Forest at risk of extinction;

(d) the proposed works would remove approximately 0.37 ha of habitat for Swamp Oak Floodplain Forest. Approximately 3.5 ha of habitat for this community would be retained and protected within the focus area. The proposed works would not cause an area of habitat to become isolated from other areas of habitat for this community. The habitat that would be affected has previously been degraded through clearing

and earthworks, and would not be of particular importance for the long-term survival of the local occurrence of Swamp Oak Floodplain Forest;

(e) there is no declared "*critical habitat*" of relevance to the focus area. The proposed works would not affect any areas of "*critical habitat*";

(f) DECCW have prepared a '*Cumberland Plain Recovery Plan*' (Jan 2011), including actions for the recovery of Swamp Oak Floodplain Forest. The proposed works are generally consistent with the objectives of the recovery plan, and would not hinder implementation of the DECCW (Jan 2011) Cumberland Plain Recovery Plan. No threat abatement plans are of specific relevance to the proposed works;

(g) 'Clearing of native vegetation', 'Loss of hollow-bearing trees', 'Removal of dead wood and dead trees' and 'Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants' are listed as Key Threatening Processes under the TSC Act, and are of relevance to the proposed works and Swamp Oak Floodplain Forest. The increase in effect of these key threatening processes would be minor, and would be compensated in accordance with current best practice.

5.2.3 River-flat Eucalypt Forest

In summary of the detailed assessment in Appendix 4:

(a) not applicable;

(b) not applicable;

(c) the proposed works would result in loss of 0.45 ha of Eucalypt River-flat Forest from a local occurrence of approximately 1 ha (a loss of 45%). The proposed works would not modify the composition of retained areas of this community. Retained vegetation is contiguous with the vegetated Killarney Chain of Ponds corridor, and would be protected through land zoning, and through implementation of vegetation management activities. Loss of the small southern patch of this community, and the single isolated tree, would not be likely to place the local occurrence of Eucalypt River-flat Forest at risk of extinction;

(d) the proposed works would remove approximately 0.45 ha of habitat for Eucalypt River-flat Forest. Approximately 0.6 ha of habitat for this community would be retained and protected within the focus area. The proposed works would not cause an area of habitat to become isolated from other areas of habitat for this community. The habitat that would be affected has previously been degraded through clearing, grazing, earthworks and pasture management, and would not be of particular importance for the long-term survival of the local occurrence of Eucalypt River-flat Forest;

(e) there is no declared "*critical habitat*" of relevance to the focus area. The proposed works would not affect any areas of "*critical habitat*";

(f) DECCW have prepared a '*Cumberland Plain Recovery Plan*' (Jan 2011), including actions for the recovery of Eucalypt River-flat Forest. The proposed works are generally consistent with the objectives of the recovery plan, and would not hinder implementation of the DECCW (Jan 2011) Cumberland Plain Recovery Plan. No threat abatement plans are of specific relevance to the proposed works;

(g) 'Clearing of native vegetation', 'Loss of hollow-bearing trees', 'Removal of dead wood and dead trees' and 'Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants' are listed as Key Threatening Processes under the TSC Act, and are of relevance to the proposed works and Eucalypt River-flat Forest. The increase in effect of these key threatening

processes would be minor, and would be compensated in accordance with current best practice.

5.3 Conclusion

Based upon the considerations detailed in Appendix 1 and Appendix 4, and summarised above, the proposed development at Box Hill would not be "*likely*" to impose "*a significant effect*" upon any "*threatened species, population or ecological community*" listed on the schedules of the NSW TSC Act.

Further assessment of this proposal under the TSC Act is not required. A Species Impact Statement is not required. Concurrence of the Office of Environment & Heritage (OEH) is not required.

6 COMMONWEALTH EPBC ACT 1999

The *Commonwealth Environment Protection & Biodiversity Conservation Act 1999* requires that an action which has, will have or is likely to have a significant impact upon one or more matters of National Environmental Significance (NES) must be referred to the Commonwealth Minister for Environment & Heritage for approval. These actions are referred to as 'controlled actions'.

Matters of NES include World Heritage properties, listed Ramsar Wetlands of international importance, listed threatened species and communities, listed migratory species, nuclear actions and Commonwealth marine areas.

6.1 Matters of National Environmental Significance

A number of bird species listed as migratory under the EPBC Act are known to occur in the locality. Many of these would be expected to occur within the focus area on occasions.

No other matters of NES are likely to be affected by the proposed works.

6.2 Requirement for Referral to the Commonwealth

6.2.1 Migratory Species

An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

- substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species;
- result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species; or
- seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

An area of 'important habitat' for a migratory species is:

a) habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species; and/or

b) habitat that is of critical importance to the species at particular life-cycle stages; and/or

c) habitat utilised by a migratory species which is at the limit of the species range; and/or

d) habitat within an area where the species is declining.

The proposed works would not be likely to impose a significant impact upon migratory species on the basis that:

- the extent of loss of potential habitat would be negligible in relation to that to be retained within the focus area and in the locality;
- the proposed works would not result in establishment of invasive species harmful to the listed migratory species;
- the proposed works would not disrupt the life-cycle of an ecologically significant proportion of a population of the listed migratory species.

6.3 Conclusion

The proposed works at Box Hill would not be likely to impose a significant impact upon any matter of NES.

On this basis there is no requirement to refer the proposal to the Commonwealth Minister for Environment and Heritage under the EPBC Act.

7 SEPP 44 – KOALA HABITAT PROTECTION

7.1 Lands to which SEPP 44 applies

SEPP 44 applies to lands for which a development application has been made, which are greater than 1 hectare in size, and which are located within local government areas listed in Schedule 1 of SEPP 44.

The subject site is greater than 1 hectare in size. The Baulkham Hills Shire (now The Hills Shire) Local Government Area is listed in Schedule 1. Therefore, SEPP 44 applies to the proposed works.

7.2 Part 1 - Is the land 'potential koala habitat'?

SEPP 44 defines 'potential koala habitat' as "*areas of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component*".

Koala 'feed tree species' listed in Schedule 2 of SEPP 44 are:

Forest red gum	*Eucalyptus tereticornis*
Tallowwood	*Eucalyptus microcorys*
Grey Gum	*Eucalyptus punctata*
Ribbon or manna gum	*Eucalyptus viminalis*
River red gum	*Eucalyptus camaldulensis*
Broad leaved scribbly gum	*Eucalyptus haemastoma*
Scribbly gum	*Eucalyptus signata*
White box	*Eucalyptus albens*
Bimble box or poplar box	*Eucalyptus populnea*
Swamp mahogany	*Eucalyptus robusta*

The tree canopy across the subject site includes *Eucalyptus tereticornis*, which is listed as a 'feed tree species'.

This species may comprise more than 15% of the tree canopy in some parts of the subject site.

The subject site, therefore, <u>may</u> constitute '*potential koala habitat*' as defined by SEPP 44.

7.3 Part 2 - Is the land 'core koala habitat'?

SEPP 44 defines 'core koala habitat' 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*".

No Koala's have been recorded on or are known to occur within the subject site. There is no evidence that a resident population of koalas occurs on or utilises the site.

The subject site does <u>not</u> constitute '*core koala habitat*'.

7.4 Part 3 - Is a Plan of Management required?

SEPP 44 states that "*before a council may grant consent to a development application for consent to carry out development on land to which this Part applies that it is satisfied is a core*

koala habitat, there must be a plan of management prepared in accordance with Part 3 that applies to the land".

The subject site may constitute 'potential koala habitat', but does not constitute '*core koala habitat*' as defined by SEPP 44.

There is no requirement to prepare a formal plan of management in accordance with Part 3 of SEPP 44.

8 SEPP (SYDNEY REGION GROWTH CENTRES) 2006

Clauses relevant to *Zone E2 Environmental Conservation* of the 'The Hills Growth Centre Precincts Plan 2013' are addressed below.

8.1 Part 6.2 – native vegetation retention areas and riparian protection areas

8.1.1 Clause 6

The proposed works would retain virtually all native vegetation (approximately 5.1 ha) within the E2 Zone.

Loss of vegetation for the proposed Mt Carmel Road crossing (Area B on Figure 4) has been minimised to the greatest extent possible (approximately 0.15 ha), and is substantially less than that which would be affected with the current planned crossing.

Other areas of proposed vegetation loss within the focus area are not designated as native vegetation retention or riparian protection areas.

The relative extent of native vegetation that would be removed is minor, such that an effect on salinity would not be likely.

An extensive revegetation program is proposed, as set out in the separate Vegetation Management Plan. The total extent of the E2 zone within the focus area is 17.38 ha.

Total loss of vegetation within designated native vegetation retention areas and riparian protection areas is less than 0.5ha.

8.1.2 Clause 7

The proposed works have been designed to avoid impacts on native vegetation. The extent of impact is minimal, and would be compensated by extensive revegetation and rehabilitation works (as set out in the separate Vegetation Management Plan).

There would be a net beneficial effect on biodiversity values within the focus area.

8.2 Clause 6.3 – existing native vegetation

A small area of existing native vegetation would be removed from the E2 Zone, for the relocation of the Mt Carmel Road crossing.

This area, however, is substantially less than the extent of existing vegetation that would be removed for the current planned location for the Mt Carmel Road crossing, which runs through the middle of the main patch of Swamp Oak Forest.

In summary, the proposed location would result in a decrease in the amount of vegetation to be removed, reducing the impact of urban development on the Swamp Oak Floodplain Forest, an Endangered Ecological Community listed under the *NSW Threatened Species Conservation Act 1995*. The relocation of the Mt Carmel Road crossing would have a positive outcome for biodiversity.

8.3 Clause 6.4 – development on lots wholly or partly within Zone E2

A separate Vegetation Management Plan is being prepared to document vegetation management and revegetation works within the E2 Zone.

The Vegetation Management Plan will address:

i. The environmental values of the land;

ii. Methods to be used to revegetate and rehabilitate the land;

iii. Weed control;

iv. The monitoring and ongoing management of the land;

v. Other measures to control threats to the health of any remnant riparian vegetation on the land, and to increase species diversification and riparian vegetation cover on the land, and to improve the land's resistance to future weed colonisation.

9 CONCLUSIONS AND RECOMMENDATIONS

9.1 NSW Threatened Species Conservation Act 1995

The proposed development at Box Hill would not be "*likely*" to impose "*a significant effect*" upon any "*threatened species, population or ecological community*" listed on the schedules of the NSW TSC Act.

Further assessment of this proposal under the TSC Act is not required. A Species Impact Statement is not required. Concurrence of the Office of Environment & Heritage (OEH) is not required.

9.2 Commonwealth Environment Protection & Biodiversity Conservation Act 1999

The proposed development at Box Hill would not be likely to impose a significant impact upon any matter of NES.

On this basis there is no requirement to refer the proposal to the Commonwealth Minister for Environment and Heritage under the EPBC Act

9.3 SEPP 44

The subject site may constitute 'potential koala habitat', but does not constitute '*core koala habitat*' as defined by SEPP 44.

There is no requirement to prepare a formal plan of management in accordance with Part 3 of SEPP 44.

9.4 SEPP (Sydney Region Growth Centres) 2006

The proposed creek rehabilitation and bulk earthworks have been designed to avoid and minimise disturbance to native vegetation within the E2 Zone as far as practicable. Residual impacts would be substantially compensated through rehabilitation of currently cleared parts of the E2 Zone.

The proposed relocation of the Mt Carmel Road crossing would result in a decrease in the amount of vegetation to be removed, reducing the impact of urban development on the Swamp Oak Floodplain Forest, an Endangered Ecological Community listed under the *NSW Threatened Species Conservation Act 1995*. The relocation of the Mt Carmel Road crossing would have a positive outcome for biodiversity.

9.5 Recommendations

The following environmental management measures are regarded part of the proposed development:

- avoidance of loss of native trees to the greatest extent practicable (Chapter 4.2.1);
- installation of sediment and erosion control features in accordance with current engineering standards (Chapter 4.2.2);
- induction procedures which emphasize the importance of existing native vegetation for all contractors working within the E2 zone, including inspection of each section of the creekline with the project manager (Chapter 4.2.2);
- implementation of a Tree Removal Protocol, as set out in Table 2, for all tree clearing work on the site (Chapter 4.2.2);
- implementation of an Vegetation Management Plan for the riparian corridor (Chapter 4.2.3);
- revegetation of currently cleared land within the riparian corridor (Chapter 4.2.3);

- installation of nest-boxes at the rate of 1 box per 10m length of creekline. Boxes to be suitable alternately for microchiropteran bats, and for parrots (Chapter 4.2.3);

The following additional environmental management measures should be implemented to avoid, manage and minimise impacts upon native flora and fauna to the greatest extent practicable:

- construction of vehicle barriers along the edge of the riparian corridor upon completion of works, to prevent non-authorised vehicular access to these lands;
- all work boots, machinery and equipment should be cleaned prior to entering the site, and before being transferred to another site, to minimise the risk of transferring soil-borne pathogens and fungi;
- material stockpiles, vehicle parking and machinery storage should be located on existing cleared land, and not within 10m of the outer edge of the canopy of native trees that are to be retained;
- future landscaping of the site (for lands not covered by the Vegetation Management Plan) should use a high proportion of locally indigenous native plant species. Landscaping should not use any exotic or non-indigenous species that are known to be invasive in areas of native bushland.

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FLORA AND FAUNA ASSESSMENT

PROPOSED CREEK REHABILITATION & BULK EARTHWORKS,
INCLUDING RELOCATION OF THE MT CARMEL ROAD CROSSING

WINDSOR ROAD & BOUNDARY ROAD,
BOX HILL

APPENDIX 1

Threatened fauna species known to occur in the locality

April 2014

APPENDIX 1

Threatened flora and fauna species known to occur within 10km of the subject site (Bionet database), data obtained April 2013.

Species/Status	Records in 10km	Habits and Specific Habitat Requirements	Habitat within the site	Records on site	Further consideration
FLORA					
Acacia bynoeana E (TSC) V (EPBC)	27	Shrub, occurs in central eastern NSW, from the Hunter District to the Southern Highlands and west to the Blue Mountains. Occurs in heath or dry sclerophyll forest on sandy soils. Seems to prefer open, sometimes slightly disturbed sites. Associated overstorey species include Red Bloodwood, Scribbly Gum, Parramatta Red Gum, Saw Banksia and Narrow-leaved Apple. OEH profile (Feb 2013).	X	X	Not required.
Acacia gordonii E (TSC) E (EPBC)	16	Shrub, restricted to the NW of Sydney, and known from only a few locations. Grows in dry sclerophyll forest and heathlands amongst or within rock platforms on sandstone outcrops. Flowers August to September and produces fruit October to February. Fire promotes germination of the soil stored seedbank and seed germination will not occur in the absence of fire. OEH Profile (Aug 2013).	X	X	Not required.
Acacia pubescens V (TSC) V (EPBC)	60	Shrub, confined to the Sydney district, with most occurrences on the Cumberland Plain. It is concentrated in the Bankstown-Fairfield-Rookwood area and around Pitt Town, near Windsor, with outliers occurring at Barden Ridge, near Sutherland; Oakdale; and at Mountain Lagoon. Occurs on ridges, hillsides and flat areas, at altitudes up to 650 m asl, in gravelly clay or sandy soils on alluviums, shales and at the interface between shales and sandstones. These soils contain ironstone, are usually low in nutrients and are well drained. Average annual rainfall is 700-1200 mm. Grows in dry open sclerophyll forest, woodland and *Melaleuca* scrub. Associated species include *Eucalyptus gummifera, E. sieberi, E. punctata, E. fibrosa, E. moluccana, Acacia suaveolens, A. ulicifolia, A. brownii, A. parramattensis, A. falcata, Bursaria spinosa, Corymbia maculata, M. nodosa, M. stypheliodes, M. decora* and *Angophora bakeri*. SPRAT Profile (Aug 2013).	Unlikely.	X	Not required.

Species/Status	Records in 10km	Habits and Specific Habitat Requirements	Habitat within the site	Records on site	Further consideration
Darwinia biflora V (TSC) V (EPBC)	524	Shrub, the northern, southern, eastern and western limits of the range are at Maroota, North Ryde, Cowan and Kellyville, respectively. Occurs on the edges of weathered shale-capped ridges, where these intergrade with Hawkesbury Sandstone. Associated overstorey species include *Eucalyptus haemastoma, Corymbia gummifera* and/or *E. squamosa*. The vegetation structure is usually woodland, open forest or scrub-heath. Flowers throughout the year but concentrated in autumn, with mature fruits being produced from May to August. Fire is an important factor in the life cycle of this species. Fire kills all plants, but produces a flush of germination from seed stored in the soil. The number of individuals at a site then declines with time since fire, as the surrounding vegetation develops. OEH Profile (Aug 2013).	X	X	Not required.
Dillwynia tenuifolia V (TSC) E pop (TSC)	74	Shrub, core distribution is the Cumberland Plain. Disjunct occurrences outside the Cumberland Plain include Yengo, Kurrajong Heights and Woodford. May be locally abundant particularly within scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays. May also be common in transitional areas where these communities adjoin Castlereagh Scribbly Gum Woodland. At Yengo it occurs in disturbed escarpment woodland on Narrabeen sandstone. Dominant canopy tree is usually *Eucalyptus fibrosa*. Other trees present or co-dominant are *E globoidea*, *E. longifolia*, *E. parramattensis*, *E. sclerophylla* and *E. sideroxylon*, with *Melaleuca decora* frequently forming a secondary canopy layer. At Yengo, associated tree species include *E eximia*, *E. punctata*, *E. sparsifolia* and *Callitris endlicheri*. Flowering occurs sporadically from August to March. Killed by fire and re-establishes from soil-stored seed. Abundance is influenced by past disturbance history, with prolific seed germination in response to fire. OEH Profile (Aug 2013).	X	X	Not required.

Species/Status	Records in 10km	Habits and Specific Habitat Requirements	Habitat within the site	Records on site	Further consideration
Epacris purpurascens var. purpurascens V (TSC)	155	A straggly shrub recorded from Gosford in the north, to Narrabeen in the east, Silverdale in the west and Avon Dam vicinity in the South. Found in a range of habitat types, most of which have a strong shale soil influence. OEH Profile (Feb 2013).	Potential.	X	Identified as a 'subject species'. Refer to Chapter 2.3 of the main report.
Eucalyptus nicholii V (TSC) V (EPBC)	3	Tree, sparsely distributed but widespread on the New England Tablelands from Nundle to north of Tenterfield, being most common in central portions of its range. Widely planted outside of this region as urban trees, windbreaks and corridors. Grows in dry grassy woodland, on shallow soils of slopes and ridges, primarily on infertile soils derived from granite or metasedimentary rock. OEH Profile (Aug 2013).	X	X	Not required.
Eucalyptus sp Cattai E (TSC)	29	Tree, occurs in the area between Colo Heights and Castle Hill, in NW Sydney, with historical records from central Sydney. Occurs as a rare emergent tree in scrub, heath and low woodland on sandy soils, usually as isolated individuals or occasionally in small clustered groups. The sites at which it occurs are generally flat and on ridge tops. Associated soils are laterised clays overlying sandstone. OEH Profile (Aug 2013).	X	X	Not required.
Grevillea parviflora ssp *supplicans* E (TSC)	37	Shrub, has a very restricted known distribution (approx 8 x 10 km) confined to the NW of Sydney near Arcadia and the Maroota–Marramarra Creek area. Known from only a few locations. Occurs in heathy woodland on skeletal sandy soils over massive sandstones. It is strongly associated with clay-capped ridged of the Lucas Heights and Faulconbridge soil landscapes, but is quite restricted within these areas, suggesting it has a preference for yellow clays with periodically impeded drainage. May have an affinity with disturbance margins such as trail and road verges where soils are suitable and the availability of light due to clearing has promoted its growth. May be associated with the margins of the Sydney Turpentine Ironbark Forest, and to a greater extent, with Shale/Sandstone Transition Forest. Flowering is from August to November. OEH Profile (Aug 2013).	X	X	Not required.

Species/Status	Records in 10km	Habits and Specific Habitat Requirements	Habitat within the site	Records on site	Further consideration
Grevillea juniperina ssp *juniperina* V (TSC)	127	Shrub, endemic to Western Sydney in an area bounded by Blacktown, Erskine Park, Londonderry and Windsor, with outlier populations at Kemps Creek and Pitt Town. Grows on reddish clay to sandy soils derived from Wianamatta Shale and Tertiary alluvium (often with shale influence), typically containing lateritic gravels. Recorded from Cumberland Plain Woodland, Castlereagh Ironbark Woodland, Castlereagh Scribbly Gum Woodland and Shale/Gravel Transition Forest. Associated canopy species within Cumberland Plain Woodland and Shale/Gravel Transition Forest include *Eucalyptus tereticornis, E. moluccana, E. crebra, E. fibrosa* and *E. eugenioides*. In Castlereagh Woodland on more sandy soils the dominant canopy species are *Eucalyptus fibrosa, E. sclerophylla, Angophora bakeri* and *Melaleuca decora*. Flowering may occur sporadically throughout the year, but particularly between July and October. Plants are killed by fire with regeneration solely from soil-stored seed. Fire leads to a sudden increase in the recruitment of seedlings. Physical disturbance of the soil appears to result in an increase in seedling recruitment. Has a tendency to colonise mechanically disturbed areas. OEH Profile (Aug 2013).	Potential.	X	Identified as a 'subject species'. Refer to Chapter 2.3 of the main report.
Hibbertia superans E (TSC)	148	Shrub, occurs from Baulkham Hills to South Maroota in northern Sydney, where there are 16 known sites, and one locality at Mount Boss, inland from Kempsey. Occurs on sandstone ridgetops often near the shale/sandstone boundary. Occurs in both open woodland and heathland, and appears to prefer open disturbed areas, such as tracksides. Highly sensitive to both frequent and infrequent fire and other disturbance regimes. The recommended maximum fire interval is 25 years. Flowering time is July to December. OEH Profile (Aug 2013).	X	X	Not required.
Lasiopetalum joyceae V (TSC) V (EPBC)	1	Has a restricted range occurring on lateritic to shaley ridgetops on the Hornsby Plateau south of the Hawkesbury River. Currently known from 34 sites between Berrilee and Duffys Forest. Grows in heath on sandstone. OEH Profile (Aug 2013).	X	X	Not required.

Species/Status	Records in 10km	Habits and Specific Habitat Requirements	Habitat within the site	Records on site	Further consideration
Leucopogon fletcheri ssp *fletcheri* E (TSC)	26	Shrub, restricted to NW Sydney between St Albans and Annangrove. Occurs in dry eucalypt woodland or in shrubland on clayey lateritic soils, generally on flat to gently sloping terrain along ridges and spurs. Flowers August to September. Fruit produced October. OEH Profile (Aug 2013).	X	X	Not required.
Melaleuca deanei V (TSC) V (EPBC)	3	Shrub, occurs in two distinct areas: Ku-ring-gai/Berowra and Holsworthy/Wedderburn. There are also more isolated occurrences in Springwood, Wollemi National Park, Yalwal and Central Coast areas. Grows in heath on sandstone. OEH Profile (Feb 2013).	X	X	Not required.
Micromyrtus blakelyi V (TSC) V (EPBC)	2	Shrub, restricted to areas near the Hawkesbury River, north of Sydney. Distribution extends from north of Maroota in the north, to Cowan in the south. Typically occurs within heathlands in shallow sandy soil in cracks and depressions of sandstone rock platforms. Flowers from Sept to Nov and produces fruit Oct to Nov. OEH Profile (Aug 2013).	X	X	Not required.
Micromyrtus minutiflora E (TSC) V (EPBC)	6	Shrub, restricted to the general area between Richmond and Penrith, NW Sydney. Grows in Castlereagh Scribbly Gum Woodland, Ironbark Forest, Shale/Gravel Transition Forest, open forest on tertiary alluvium and consolidated river sediments. Sporadic flowering, June to March. OEH Profile (Aug 2013).	X	X	Not required.
Olearia cordata V (TSC) V (EPBC)	1	Shrub, endemic to NSW with a scattered distribution generally restricted to the SW Hunter Plateau, eastern Colo Plateau, and the far NW of the Hornsby Plateau near Wisemans Ferry east of Maroota. Grows in dry open sclerophyll forest and open shrubland, on sandstone ridges. Flowers November to May, with seed released from February to May. Abundant seedlings have been observed following fire, but seeds are also capable of germinating in the absence of fire as there is no seed dormancy with this species and germination should occur with any significant rains soon after seed release. OEH Profile (Aug 2013).	X	X	Not required.

Species/Status	Records in 10km	Habits and Specific Habitat Requirements	Habitat within the site	Records on site	Further consideration
Persoonia hirsuta E (TSC) E (EPBC)	36	Shrub, a scattered distribution around Sydney, from Singleton in the north, along the east coast to Bargo in the south and to the Blue Mountains to the west. Found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone. OEH Profile (Feb 2013).	X	X	Not required.
Persoonia mollis E (TSC) E (EPBC)	1	Shrub, highly restricted distribution, known from the Hornsby Heights-Mt Colah area north of Sydney. Occurs in three populations located over an approximate north-south range of 5.75 km and east-west distance of 7.5 km. Additional locations may exist outside the current distribution. Occurs in sheltered aspects of deep gullies or on the steep upper hillsides of narrow gullies on Hawkesbury Sandstone. These habitats support relatively moist, tall forest vegetation communities, often with warm temperate rainforest influences. Associated species: *Angophora costata*, *Eucalyptus piperita*, *Corymbia gummifera*, *Syncarpia glomulifera*, *Ceratopetalum apetalum* and *Callicoma serratifolia*. Flowers late December – March. OEH Profile (Aug 2013).	X	X	Not required.
Pimelea curviflora var *curviflora* V (TSC V (EPBC)	88	Shrub, occurs on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands. Also recorded in Illawarra Lowland Grassy Woodland habitat at Albion Park on the Illawarra coastal plain. Has an inconspicuous cryptic habit as it is fine and scraggly and often grows amongst dense grasses and sedges. It may not always be visible at a site as it appears to survive for some time without any foliage after fire or grazing, relying on energy reserves in its tuberous roots. Flowers October to May. OEH profile (Feb 2013).	X	X	Not required.

Species/Status	Records in 10km	Habits and Specific Habitat Requirements	Habitat within the site	Records on site	Further consideration
Pimelea spicata E (TSC E (EPBC)	8	A shrub found on the Cumberland Plain and the Illawarra. In both areas it is found on well-structured clay soils. On the Cumberland Plain sites it is associated with Grey Box communities (particularly Cumberland Plain Woodland variants and Moist Shale Woodland) and in areas of ironbark. The co-occurring species in the Cumberland Plain sites are *Eucalyptus moluccana*, *E. tereticornis* and *E. crebra*. *Bursaria spinosa* is often present at sites (and may be important in protection from grazing) and *Themeda australis* is usually present in the groundcover (also indicative of a less intense grazing history). OEH Profile (Aug 2013).	Potential.	X	Identified as a 'subject species'. Refer to Chapter 2.3 of the main report.
Pultenaea parviflora E (TSC) V (EPBC)	82	Shrub, endemic to the Cumberland Plain. Core distribution is from Windsor to Penrith and east to Dean Park. Also at Kemps Creek and Wilberforce. May be locally abundant, particularly within scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays. May also be common in transitional areas where these communities adjoin Castlereagh Scribbly Gum Woodland. Dominant canopy tree is usually *E fibrosa*. Other trees present are *E globoidea*, *E. longifolia*, *E. parramattensis*, *E. sclerophylla* and *E. sideroxylon*, with *Melaleuca decora* frequently forming a secondary canopy layer. Flowering between Aug and Nov. Germination can be prolific after a moderate to high intensity fire. OEH Profile (Aug 2013).	X	X	Not required.
Syzygium paniculatum E (TSC) V (EPBC)	5	A small to medium sized rainforest tree found only in NSW, in a narrow, linear coastal strip from Upper Lansdowne to Conjola State Forest. On the south coast it occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest. On the central coast it occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest. OEH Profile (Aug 2013).	X	X	Not required.

Species/Status	Records in 10km	Habits and Specific Habitat Requirements	Habitat within the site	Records on site	Further consideration
Tetratheca glandulosa V (TSC) V (EPBC)	65	Herb, with approx 150 populations ranging from Sampons Pass in the north to West Pymble in the south, east to Ingleside and west to East Kurrajong. Associated with shale-sandstone transition habitat where shale-cappings occur over sandstone, with associated soil landscapes. Topographically, the plant occupies ridgetops, upper-slopes and to a lesser extent mid-slope sandstone benches. Soils are generally shallow, consisting of a yellow, clayey/sandy loam. Stony lateritic fragments are also common in the soil profile on many of these ridgetops. Vegetation structure varies from heaths and scrub to woodlands/open woodlands, and open forest. Vegetation communities correspond broadly to Benson & Howell's Sydney Sandstone Ridgetop Woodland (Map Unit 10ar). Common woodland tree species include: *Corymbia gummifera, C. eximia, Eucalyptus haemastoma, E. punctata, E. racemosa*, and/or *E. sparsifolia*, with an understorey dominated by species from the families Proteaceae, Fabaceae, and Epacridaceae. Flowers July-November however residual flowers may persist until late December. OEH Profile (Aug 2013).	X	X	Not required.
Zieria involucrata E (TSC) V (EPBC)	154	Shrub, with a disjunct distribution north and west of Sydney. Recent records come from 22 populations in the catchments of the Macdonald, Colo and Hawkesbury Rivers between Melon Creek and Mogo Creek in the north to Little Cattai Creek and Wheeny Creek in the south and from a single population in the upper Blue Mountains north of Katoomba. Found primarily on quaternary alluvium in sheltered forests on mid- to lower slopes and valleys, e.g. in or adjacent to gullies which support sheltered forest, although some populations extend upslope into drier vegetation. Also known from at least two atypical ridgetop locations. The canopy typically includes *Syncarpia glomulifera* subsp. *glomulifera*, *Angophora costata*, *Eucalyptus agglomerata* and *Allocasuarina torulosa*. Flowering usually takes place in spring. OEH Profile (Aug 2013).	X	X	Not required.

Species/Status	Records in 10km	Habits and Specific Habitat Requirements	Habitat within the site	Records on site	Further consideration
FAUNA					
BIRDS					
Australasian Bittern *Botaurus poiciloptilus* E (TSC) E (EPBC)	2	In NSW, occurs along the coast as well as in wetlands of the Murrumbidgee and Lachlan Rivers, and is frequently recorded in the Murray-Darling Basin. Inhabits terrestrial and estuarine wetlands, generally where there is permanent water. Prefers freshwater, and wetlands with dense vegetation, including sedges, rushes and reeds. Also occurs in dense saltmarsh vegetation and in flooded grasslands. A shy and cryptic bird. During the day, it roosts on the ground amongst dense reeds. At dusk, the species forages in shallow water up to 30cm deep, primarily feeding on frogs, fish, invertebrates (including crayfish), leaves and fruit. It builds a foraging platform by trampling reeds and sedges. Platforms are often littered with prey remains. Generally sedentary, but often moves in response to flooding and drought. Nest is constructed of trampled reeds and rushes and is generally located amongst dense vegetation over shallow water. TS Profile (NPWS 1999).	X	X	Not required.
Black Bittern *Ixobrychus flavicollis* V (TSC)	1	In NSW, records are scattered along the east coast, with individuals rarely being recorded south of Sydney or inland. Inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. Where permanent water is present, the species may occur in flooded grassland, forest, woodland, rainforest and mangroves. Feeds mainly at dusk and at night on frogs, reptiles, fish and invertebrates. During the day, roosts in trees or on the ground amongst dense reeds. When disturbed, it freezes in a characteristic bittern posture (stretched tall, bill pointing up, so that shape and streaked pattern blend with upright stems of reeds), or will fly up to a branch or flush for cover where it will freeze again. Nests are located on a branch overhanging water and consist of a bed of sticks and reeds on a base of larger sticks. OEH Profile (Feb 2013).	X	X	Not required.

Species/Status	Records in 10km	Habits and Specific Habitat Requirements	Habitat within the site	Records on site	Further consideration
Freckled Duck *Stictonetta naevosa* V (TSC)	1	Found primarily in SE and SW Australia, occurring as a vagrant elsewhere. It breeds in large temporary swamps created by floods in the Bulloo and Lake Eyre basins and the Murray-Darling system. Prefers permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds. OEH Profile (Feb 2013).	X	X	Not required.
Spotted Harrier *Circus assimilis* V (TSC)	1	A wide-ranging bird of prey which occurs throughout the Australian mainland. Occurs in grassy open woodland including *Acacia* and mallee remnants, inland riparian woodland, grassland and shrub steppe. It is most common in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands. Builds a stick nest in a tree and lays eggs in spring (or sometimes autumn), with young remaining in the nest for several months. Preys on terrestrial mammals (eg bandicoots, bettongs, and rodents), birds and reptile, occasionally insects and rarely carrion. OEH Profile (Feb 2013).	Potential.	X	No nests recorded. Could potentially forage over the site on occasioms. Identified as a 'subject species'. Refer to Chapter 2.3 of the main report.
Little Eagle *Hieraaetus morphnoides* V (TSC)	7	A wide-ranging bird of prey which occurs throughout the Australian mainland. Occupies open eucalypt forest, woodland or open woodland. Sheoak or *Acacia* woodlands and riparian woodlands of interior NSW are also used. Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter. Preys on birds, reptiles and mammals, occasionally adding large insects and carrion. OEH Profile (Feb 2013).	Potential low quality.	X	No nests recorded. Could potentially forage over the site on occasios. Identified as a 'subject species'. Refer to Chapter 2.3 of the main report.
Square-tailed Kite *Lophoictinia isura* V (TSC)	1	A wide-ranging bird of prey with a broad distribution around coastal and subcoastal Australia. Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses. Occupies large hunting ranges of more than 100km^2. Is a specialist hunter of passerines, especially honeyeaters, and most particularly nestlings, and insects in the tree canopy, picking most prey items from the outer foliage. Nest sites are generally located along or near watercourses, in a fork or on large horizontal limbs. OEH Profile (Feb 2013).	Potential.	X	No nests recorded. Could potentially forage over the site on occasios. Identified as a 'subject species'. Refer to Chapter 2.3 of the main report.

Species/Status	Records in 10km	Habits and Specific Habitat Requirements	Habitat within the site	Records on site	Further consideration
Gang Gang Cockatoo *Callocephalon fimbriatum* V (TSC)	18	In NSW, it is distributed from the SE coast to the Hunter region, and inland to the Central Tablelands and SW slopes. It occurs regularly in the ACT. In summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter, may occur at lower altitudes in drier more open eucalypt forests and woodlands (particularly Box-Ironbark associations, and dry forest in coastal areas), and often found in urban areas. May also occur in sub-alpine Snow Gum *Eucalyptus pauciflora* woodland, and occasionally in temperate rainforests. Favours old growth attributes for nesting and roosting. OEH Profile (Feb 2013). Nests in hollows in large old live trees, usually close to water. Shows strong nest site fidelity. Breeding occurs mainly in tall mature wet sclerophyll forests with a dense understorey (NSW Scientific Committee). Feeds on seeds, fruits and berries, including of introduced plant species. Tends to exhaust one food supply before moving to another (Blakers *et al* 1984).	Potential winter non-breeding habitat.	X	Identified as a 'subject species'. Refer to Chapter 2.3 of the main report.
Glossy Black Cockatoo *Calyptorhynchus lathami* V (TSC)	20	Uncommon although widespread throughout suitable forest and woodland habitats, inland to the southern tablelands and central western plains of NSW, with a small population in the Riverina. Inhabits open forest and woodlands of the coast and the Great Dividing Range up to 1000 m in which stands of She-oak species, particularly Black She-oak (*Allocasuarina littoralis*), Forest She-oak (*A. torulosa*) or Drooping She-oak (*A. verticillata*) occur. In the Riverina, can also occur in woodlands dominated by Belah (*Casuarina cristata*). Prefers intact landscapes (NPWS 1999; DEC 2004a). Characteristically occurs on sites with low soil nutrient status (Blakers et al 1984; NPWS 1999). Feeds almost exclusively on the seeds of several species of she-oak (*Casuarina* and *Allocasuarina* species), shredding the cones with the massive bill. Dependent on large hollow-bearing eucalypts for nest sites. One or two eggs are laid between March and August. OEH Profile (Feb 2013).	Potential low quality.	X	Identified as a 'subject species'. Refer to Chapter 2.3 of the main report.

Species/Status	Records in 10km	Habits and Specific Habitat Requirements	Habitat within the site	Records on site	Further consideration
Little Lorikeet *Glossopsitta pusilla* V (TSC)	13	Distributed widely across the coastal and Great Divide regions of eastern Australia. Nomadic movements are common, influenced by season and food availability. Forages primarily in the canopy of open *Eucalyptus* forest and woodland, yet also finds food in *Angophora, Melaleuca* and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Will also use isolated flowering trees in open country, e.g. paddocks, roadside remnants and urban trees. Roosts in treetops, often distant from feeding areas. Nests in proximity to feeding areas if possible, most typically selecting hollows in the limb or trunk of smooth-barked Eucalypts. Entrance is small (3 cm) and usually high above the ground (2–15 m). These nest sites are often used repeatedly for decades, suggesting that preferred sites are limited. Riparian trees often chosen, including species like *Allocasuarina*. OEH Profile (Feb 2013).	Potential.	X	Identified as a 'subject species'. Refer to Chapter 2.3 of the main report.
Swift Parrot *Lathamus discolor* E (TSC) E (EPBC)	6	Breeds in Tasmania during spring and summer, migrating to the mainland between March and October (to Victoria, eastern South Australia, the coast and south west slopes of NSW, and SE Queensland). On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany *Eucalyptus robusta*, Spotted Gum *Corymbia maculata*, Red Bloodwood *C. gummifera*, Mugga Ironbark *E. sideroxylon*, and White Box *E. albens*. Commonly uses lerp-infested trees include Inland Grey Box *E. microcarpa*, Grey Box *E. moluccana* and Blackbutt *E. pilularis*. OEH Profile (Feb 2013).	Unlikely.	X	Not required.
Turquoise Parrot *Neophema pulchella* V (TSC)	1	Occurs from the coastal plains to the western slopes of the Great Dividing Range, on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. Prefers to feed in the shade of a tree and spends most of the day on the ground searching for the seeds or grasses and herbaceous plants, or browsing on vegetable matter. Nests in tree hollows, logs or posts, from August to December.	Potential.	X	Identified as a 'subject species'. Refer to Chapter 2.3 of the main report.

Species/Status	Records in 10km	Habits and Specific Habitat Requirements	Habitat within the site	Records on site	Further consideration
Barking Owl *Ninox connivens* V (TSC)	3	Found throughout continental Australia except for the central arid regions. Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. Hunting can extend into closed forest and more open areas. Sometimes able to successfully breed along timbered watercourses in heavily cleared habitats (e.g. western NSW) due to the higher density of prey on these fertile soils. Requires very large permanent territories in most habitats due to sparse prey densities. Monogamous pairs hunt over as much as 6000 hectares, with 2000 hectares being more typical in NSW habitats Roosts in shaded portions of tree canopies, including tall midstorey trees with dense foliage such as *Acacia* and *Casuarina* species. Nests in hollows of large, old trees. Living eucalypts are preferred though dead trees are also used. Nest sites are used repeatedly over years by a pair, but they may switch sites if disturbed by predators *eg* goannas. OEH Profile (Feb 2013).	Unlikely.	X	Not required.
Powerful Owl *Ninox strenua* V (TSC)	54	In NSW it is widely distributed throughout the eastern forests, from the coast to the tablelands. Inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. Requires large tracts of forest or woodland habitat, but can occur in fragmented landscapes. Breeds and hunts in sclerophyll forest or woodlands and occasionally hunts in open habitats. Roosts by day in dense vegetation such as Turpentine *Syncarpia glomulifera*, Black She-oak *Allocasuarina littoralis*, Blackwood *Acacia melanoxylon*, Rough-barked Apple *Angophora floribunda*, Cherry Ballart *Exocarpus cupressiformis* and a number of eucalypt species. Main prey is medium-sized arboreal marsupials, particularly the Greater Glider, Common Ringtail Possum and Sugar Glider. As most prey species require hollows and a shrub layer, these are important habitat components for the owl. Prefers to forage in moist unlogged forest in gully systems (Blakers 1984). Pairs are believed to have high fidelity to a small number of nest trees and will defend a large home range of 400-1450 ha. Nests in large tree hollows (at least 0.5 m deep), in large eucalypts (DBH of 80-240 cm) that are at least 150 years old. Nesting sites are typically in unlogged unburnt gullies and lower slopes. The male roosts in a "grove" of up to 20-30 trees, situated within 100-200 metres of the nest tree where the female shelters. OEH Profile (Feb 2013).	Unlikely.	X	Not required.

Species/Status	Records in 10km	Habits and Specific Habitat Requirements	Habitat within the site	Records on site	Further consideration
Masked Owl *Tyto novaehollandiae* *V* (TSC)	7	Inhabits eucalypt forest and woodland from the coast to the western plains (DEC 2005a). It is most abundant within 300km of the coast (DEC 2005a; Blakers *et al* 1984). Optimal habitat includes a mosaic of sparse (grassy) and dense (shrubby) groundcover on gentle terrain (DEC 2005a). A sedentary species which occupies permanent territories 500-1000 ha in size (Blakers *et al* 1984). Nocturnal, roosts by day in hollows, in cover of dense vegetation in gullies or in caves (Blakers *et al* 1984; Lindsey 1992; DEC 2005a). Roosts at least 5m above the ground (DEC 2005a). Forages at forest edges or in partial clearing for small terrestrial mammals including rabbits, supplemented by some arboreal mammals, bats and birds (Blakers *et al* 1984; Lindsey 1992; DEC 2005a)). Nests in tree hollows greater than 40cm wide and greater than 100cm deep. No relationship with distance to streams. Entrances are at least 3m above the ground in trees with DBH of at least 90cm. Generally faithful to traditional hollows (DEC 2005a).	X	X	Not required.
Sooty Owl *Tyto tenebricosa* V (TSC)	8	Inhabits tall moist eucalypt forests and rainforests of the escarpment and coastal areas along the southeastern coastline of Australia (DEC 2005a; Lindsey 1992). Sooty Owls are strongly associated with sheltered gullies, particularly those with a tall dense understorey (DEC 2005a) Nocturnal, feeds mainly on terrestrial mammals, to a lesser extent arboreal mammals and occasionally birds (Blakers *et al* 1984). A sedentary species which occupies permanent territories 200-800 ha in size (Blakers *et al* 1984). Generally roosts in dense foliage in rainforest gullies, caves, and crevices in cliffs, in the darkest and most secluded positions in the forest, usually less than 100m from streams (DEC 2005a). Nests in a large high tree cavity greater than 40cm wide and 100cm deep, usually in a live tree but occasionally in stags, surrounded by canopy. Also nests in caves (DEC 2005a; Lindsey 1992). Nest sites are generally in unlogged unburnt gullies and lower slopes within 100m of streams. Faithful to traditional hollows (DEC 2005a).	X	X	Not required.

Species/Status	Records in 10km	Habits and Specific Habitat Requirements	Habitat within the site	Records on site	Further consideration
Brown Treecreeper *Climacteris picumnus victoriae* V (TSC)	1	Occurs in eucalypt forests and woodlands of the inland plains and slopes of the Great Dividing Range. Less common on the coastal plains and ranges. Prefers woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species. Also found in mallee and River Red Gum (*Eucalyptus camaldulensis*) Forest bordering wetlands with an open understorey of acacias, saltbush, lignum, cumbungi and grasses. Usually not found in woodlands with a dense shrub layer. Fallen timber is an important habitat component for foraging. Population declines have occurred in remnant vegetation fragments smaller than 300 ha, that have been isolated or fragmented for more than 50 years. Requires hollows in standing dead or live trees and tree stumps for nesting. Sedentary, gregarious and usually observed in pairs or small groups of 8 to 12 birds. Terrestrial and arboreal in about equal proportions. It is active, noisy and conspicuous while foraging on trunks and branches of trees and amongst fallen timber. Feeds primarily on invertebrates, also on nectar and sap. OEH Profile (Aug 2013).	Unlikely due to extent and history of fragmented and isolated habitats within site. 'tidy' farmland with very little fallen timber.	X	Not required.
Speckled Warbler *Cthonicola sagittata* V (TSC)	166	Has a patchy distribution throughout SE Queensland, eastern NSW and into Victoria. Most frequently reported from the hills and tablelands of the Great Dividing Range, and rarely from the coast. Inhabits a wide range of *Eucalyptus* dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an area. Decline in population density exceeds 40% where no vegetation remnants larger than 100ha survive. Feeds on seeds and insects, mostly on the ground. Pairs are sedentary and occupy a breeding territory of about 10 ha, with a slightly larger home-range when not breeding. Builds a rounded, domed, roughly built nest of dry grass and strips of bark in a slight hollow in the ground or the base of a low dense plant, often among fallen branches and other litter. OEH Profile (Aug 2013).	Unlikely due to extent and history of fragmented and isolated habitats within site. 'tidy' farmland with very little understorey complexity.	X	Not required.

Species/Status	Records in 10km	Habits and Specific Habitat Requirements	Habitat within the site	Records on site	Further consideration
White-fronted Chat *Epthianura albifrons* V (TSC)	1	Found mostly in temperate to arid climates and very rarely sub-tropical areas, it occupies foothills and lowlands up to 1000 m above sea level. In NSW, it occurs mostly in the southern half of the state, in damp open habitats along the coast, and near waterways in the western part of the state. Along the coastline, it is found predominantly in saltmarsh vegetation but also in open grasslands and sometimes in low shrubs bordering wetland areas. Usually found foraging on bare or grassy ground in wetland areas. Nests are 'open-cups' built in low vegetation. Nests in the Sydney region have also been seen in low isolated mangroves. OEH Profile (Feb 2013).	X	X	Not required.
Black-chinned *Honeyeater* *Melithreptus gularis* gularis V (TSC)	5	In NSW, it is widespread, with records from the tablelands and western slopes of the Great Dividing Range to the NW and central-west plains and the Riverina. It is rarely recorded east of the Great Dividing Range. It has also been recorded at a few scattered sites in the Hunter, Central Coast and Illawarra regions, though it is very rare in the latter. Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (*Eucalyptus sideroxylon*), White Box (*E. albens*), Inland Grey Box (*E. microcarpa*), Yellow Box (*E. melliodora*), Blakely's Red Gum (*E. blakelyi*) and Forest Red Gum (*E. tereticornis*). Also inhabits open forests of smooth-barked gums, stringybarks, ironbarks, river sheoaks (nesting habitat) and tea-trees. A gregarious species usually seen in pairs and small groups of up to 12 birds. Feeding territories are large making the species locally nomadic. Recent studies have found that the Black-chinned Honeyeater tends to occur in the largest woodland patches in the landscape as birds forage over large home ranges of at least 5 hectares. Moves quickly from tree to tree, foraging rapidly along outer twigs, underside of branches and trunks, probing for insects. Nectar is taken from flowers, and honeydew is gleaned from foliage. Breeds from June to December. Builds a compact, suspended, cup-shaped nest placed high in the crown of a tree, in the uppermost lateral branches, hidden by foliage. OEH Profile (Aug 2013).	X	X	Not required.

Species/Status	Records in 10km	Habits and Specific Habitat Requirements	Habitat within the site	Records on site	Further consideration
Varied Sittella *Daphoenositta chrysoptera* V (TSC)	36	Inhabits eucalypt forests and woodlands, mallee and Acacia woodland. Occurs throughout most of mainland Australia, except the treeless deserts and open grasslands (NSW Scientific Committee). A sedentary species. Feeds on arthropods gleaned from crevices in rough or decorticating bark, and from dead twigs, branches or dead trees. Builds a cup-shaped nest of plant fibres and cobweb in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years (NSW Scientific Committee). Population viability is sensitive to habitat isolation, reduced patch size and habitat simplification, including reductions in tree species diversity, tree canopy cover, shrub cover, ground cover, logs, fallen branches and litter (NSW Scientific Committee). Adversely affected by the dominance of Noisy Miners in woodland patches.	Unlikely due to extent and history of fragmented and isolated habitats within site. 'tidy' farmland with very little understorey complexity.	X	Not required.
Scarlet Robin *Petroica boodang* V (TSC)	2	Occurs from the coast to the inland slopes. Breeds in drier eucalypt forests and temperate woodlands, often on ridges and slopes, within an open understorey of shrubs and grasses. In autumn/winter it migrates to more open habitats such as grassy open woodland or paddocks with scattered trees. Abundant logs and coarse woody debris are important structural components of its habitat. Nest is an open cup of plant fibres and cobwebs in the fork of tree, usually more than 2 m above the ground. It is sensitive to habitat degradation and overgrazing. Occurrence is positively associated with patch size and habitat complexity.	Unlikely due to extent and history of fragmented and isolated habitats within site. 'tidy' farmland with very little understorey complexity.	X	Not required.
Flame Robin *Petroica phoenica* V (TSC)	2	In NSW, it breeds in upland moist eucalypt forests and woodlands, often on ridges and slopes, in areas of open understorey. Migrates in winter to more open lowland habitats such as grassland with scattered trees and open woodland on the inland slopes and plains (Higgins and Peter 2002). There may be two disjunct breeding populations in NSW, on the Northern Tablelands and the Central–Southern Tablelands. (DECCW Profile). Forages from low perches, feeding on invertebrates taken from the ground, tree trunks, logs and other coarse woody debris. Nest is an open cup nest of plant fibres and cobweb, often near the ground in a sheltered niche, ledge or shallow cavity in a tree, stump or bank (DECCW Profile).	Possible low quality habitat.	X	Identified as a 'subject species'. Refer to Chapter 2.3 of the main report.

Species/Status	Records in 10km	Habits and Specific Habitat Requirements	Habitat within the site	Records on site	Further consideration
MAMMALS					
Spotted-tailed Quoll *Dasyurus maculatus* V (TSC) E (EPBC)	6	Occurs on the east coast of NSW, Tas, eastern Vic and NE Qld, in a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Females occupy home ranges up to about 750 ha and males up to 3500 ha. They usually traverse their ranges along densely vegetated creeklines. Spends most of the time on the ground, although also an excellent climber and may raid possum and glider dens and prey on roosting birds. Consumes a variety of prey, including gliders, possums, small wallabies, rats, birds, bandicoots, rabbits and insects; also eats carrion and takes domestic fowl. Mostly nocturnal. Individual animals use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites. Uses 'latrine sites', often on flat rocks among boulder fields and rocky cliff-faces; these may be visited by a number of individuals; latrine sites can be recognised by the accumulation of the sometimes characteristic 'twisty-shaped' faeces deposited by animals. OEH Profile (Feb 2013). Requires an abundance of prey and relatively large areas of intact vegetation for foraging (NPWS 1999; Edgar & Belcher 1995).	Theoretical, but no indirect evidence such as tracks, latrines, dens, scats etc.	X	Not required.
Koala *Phascolarctos cinereus* V (TSC) V (EPBC)	4	In NSW the Koala occurs mainly on the north coast and central coast, extending west of the Great Dividing Range along inland rivers (NPWS 1999). Koalas inhabit eucalypt forest and woodland, and are influenced in distribution by size and species of tree present, soil nutrients, climate, rainfall, and size and disturbance history of habitat patches (NPWS 1999). Although solitary in appearance, Koalas live in complex groups with individuals having overlapping territories (NPWS 1999). Koalas are relatively sedentary, and spend the majority of their time resting in the forks of trees (NPWS 1999; Martin & Handasyde 1995). Koalas are generally most active at dusk (NPWS 1999). Koalas feed almost exclusively on the leaves of a wide range of eucalypts, although within any one area Koalas will prefer only a small number of species (NPWS 1999; Martin & Handasyde 1995).	Theoretically possible, but the habitats are too fragmented and are surrounded by significant threats	X	Not required.

Species/Status	Records in 10km	Habits and Specific Habitat Requirements	Habitat within the site	Records on site	Further consideration
Yellow-bellied Glider *Petaurus australis* V (TSC)	90	Inhabits tall mature forests in areas of high rainfall along the east coast of Australia (Menkhorst & Knight 2001). Prefers areas where year-round food resources are available from a mixture of eucalypt species (NPWS 1999). Plant and Insect exudates make up the bulk of its diet. Makes characteristic triangular or V-shaped incisions in tree trunks to obtain sap. Nocturnal, it rests by day in a den in a hollow branch. Its home range is in the order of 30-65ha (NPWS 1999; Menkhorst & Knight 2001Russell 1995).	X	X	Not required.
Squirrel Glider *Petaurus norfolcensis* V (TSC)	3	In NSW, it occurs on the North Coast and on the inland slopes, probably as two populations as it is sparse or absent on the higher elevations of the tablelands. There are hotspots in the Clarence and lower Richmond Valleys, and the Central Coast, and some parts of the western slopes. It is rare on the coast south of Sydney - records are possibly misidentified Sugar Gliders. Requires hollow-bearing, floriferous eucalypt open forests and woodlands, preferably with one or more smooth-barked species, with a *Banksia* or *Acacia* shrub layer, that provide den sites in tree cavities and a good winter supply of nectar. Prime habitat is on richer soils and gentle terrain. Large trees with abundant hollows are critical elements. Preferred hollows are those with a large cavity that can house multiple gliders in a large nest, yet with a small entrance that protects the group from predators. Nocturnal. Lives in social groups that defend a large territory that may have about 20 hollow trees used over a period of six weeks. Home range is 3-9 ha in coastal habitats and 3-4 ha in productive inland habitats. Requires trees spaced close enough for gliding (maximum of approx 50-70m).	Unlikely – no suitable shrub layer, limited hollows, no chew marks.	X	Not required.
Grey-headed Flying-fox *Pteropus poliocephalus* V (TSC) V (EPBC)	37	Occurs in rainforest, tall sclerophyll forests and woodlands, heaths and swamps along the east coast of Australia from Bundaberg to Melbourne, generally to the east of the Great Dividing Range (NPWS 2001). Also recorded in urban gardens and cultivated fruit crops (NPWS 2001). Forages on pollen, nectar and fruits of native trees (in particular *Melaleuca, Eucalyptus* and *Banksia*), and is an important pollinator and seed-disperser of native trees (NPWS 2001). Partly migratory in response to food availability. Roosts in large congregations or 'camps' during the day (NPWS 2001; Strahan 1995), which are generally located within 20km of a regular food source, in stands of riparian rainforest paperbark or casuarina forest (NPWS 2001). Camp site fidelity is high.	Potential.	X	Identified as a 'subject species'. Refer to Chapter 2.3 of the main report.

Species/Status	Records in 10km	Habits and Specific Habitat Requirements	Habitat within the site	Records on site	Further consideration
Yellow-bellied Sheath-tail Bat *Saccolaimus flaviventris* V (TSC)	5	Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory. When foraging for insects, flies high and fast over the forest canopy, but lower in more open country Roosts singly or in groups of up to six, in tree hollows and buildings. In treeless areas they are known to utilise mammal burrows. Breeding has been recorded from December to mid-March, when a single young is born. OEH Profile (Feb 2013).	Potential.	X	Identified as a 'subject species'. Refer to Chapter 2.3 of the main report.
Eastern Freetail Bat *Mormopterus norfolkensis* V (TSC)	49	Usually recorded in dry eucalypt forest and woodland east of the Great Dividing Range. Has been recorded in rainforest and wet sclerophyll forest. Apparently solitary. Predominantly tree-dwelling, but has been recorded roosting in the roof of a hut (Allison & Hoye 1995).	Potential.	X	Identified as a 'subject species'. Refer to Chapter 2.3 of the main report.
Large-eared Pied Bat *Chalinolobus dwyeri* V (TSC) V (EPBC)	3	Inhabits dry sclerophyll forests and woodlands to the east and west of the Great Dividing Range, from Queensland to Bungonia. Has also been recorded occasionally in sub-alpine woodlands above 1500m, and at the edge of rainforest and moist eucalypt forest (Hoye & Dwyer 1995). Probably forages for insects below the forest canopy (Hoye & Dwyer 1995). Roosts by day in tree-hollows, caves and dis-used mine-tunnels (DEC 2004). No evidence exists of the Large-eared Pied Bat roosting in tree hollows (Recovery Plan – Qld DERM 2011). In caves it often selects positions close to the entrance in the 'twilight zone'. Appears to hibernate during winter (Hoye & Dwyer 1995).	Potential foraging habitat.	X	Identified as a 'subject species'. Refer to Chapter 2.3 of the main report.
Little Bent-wing Bat *Miniopterus australis* V (TSC)	5	Occurs along the east coast and ranges of Australia from Cape York in Queensland to Wollongong in NSW. Inhabits moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, *Melaleuca* swamps, dense coastal forests and banksia scrub. It is generally found in well-timbered areas. Roosts in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings. Only five nursery sites /maternity colonies are known in Australia. Maternity colonies form in spring. In NSW, the largest maternity colony is in close association with a large maternity colony of Eastern Bentwing-bats and appears to depend on the large colony to provide the high temperatures needed to rear its young. Males and juveniles disperse in summer. OEH Profile (Feb 2013).	Potential foraging habitat.	X	Identified as a 'subject species'. Refer to Chapter 2.3 of the main report.

Species/Status	Records in 10km	Habits and Specific Habitat Requirements	Habitat within the site	Records on site	Further consideration
Eastern False Pipistrelle *Falsistrellus tasmaniensis* V (TSC)	13	Thought to forage above the forest canopy, in open woodland or over water. Occurs along the Great Dividing Range of SE Australia, and east to the coast. Is more common at cooler elevations (Phillips 1995). Has been recorded roosting in tree hollows (Phillips 1995). Occasionally found in caves (DEC NRMAS-7 2004). Apparently hibernates during winter, and may sexually segregate for part of the year (Phillips 1995).	Potential.	Possible call ID	Identified as a 'subject species'. Refer to Chapter 2.3 of the main report.
Eastern Bent-wing Bat *Miniopterus schreibersii oceanenis* V (TSC)	49	Typically inhabits well-timbered valleys where it forages above the tree canopy (Dwyer 1995b). Roosts in caves, old mines, stormwater channels and comparable structures (DEC NRMAS-7 2004; Dwyer 1995b). In SE Australia it seeks cold roosts through winter to allow hibernation. Depends upon specific mass nursery sites in Spring to rear its young (Dwyer 1995b), thus prone to mass damage from catastrophic events (DEC NRMAS-7 2004).	Potential foraging habitat.	X	Identified as a 'subject species'. Refer to Chapter 2.3 of the main report.
Southern Myotis *Myotis macropus* V (TSC)	20	Occurs in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. It is rarely found more than 100 km inland, except along major rivers (DEC Profile). Generally roosts in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage (DEC Profile). Colonies never occur far from bodies of water, ranging from rainforest streams to large lakes and reservoirs (Richards 1995b). Forage over streams and pools catching insects and small fish by raking their feet across the water surface (DEC Profile; Richards 1995b). Males roost alone and defend territories when not breeding. Torpid in winter in roosts separate to maternity sites (Richards 1995b).	Potential.	X	Identified as a 'subject species'. Refer to Chapter 2.3 of the main report.
Greater Broad-nosed Bat *Scoteanax rueppellii* V (TSC)	12	Inhabits gullies and river systems draining the Great Dividing Range, occurs in a variety of woodland and forest habitats, from open eucalypt woodland to rainforest. Open woodlands suit its direct flight pattern, in denser rainforests it favours creekline corridors for foraging (Hoye & Richards 1995). Usually roosts in tree-hollows, but has been found in old buildings (Hoye & Richards 1995).	Potential.	Possible call ID	Identified as a 'subject species'. Refer to Chapter 2.3 of the main report.

Species/Status	Records in 10km	Habits and Specific Habitat Requirements	Habitat within the site	Records on site	Further consideration
AMPHIBIANS					
Green & Golden Bell Frog *Litoria aurea* E (TSC) V (EPBC)	3	Since 1990 there have been approximately 50 recorded locations in NSW, most of which are small, coastal, or near coastal populations. Large populations are located around the metropolitan areas of Sydney, Shoalhaven and mid north coast. Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (*Typha* spp.) or spikerushes (*Eleocharis* spp.). Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (*Gambusia holbrooki*), have a grassy area nearby and diurnal sheltering sites available. The species is active by day and usually breeds in summer when conditions are warm and wet. Males call while floating in water and females produce a raft of eggs that initially float before settling to the bottom, often amongst vegetation. OEH Profile (Feb 2013).	Potential.	X	Identified as a 'subject species'. Refer to Chapter 2.3 of the main report.
Giant Burrowing Frog *Heleioporus australiacus* V (TSC) V (EPBC)	1	In the Sydney area there is a marked preference for sandstone ridgetop habitat and broader upland valleys. The frog is associated with small headwater creeklines and slow flowing to intermittent creeklines, and may be associated with 'hanging swamp' seepage lines and where small pools form from the collected water. Vegetation is typically woodland, open woodland and heath, They have also been observed occupying artificial ponded structures that have naturalised over time and are still surrounded by other undisturbed habitat (DEC Profile). Appears to range widely, frequently being observed on roads at considerable distance from suitable riparian breeding, or other moist habitat (DEC Profile).	X	X	Not required.
Red-crowned Toadlet *Pseudophryne australis* V (TSC)	39	Occurs in open forests, mostly on Hawkesbury and Narrabeen Sandstones, within the Sydney Basin (Pokolbin in the north, the Nowra area to the south, and west to Mt Victoria in the Blue Mountains) (DEC Profile). Inhabits periodically wet drainage lines below sandstone ridges, that often have shale lenses or cappings. Shelters under rocks and amongst masses of dense vegetation or thick piles of leaf litter (DEC Profile). Breeding congregations occur in dense vegetation and debris beside ephemeral creeks and gutters (DEC Profile).	X	X	Not required.

Species/Status	Records in 10km	Habits and Specific Habitat Requirements	Habitat within the site	Records on site	Further consideration
INVERTEBRATES					
Cumberland Plain Land Snail *Meridolum corneovirens* E (TSC)	111	Lives in small areas on the Cumberland Plain west of Sydney, from Richmond and Windsor south to Picton and from Liverpool west to the Hawkesbury and Nepean Rivers at the base of the Blue Mountains. Known from over 100 different locations, but not all are currently occupied, and they are usually isolated from each other as a result of land use patterns. Primarily inhabits Cumberland Plain Woodland. This community is a grassy, open woodland with occasional dense patches of shrubs. It is also known from Shale Gravel Transition Forests, Castlereagh Swamp Woodlands and the margins of River-flat Eucalypt Forest, which are also listed communities. Lives under litter of bark, leaves and logs, or shelters in loose soil around grass clumps. Occasionally shelters under rubbish. Can dig several centimetres into soil to escape drought. Is a fungus specialist, does not eat green plants. It is generally active at night. OEH Profile (Aug 2013).	Potential.	X	Identified as a 'subject species'. Refer to Chapter 2.3 of the main report.

FLORA AND FAUNA ASSESSMENT

PROPOSED CREEK REHABILITATION & BULK EARTHWORKS,
INCLUDING RELOCATION OF THE MT CARMEL ROAD CROSSING

WINDSOR ROAD & BOUNDARY ROAD,
BOX HILL

APPENDIX 2

Flora species recorded on the subject site

April 2014

APPENDIX 2 Flora species recorded during surveys conducted within the subject site (Hayes Env, 2007).

KEY	
Status	
*	Weed species (including horticultural and native non-indigenous specimens)
N	'Noxious' weed (Class*) listed under the *NSW Noxious Weeds Act 1993* for The Hills LGA.
Record	
Riparian	Species recorded in the riparian corridor on the site.
Other	Species recorded outside of the riparian corridor, on adjacent slopes and nearby hilltops on the site.

Status	SCIENTIFIC NAME	COMMON NAME	Riparian	Other
	FILICOPSIDA			
	Salviniaceae			
*	*Salvinia molesta*		✓	
	CONIFEROPSIDA			
	Pinaceae			
*	*Pinus radiata*	Radiata Pine		✓
	MAGNOLIOPSIDA: DICOTYLEDONS			
	Acanthaceae			
	Brunoniella australis	Blue Trumpet	✓	
	Amaranthaceae			
	Alternanthera denticulata	Lesser Joyweed	✓	
*	*Alternanthera pungens*	Khaki Weed		✓
	Amygdalaceae			
*	*Prunus perisca var. persica*	Peach		✓
	Anacardiaceae			
*	*Schinus areira*	Pepper Tree		✓
	Apiaceae			
	Centella asiatica	Pennywort	✓	
	Apocynaceae			
*	*Araujia sericifera*	Moth Vine	✓	
*	*Gomphocarpus fruticosus*	Narrow-leaved Cotton Bush		✓
	Asteraceae			
*	*Ambrosia sp.*	Ragweed		✓
*	*Cirsium vulgare*	Spear Thistle		✓
*	*Senecio madagascariensis*	Fireweed	✓	✓
*	*Sonchus oleraceus*	Common Sowthistle	✓	
*	*Xanthium spinosum*	Bathurst Burr		✓
	Basellaceae			
*	*Anredera cordifolia*	Madeira Vine		✓

Status	SCIENTIFIC NAME	COMMON NAME	Riparian	Other
	Boraginaceae			
*	*Heliotropium amplexicaule*	Blue Heliotrope	✓	
	Brassicaceae			
*	*Lepidium bonariense*		✓	✓
	Cactaceae			
N (4a)	*Opuntia sp*	Prickly Pear	✓	
	Caryophyllaceae			
*	*Spergularia diandra*	Lesser Sandspurry	✓	
	Casuarinaceae			
	Casuarina glauca	Swamp Oak	✓	✓
	Chenopodiaceae			
*	*Chenopodium album*	Fat Hen		✓
	Einadia hastata	Berry Saltbush	✓	✓
	Einadia polygonoides		✓	
	Einadia trigonos	Fishweed	✓	✓
	Convolvulaceae			
	Dichondra repens	Kidney Weed	✓	
	Crassulaceae			
*	*Bryophyllum delagoense*	Mother of millions		✓
	Fabaceae (Faboideae)			
	Glycine clandestina		✓	
	Malaceae			
*	*Malus pumila*	Apple		✓
	Malvaceae			
*	*Modiola caroliniana*	Red-flowered Mallow	✓	
*	*Sida rhombifolia*	Paddy's Lucerne	✓	✓
	Moraceae			
*	*Ficus pumila*	Creeping Fig		✓
	Myoporaceae			
	Eremophila debilis	Winter Apple	✓	
	Myrtaceae			
	Angophora floribunda	Rough-barked Apple	✓	
	Eucalyptus amplifolia subsp. amplifolia		✓	✓
	Eucalyptus crebra	Narrow-leaved Ironbark		✓
	Eucalyptus fibrosa	Red Ironbark		✓
	Eucalyptus moluccana	Grey Box	✓	✓
	Eucalyptus tereticornis	Forest Red Gum	✓	✓
	Oleaceae			
*	*Fraxinus sp.*	Ash		✓
*	*Olea europaea subsp. cuspidata*		✓	✓
	Onagraceae			
	Ludwigia peploides subsp. montevidensis	Water Primrose	✓	
	Oxalidaceae			
	Oxalis perennans		✓	
*	*Oxalis* sp.			✓

Status	SCIENTIFIC NAME	COMMON NAME	Riparian	Other
	Pittosporaceae			
	Bursaria spinosa subsp. spinosa		✓	✓
	Plantaginaceae			
*	*Plantago lanceolata*	Lamb's Tongues	✓	✓
	Polygonaceae			
	Persicaria decipiens	Slender Knotweed	✓	
*	*Polygonum arenastrum*	Wireweed	✓	✓
	Rumex brownii	Swamp Dock	✓	
	Portulacaceae			
	Portulaca oleracea	Pigweed	✓	✓
	Ranunculaceae			
*	*Ranunculus repens*	Creeping Buttercup	✓	
	Rosaceae			
N (4a)	*Rubus fruticosus* sp. agg.	Blackberry		✓
	Solanaceae			
*	*Lycium ferocissimum*	African Boxthorn	✓	✓
*	*Solanum nigrum*	Black-berry Nightshade	✓	
	Solanum prinophyllum	Forest Nightshade	✓	
	Sterculiaceae			
	Brachychiton populneus subsp. populneus	Kurrajong	✓	
	Verbenaceae			
*	*Lantana camara*	Lantana	✓	
	MAGNOLIOPSIDA: MONOCOTYLEDONS			
	Alismataceae			
	Alisma plantago-aquatica	Water Plantain	✓	
	Anthericaceae			
	Arthropodium milleflorum	Vanilla Lily	✓	
	Commelinaceae			
	Commelina cyanea	Scurvy Weed	✓	✓
*	*Tradescantia fluminensis*	Wandering Jew	✓	
	Cyperaceae			
*	*Cyperus eragrostis*	Umbrella Sedge	✓	
	Cyperus gracilis		✓	
*	*Cyperus sp*		✓	
	Juncaceae			
*	*Juncus acutus subsp. acutus*	Sharp Rush		✓
	Juncus sp		✓	✓
	Juncus usitatus			✓
	Poaceae			
	Aristida ramosa	Purple Wiregrass	✓	
	Aristida vagans	Threeawn Speargrass	✓	
	Austrodanthonia racemosa var. racemosa		✓	✓
*	*Bromus catharticus*	Prairie Grass	✓	
*	*Cynodon dactylon*	Common Couch	✓	✓
*	*Ehrharta erecta*	Panic Veldtgrass	✓	
	Eragrostis leptostachya	Paddock Lovegrass	✓	✓

Status	SCIENTIFIC NAME	COMMON NAME	Riparian	Other
	Microlaena stipoides var. stipoides		✓	✓
	Paspalidium distans		✓	
*	*Paspalum dilatatum*	Paspalum	✓	✓
	Paspalum distichum	Water Couch	✓	
*	*Pennisetum clandestinum*	Kikuyu Grass		✓
*	*Phalaris ? canariensis*		✓	
	Sporobolus creber	Slender Rat's Tail Grass		✓
*	*Sporobolus sp*	Rat's Tail Grass		✓
	Typhaceae			
	Typha spp	Cumbungi	✓	

Noxious Weed Classes

4a The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction and the plant must not be sold propagated or knowingly distributed.

FLORA AND FAUNA ASSESSMENT

PROPOSED CREEK REHABILITATION & BULK EARTHWORKS,
INCLUDING RELOCATION OF THE MT CARMEL ROAD CROSSING

WINDSOR ROAD & BOUNDARY ROAD,
BOX HILL

APPENDIX 3

Fauna species recorded on the site, and known to occur in the vicinity.

April 2014

APPENDIX 3 Fauna species recorded on the site (Hayes Env, 2007), and known to occur in the vicinity (DEC Wildlife Atlas, 2006).

KEY

Status

*	Introduced species
E (TSC)	Endangered species listed on the NSW TSC Act
V (TSC)	Vulnerable species listed on the NSW TSC Act
E (EPBC)	Endangered species listed on the Commonwealth EPBC Act
V (EPBC)	Vulnerable species listed on the Commonwealth EPBC Act

Record

A Species recorded on the subject site in 2007 (Hayes Env)

B Species known to have occurred within 2km of the study area (DEC Atlas, data obtained Dec 2006)

Microchiropteran Bat Anabat Identifications

C Confident **P** Probable **Po** Possible

Status	COMMON NAME	SCIENTIFIC NAME	A	B
	BIRDS			
	Phasianidae			
	Stubble Quail	*Coturnix pectoralis*		✓
	Anatidae			
	Pacific Black Duck	*Anas superciliosa*	✓	✓
	Chestnut Teal	*Anas castanea*		✓
*	Mallard	*Anas platythynchos*		✓
	Australian Wood Duck	*Chenonetta jubata*	✓	✓
V (TSC)	Blue-billed Duck	*Oxyura australis*		✓
	Phalacrocoracidae			
	Little Pied Cormorant	*Phalacrocorax melanoleucos*		✓
	Little Black Cormorant	*Phalacrocorax sulcirostris*	✓	
	Pied Cormorant	*Phalacrocorax varius*	✓	
	Anhingidae			
	Darter	*Anhinga melanogaster*		✓
	Ardeidae			
	Cattle Egret	*Ardea ibis*		✓
	Intermediate Egret	*Ardea intermedia*		✓
V (TSC)	Australasian Bittern	*Botaurus poiciloptilus*		✓
	White-faced Heron	*Egretta novaehollandiae*	✓	✓
	Threskiornithidae			
	Yellow-billed Spoonbill	*Platalea flavipes*	✓	
	Australian White Ibis	*Threskiornis molucca*		✓
	Straw-necked Ibis	*Threskiornis spinicollis*	✓	
	Accipitridae			
	Wedge-tailed Eagle	*Aquila audax*		✓
	Black-shouldered Kite	*Elanus axillaris*		✓
	Falconidae			
	Nankeen Kestrel	*Falco cenchroides*		✓
	Peregrine Falcon	*Falco peregrinus*		✓
	Brown Falcon	*Falco berigora*	✓	

Status	COMMON NAME	SCIENTIFIC NAME	A	B
	Rallidae			
	Dusky Moorhen	*Gallinula tenebrosa*		✓
	Purple Swamphen	*Porphyrio porphyrio*	✓	✓
	Ballion's Crake	*Porzana pusilla*	✓	
	Recurvirostridae			
	Red-necked Avocet	*Recurvirostra novaehollandiae*		✓
	Charadriidae			
	Black-fronted Dotterel	*Elseyornis melanops*	✓	
	Masked Lapwing	*Vanellus miles*	✓	✓
	Columbidae			
*	Rock Dove	*Columba livia*		✓
	Crested Pigeon	*Ocyphaps lophotes*	✓	✓
	Common Bronzewing	*Phaps chalcoptera*		✓
*	Spotted Turtledove	*Streptopelia chinensis*	✓	✓
	Cacatuidae			
	Galah	*Cacatua roseicapilla*		✓
	Sulphur-crested Cockatoo	*Cacatua galerita*	✓	✓
	Little Corella	*Cacatua sanguinea*		✓
	Long-billed Corella	*Cacatua tenuirostris*		✓
	Psittacidae			
	Musk Lorikeet	*Glossopsitta concinna*		✓
	Eastern Rosella	*Platycercus eximius*	✓	✓
	Crimson Rosella	*Platycercus elegans*		✓
	Red-rumped Parrot	*Psephotus haematonotus*	✓	✓
	Scaly-breasted Lorikeet	*Trichglossus chlorolepidotus*		✓
	Rainbow Lorikeet	*Trichoglossus haematodus*		✓
	Cuculidae			
	Fan-tailed Cuckoo	*Cacomantis flabelliformis*		✓
	Strigidae			
V (TSC)	Powerful Owl	*Ninox strenua*		✓
	Tytonidae			
	Barn Owl	*Tyto alba*		✓
	Podargidae			
	Tawny Frogmouth	*Podargus strigoides*		✓
	Halcyonidae			
	Laughing Kookaburra	*Dacelo novaeguineae*		✓
	Coraciidae			
	Dollarbird	*Eurystomus orientalis*		✓
	Maluridae			
	Superb Fairy-wren	*Malurus cyaneus*	✓	✓
	Variegated Fairy-wren	*Malurus lamberti*		✓
	Pardalotidae			
	Spotted Pardalote	*Pardalotus punctatus*		✓
	Striated Pardalote	*Pardalotus striatus*		✓
	Acanthizidae			
	Brown Thornbill	*Acanthiza pusilla*		✓
	Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	✓	
	Yellow Thornbill	*Acanthiza nana*		✓
	Buff-rumped Thornbill	*Acanthiza reguloides*		✓
	White-throated Gerygone	*Gerygone olivacea*	✓	✓
	White-browed Scrub-wren	*Sericornis frontalis*		✓
	Weebill	*Smicrornis brevirostris*		✓

Status	COMMON NAME	SCIENTIFIC NAME	A	B
	Meliphagidae			
	Red Wattlebird	*Anthochaera carunculata*		✓
	Yellow-faced Honeyeater	*Lichenostomus chrysops*		✓
	Yellow-plumed Honeyeater	*Lichenostomus ornatus*	✓	
	White-plumed Honeyeater	*Lichenostomus penicillatus*		✓
	Noisy Miner	*Manorina melanocephala*	✓	✓
	Bell Miner	*Manorina melanophrys*		✓
	Brown-headed Honeyeater	*Melithreptus brevirostris*		✓
	White-naped Honeyeater	*Melithreptus lunatus*		✓
	Scarlet Honeyeater	*Myzomela sanguinolenta*		✓
	Noisy Friarbird	*Philemon corniculatus*		✓
	Petroicidae			
	Eastern Yellow Robin	*Eopsaltria australis*		✓
	Rose Robin	*Petroica rosea*		✓
	Neosittidae			
	Varied Sittella	*Daphoenositta chrysoptera*		✓
	Pachycephalidae			
	Grey Shrike-thrush	*Colluricincla harmonica*		✓
	Eastern Shrike-tit	*Falcunculus frontatus*		✓
	Golden Whistler	*Pachcephala pectoralis*		✓
	Rufous Whistler	*Pachycephala rufiventris*		✓
	Dicruridae			
	Magpie-lark	*Grallina cyanoleuca*	✓	✓
	Restless Flycatcher	*Myiagra inquieta*	✓	✓
	Grey Fantail	*Rhipidura albiscapa*		✓
	Willie Wagtail	*Rhipidura leucophrys*	✓	✓
	Campephagidae			
	White-winged Triller	*Lalage tricolor*		✓
	White-bellied Cuckoo-shrike	*Coracina papuensis*		✓
	Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	✓	✓
	Corcoracidae			
	White-winged Chough	*Corcorax melanoramphos*		✓
	Artamidae			
	Dusky Woodswallow	*Artamus cyanopterus*	✓	✓
	Pied Butcherbird	*Cracticus nigrogularis*		✓
	Grey Butcherbird	*Cracticus torquatus*	✓	
	Australian Magpie	*Gymnorhina tibicen*	✓	✓
	Pied Currawong	*Strepera graculina*	✓	✓
	Corvidae			
	Australian Raven	*Corvus coronoides*	✓	✓
	Motacillidae			
	Australian Pipit	*Anthus australis*	✓	✓
	Passeridae			
*	House Sparrow	*Passer domesticus*	✓	✓
	Estrilidae			
	Red-browed Finch	*Neochmia temporalis*		✓
	Double-barred Finch	*Taeniopygia bichenovii*		✓
	Hirundinidae			
	Welcome Swallow	*Hirundo neoxena*	✓	✓
	Tree Martin	*Petrochelidon nigricans*		✓
	Fringillidae			
*	European Goldfinch	*Carduelis carduelis*	✓	

Status	COMMON NAME	SCIENTIFIC NAME	A	B
	Sylviidae			
	Clamorous Reed-warbler	*Acrocephalus stentoreus*	✓	
	Golden-headed Cisticola	*Cisticola exilis*		✓
	Zosteropidae			
	Silvereye	*Zosterops lateralis*		✓
	Sturnidae			
*	Common Starling	*Sturbus vulgaris*	✓	✓
*	Common Myna	*Acridotheres tristis*	✓	✓
	REPTILES			
	Gekkonidae			
	Eastern Stone Gecko	*Diplodactylus vittatus*		✓
	Agamidae			
	Eastern Bearded Dragon	*Pogona barbata*		✓
	Eastern Water Dragon	*Physignathus lesueurii*		✓
	Scincidae			
	Cream-striped Shinning-skink	*Cryptoblepharus virgatus*		✓
	Robust Ctenotus	*Ctenotus robustus*		✓
	Eastern Water Skink	*Eulamprus quoyii*		✓
	Bar-sided Forest Skink	*Eulamprus tenuis*		✓
	Dark-flecked Garden Sun-skink	*Lampropholis delicata*		✓
	Pale-flecked Garden Sun-skink	*Lampropholis guichenoti*		✓
	Common Bluetongued Lizard	*Tiliqua scincoides*		✓
	Elapidae			
	Red-naped Snake	*Furina diadema*		✓
	Eastern Brown Snake	*Pseudonaja textilis*		✓
	Red-bellied Black Snake	*Pseudechis porphyriacus*		✓
	AMPHIBIANS			
	Myobatrachidae			
	Common Eastern Froglet	*Crinia signifera*		✓
V (TSC)	Giant Burrowing Frog	*Heleioporus australiacus*		✓
	Striped Marsh Frog	*Limnodynastes peronii*		✓
	Bibron's Toadlet	*Pseudophryne bibroni*		✓
	Smooth Toadlet	*Uperoleia laevigata*		✓
	Hylidae			
E (TSC)	Green & Golden Bell Frog	*Litoria aurea*		✓
	Eastern Dwarf Tree Frog	*Litoria fallax*		✓
	Lesueuri's Tree Frog	*Litoria lesueurii*		✓
	Peron's Tree Frog	*Litoria peronii*	✓	✓
	Tyler's Tree Frog	*Litoria tyleri*		✓
	Verreaux's Tree Frog	*Litoria verreauxii*		✓
	MAMMALS			
	Petauridae			
	Sugar Glider	*Petaurus breviceps*		✓
	Pseudocheiridae			
	Common Ringtail Possum	*Pseudocheirus peregrinus*		✓
	Phalangeridae			
	Common Brushtail Possum	*Trichosurus vulpecula*		✓
	Emballonuridae			
V (TSC)	Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*		✓

Status	COMMON NAME	SCIENTIFIC NAME	A	B
	Molossidae			
	Undescribed Mastiff-bat	*Mormopterus* sp 1		✓
	White-striped Freetail-bat	*Tadarida australis*	✓	
	Vespertilionidae			
	Gould's Wattled Bat	*Chalinolobus gouldii*	C	✓
	Chocolate Wattled Bat	*Chalinolobus morio*	C	
V (TSC)	Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	Po	
V (TSC)	Large-footed Myotis	*Myotis adversus*		✓
	Gould's Long-eared Bat	*Nyctophilus gouldi*		✓
	Unidentified Long-eared Bat	*Nyctophilus* sp	P	
V (TSC)	Greater Broad-nosed Bat	*Scoteanax rueppellii*	Po	
	Eastern Broad-nosed Bat	*Scotorepens orion*	P	
	Little Forest Bat	*Vespadelus vulturnus*	C	✓
	Introduced Mammals			
*	Dog	*Canis lupus familiaris*		✓
*	Fox	*Vulpes vulpes*	✓	✓
*	Rabbit	*Oryctolagus cuniculus*	✓	✓
*	Brown Hare	*Lepus capensis*		✓
*	Black Rat	*Rattus rattus*		✓
*	House Mouse	*Mus musculus*		✓
	THREATENED INVERTEBRATES			
	Camaenidae			
E (TSC)	Cumberland Plain Land Snail	*Meridolum corneovirens*		✓

FLORA AND FAUNA ASSESSMENT

PROPOSED CREEK REHABILITATION & BULK EARTHWORKS,
INCLUDING RELOCATION OF THE MT CARMEL ROAD CROSSING

WINDSOR ROAD & BOUNDARY ROAD,
BOX HILL

APPENDIX 4

Assessment of significance pursuant to s.5A of the EP&A Act

April 2014

APPENDIX 4

Assessment of significance of potential impacts of the proposed development at Box Hill, upon the Yellow-bellied Sheath-tail Bat, Eastern Freetail Bat, Eastern False Pipistrelle, Southern Myotis, Greater Broad-nosed Bat, Swamp Oak Floodplain Forest and Eucalypt River-flat Forest, pursuant to s.5A of the EP&A Act.

1 INTRODUCTION

The *NSW Threatened Species Conservation Act 1995* (TSC Act) modifies the *NSW Environmental Planning & Assessment Act 1979* (EP&A Act) by including in Section 5A seven factors which are to be considered when determining "*whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats*".

These seven factors "*must be taken into account*" by a consent or determining authority when considering a development proposal or Development Application, particularly in administering Sections 78, 79 and 112 of the EP&A Act.

Five threatened fauna species could forage and roost within the focus area, and could be affected by the proposed works:

- Yellow-bellied Sheath-tail Bat *Saccolaimus flaviventris*;
- Eastern Freetail Bat *Mormopterus norfolkensis*;
- Eastern False Pipistrelle *Falsistrellus* tasmaniensis;
- Southern Myotis *Myotis* macropus;
- Greater Broad-nosed Bat *Scoteanax rueppellii*.

Two endangered ecological communities occur in the focus area and would be affected by the proposed works:

- Swamp Oak Floodplain Forest; and
- Eucalypt River-flat Forest.

The potential impacts of the proposed works upon the five threatened microchiropteran bat species and upon the two endangered ecological communities have been assessed, pursuant to s.5A of the EP&A Act.

2 FACTORS for CONSIDERATION

2.1 Microchiropteran Bats

(Yellow-bellied Sheath-tail Bat *Saccolaimus flaviventris,* Eastern Freetail Bat *Mormopterus norfolkensis,* Eastern False Pipistrelle *Falsistrellus tasmaniensis,* Southern Myotis *Myotis macropus, and* Greater Broad-nosed Bat *Scoteanax rueppellii*)

General distribution and habits

Microchiropteran bats are nocturnal, small, insectivorous, flying mammals which shelter by day either in caves, tunnels, disused mines *etc*, or in trees, either in small crevices beneath bark, or in hollows. They emerge at night to forage on the wing for small flying insects.

Microchiropteran bats are generally highly mobile and wide-ranging, capable of flying large distances in search of suitable foraging habitat and roosting sites.

Some species have critical habitat requirements such as specific nursery caves which they migrate to at certain seasons.

Tree-roosting microchiropteran bats can utilise hollows with very small entrances, and will sometimes roost under exfoliating bark. They are known to change roost sites frequently. They usually prefer the largest and oldest hollow-bearing trees within the landscape.

(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*"

The Eastern False Pipistrelle and Greater Broad-nosed Bat were both [possibly] recorded by Anabat detector within the subject site. The Yellow-Bellied Sheath-tail Bat, Eastern Freetail Bat and Southern Myotis are all known to occur in the locality, and could also forage and/or roost within the site.

The proposed works would result in some loss of native vegetation from the focus area (approximately 0.82 ha), including some hollow-bearing trees. The majority of native vegetation and hollow-bearing trees present within the focus area would be retained (approximately 5.1 ha).

No significantly large hollow-bearing trees would be removed.

Microchiropteran bat nest-boxes would be installed along the creeklines, at a rate of 1 box per 20m length of creekline. Whilst these are not regarded as being of equivalent value as existing natural hollows, microchiropteran bats will utilise such features.

Whilst it is probable that one or more of these five species would utilise tree-hollows within the focus area for roosting, it is not likely that any individuals would be particularly dependent upon individual hollow-bearing trees that would be removed. The hollow-bearing tree resource within the focus area would essentially be maintained.

The extent of foraging habitat that would be affected is negligible in relation to that present within the focus area and within the foraging range of these species.

The proposed works would not be likely to affect the life cycle of any of the five microchiropteran bat species, such that the population would be placed at risk of extinction.

(b) "*in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction*"

The TSC Act defines an "*endangered population*" as "*a population specified in Part 2 of Schedule 1*" of the Act.

Not applicable.

(c) "*in the case of a critically endangered or 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

(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"

Not applicable.

(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, and

(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, and

(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"

(i) extent

The proposed works would result in loss of approximately 0.82ha of habitat for microchiropteran bats within the focus area.

Approximately 5.1 ha of habitat would be retained.

(ii) fragmentation

The proposed works would not cause an area of habitat for microchiropteran bats to become isolated from other areas of habitat for these species.

(iii) importance

The vegetation that would be affected is not likely to be of particular importance for any of the five microchiropteran bat species – no significantly large hollow-bearing trees would be removed, no areas of intact good quality foraging habitat would be removed, no ecologically functional dams or ponds would be removed.

Conclusion

The extent of vegetation that would be removed or modified (0.82 ha) is minor in relation to the extent of vegetation that would be retained within the focus area (5.1 ha). The proposed works would not cause an area of habitat for microchiropteran bats to become isolated from other areas of habitat for these species. The vegetation that would be affected is not likely to be of particular importance for any of the five microchiropteran bat species – no significantly large hollow-bearing trees would be removed, no areas of intact good quality foraging habitat would be removed, no ecologically functional dams or ponds would be removed.

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

The TSC Act 1995 defines "*critical habitat*" as "*habitat declared to be critical habitat under part 3*" of the Act.

There is no declared "*critical habitat*" of relevance to the focus area. The proposed works would not affect any areas of "*critical habitat*".

(f) "*whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan*"

There are no Recovery Plans for any of the five microchiropteran bat species.

No threat abatement plans are of specific relevance to the proposed works.

(g) "*whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process*"

'Clearing of native vegetation', 'Loss of hollow-bearing trees', and 'Removal of dead wood and dead trees' are listed as Key Threatening Processes under the TSC Act, and are of relevance to the proposed works and microchiropteran bats.

The extent of loss of native vegetation, hollow-bearing trees and dead wood and dead trees is minimal. Approximately 0.82ha of vegetation would be removed from the focus area, with approximately 5.1ha of vegetation retained.

The proposed works include revegetation of cleared lands within the E2 Zoned riparian corridor, to increase the extent and connectivity of vegetation within the focus area. There would be a net increase in extent of native vegetation within the focus area.

The proposed works include installation of microchiropteran bat nest-boxes along the creeklines within the focus area at a rate of 1 box per 20m length of creekline.

The increase in effect of relevant key threatening processes would be minor, and would be compensated in accordance with current best practice.

Summary

In summary of the above seven parts:

(a) the proposed works would not be likely to affect the life cycle of any of the five microchiropteran bat species, such that the population would be placed at risk of extinction;

(b) not applicable;

(c) not applicable;

(d) the extent of vegetation that would be removed or modified (0.82 ha) is minor in relation to the extent of vegetation that would be retained within the focus area (5.1 ha). The proposed works would not cause an area of habitat for microchiropteran bats to become isolated from other areas of habitat for these species. The vegetation that would be affected is not likely to be of particular importance for any of the five microchiropteran bat species – no significantly large hollow-bearing trees would be removed, no areas of intact good quality foraging habitat would be removed, no ecologically functional dams or ponds would be removed;

(e) there is no declared "*critical habitat*" of relevance to the focus area. The proposed works would not affect any areas of "*critical habitat*";

(f) there are no Recovery Plans prepared or in preparation for any of the five microchiropteran bat species. No threat abatement plans are of specific relevance to the proposed works;

(g) 'Clearing of native vegetation', 'Loss of hollow-bearing trees', and 'Removal of dead wood and dead trees' are listed as Key Threatening Processes under the TSC Act, and are of relevance to the proposed works and microchiropteran bats. The increase in effect of relevant key threatening processes would be minor, and would be compensated in accordance with current best practice.

2.2 Swamp Oak Floodplain Forest

(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*"

Not applicable.

(b) "*in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction*"

The TSC Act defines an "*endangered population*" as "*a population specified in Part 2 of Schedule 1*" of the Act.

Not applicable.

(c) *"in the case of a critically endangered or 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

(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"

(i) extent

The local occurrence of Swamp Oak Floodplain Forest is approximately 8 ha in extent, comprised of a large patch in the east of the focus area and subject site, and a smaller strip along Killarney Chain of Ponds creekline in the west of the focus area and extending onto neighbouring lands to the west. There is a narrow gap between these two patches, but they are regarded as a single local occurrence given that exchange of genetic material would easily occur between the two patches via creek flows and bird movements.

The proposed works would remove the northern tip of the large patch of Swamp Oak Floodplain Forest in the east (labelled A on Figure 4), approximately 3,667m^2 in extent, and a very small patch of Swamp Oak Floodplain Forest within the E2 zone for the proposed bridge crossing (part of the area labelled B on Figure 4), approximately 83m^2 in extent. This is a total extent of 3,750m^2 (0.37 ha), comprising 4% of the local occurrence.

Approximately 3.5 ha of Swamp Oak Floodplain Forest would be retained within focus area. Additional contiguous areas of this community would be retained upstream within the subject site, and downstream on adjacent landholdings.

(ii) composition

The proposed works would not adversely modify the composition of retained areas of Swamp Oak Floodplain Forest within the focus area.

Removal of weeds would be specified in Vegetation Management Plans prepared for future subdivision applications.

Conclusion

The proposed works would result in loss of 0.37 ha of Swamp Oak Floodplain Forest from a local occurrence of approximately 8 ha (a loss of 4%). The proposed works would not modify the composition of retained areas of this community. Retained vegetation would be protected through land zoning, and through implementation of vegetation management activities. The proposed works would not be likely to place the local occurrence of Swamp Oak Floodplain Forest at risk of extinction.

(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, and

(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, and

(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"

(i) extent

The extent of habitat for Swamp Oak Floodplain Forest within the focus area would be the area that currently supports this community. The cleared section of creekline in the centre of the focus area could potentially provide habitat for this community, but is currently highly disturbed and the ground extremely compacted.

The extent of habitat to be affected is taken to be the same as the extent of the community that would be affected, as discussed in part c(i) above. The proposed works would result in loss of 0.37 ha of habitat for Swamp Oak Floodplain Forest.

Approximately 3.5 ha of habitat for this community would be retained and protected within the focus area.

(ii) fragmentation

The proposed works would not cause an area of habitat for Swamp Oak Floodplain Forest to become isolated from other areas of habitat for this community. The proposed bridge crossing would create a permanent break in the cover of this community, but would not prevent continuing exchange of genetic material through creek flows and by bird movements.

(iii) importance

The habitat that would be affected has previously been degraded through clearing and earthworks, and is not of particular importance for Swamp Oak Floodplain Forest.

Conclusion

The proposed works would remove approximately 0.37 ha of habitat for Swamp Oak Floodplain Forest. Approximately 3.5 ha of habitat for this community would be retained and protected within the focus area. The proposed works would not cause an area of habitat to become isolated from other areas of habitat for this community. The habitat that would be affected has previously been degraded through clearing and earthworks, and would not be of particular importance for the long-term survival of the local occurrence of Swamp Oak Floodplain Forest.

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

The TSC Act 1995 defines "*critical habitat*" as "*habitat declared to be critical habitat under part 3*" of the Act.

There is no declared "*critical habitat*" of relevance to the focus area. The proposed works would not affect any areas of "*critical habitat*".

(f) "*whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan*"

DECCW have prepared a '*Cumberland Plain Recovery Plan*' (Jan 2011), including actions for the recovery of Swamp Oak Floodplain Forest.

The plan advocates protection of 'priority conservation lands' which are identified in the plan.

The subject site is not part of any identified 'priority conservation land', nor is it in the vicinity of such areas.

The proposed works have been designed to avoid loss of native vegetation as much as practicable, such that approximately 90% of Swamp Oak Floodplain Forest within the focus area would be retained, with additional contiguous areas of this community to be retained within the broader subject site.

Retained vegetation would be afforded greater protection and management through land zoning, and through future implementation of Vegetation Management Plans.

The proposed works are generally consistent with the objectives of the recovery plan, and would not hinder implementation of the DECCW (Jan 2011) Cumberland Plain Recovery Plan.

No threat abatement plans are of specific relevance to the proposed works.

(g) "*whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process*"

'Clearing of native vegetation', 'Loss of hollow-bearing trees', and 'Removal of dead wood and dead trees' are listed as Key Threatening Processes under the TSC Act, and are of relevance to the proposed works and Swamp Oak Floodplain Forest.

The extent of loss of native vegetation, hollow-bearing trees and dead wood and dead trees is minimal. Approximately 0.37 ha (4%) of the local occurrence of Swamp Oak Floodplain Forest would be removed.

'Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants' is also listed as a Key Threatening Process under the TSC Act and is of potential relevance. This process would be managed through future implementation of Vegetation Management Plans.

The increase in effect of relevant key threatening processes would be minor, and would be compensated in accordance with current best practice.

Summary

In summary of the above seven parts:

(a) not applicable;

(b) not applicable;

(c) the proposed works would result in loss of 0.37 ha of Swamp Oak Floodplain Forest from a local occurrence of approximately 8 ha (a loss of 4%). The proposed works would not modify the composition of retained areas of this community. Retained vegetation would be protected through land zoning, and through implementation of

vegetation management activities. The proposed works would not be likely to place the local occurrence of Swamp Oak Floodplain Forest at risk of extinction;

(d) the proposed works would remove approximately 0.37 ha of habitat for Swamp Oak Floodplain Forest. Approximately 3.5 ha of habitat for this community would be retained and protected within the focus area. The proposed works would not cause an area of habitat to become isolated from other areas of habitat for this community. The habitat that would be affected has previously been degraded through clearing and earthworks, and would not be of particular importance for the long-term survival of the local occurrence of Swamp Oak Floodplain Forest;

(e) there is no declared "*critical habitat*" of relevance to the focus area. The proposed works would not affect any areas of "*critical habitat*";

(f) DECCW have prepared a '*Cumberland Plain Recovery Plan*' (Jan 2011), including actions for the recovery of Swamp Oak Floodplain Forest. The proposed works are generally consistent with the objectives of the recovery plan, and would not hinder implementation of the DECCW (Jan 2011) Cumberland Plain Recovery Plan. No threat abatement plans are of specific relevance to the proposed works;

(g) 'Clearing of native vegetation', 'Loss of hollow-bearing trees', 'Removal of dead wood and dead trees' and 'Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants' are listed as Key Threatening Processes under the TSC Act, and are of relevance to the proposed works and Swamp Oak Floodplain Forest. The increase in effect of these key threatening processes would be minor, and would be compensated in accordance with current best practice.

2.3 Eucalypt River-flat Forest

(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*"

Not applicable.

(b) "*in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction*"

The TSC Act defines an "*endangered population*" as "*a population specified in Part 2 of Schedule 1*" of the Act.

Not applicable.

(c) "*in the case of a critically endangered or 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

(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"

(i) extent

The local occurrence of Eucalypt River-flat Forest is approximately 1 ha in extent, comprised of narrow strips occurring along the Killarney Chain of Ponds creekline within the focus area, and a small patch located on slightly more elevated land to the south. There are narrow gaps between the patches, but they are regarded as a single local occurrence given that exchange of genetic material would easily occur between the two patches via creek flows and bird movements.

The proposed works would remove the southern small patch of Eucalypt River-flat Forest (labelled D on Figure 4), and a single isolated eucalypt tree (labelled C on Figure 4). All areas of this community adjoining the Killarney Chain of Ponds vegetated corridor would be retained. The total extent of this community that would be removed within the focus area is approximately 4,474m^2 (0.45 ha), comprising 45% of the local occurrence.

Approximately 0.6 ha of Eucalypt River-flat Forest would be retained within focus area. These areas are contiguous areas with the Killarney Chain of Ponds vegetated corridor.

(ii) composition

The proposed works would not adversely modify the composition of retained areas of Eucalypt River-flat Forest within the focus area.

Removal of weeds would be specified in Vegetation Management Plans prepared for future subdivision applications.

Conclusion

The proposed works would result in loss of 0.45 ha of Eucalypt River-flat Forest from a local occurrence of approximately 1 ha (a loss of 45%). The proposed works would not modify the composition of retained areas of this community. Retained vegetation is contiguous with the vegetated Killarney Chain of Ponds corridor, and would be protected through land zoning, and through implementation of vegetation management activities. Loss of the small southern patch of this community, and the single isolated tree, would not be likely to place the local occurrence of Eucalypt River-flat Forest at risk of extinction.

(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, and

(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, and

(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"

(i) extent

The extent of habitat for Eucalypt River-flat Forest within the focus area would be the area that currently supports this community. Additional cleared lands within the focus area would once have provided habitat for this community, but have been degraded over an extended period through clearing, grazing, earthworks and pasture management.

The extent of habitat to be affected is taken to be the same as the extent of the community that would be affected, as discussed in part c(i) above. The proposed works would result in loss of 0.45 ha of habitat for Eucalypt River-flat Forest.

Approximately 0.6 ha of habitat for this community would be retained and protected within the focus area.

(ii) fragmentation

The proposed works would not cause an area of habitat for Eucalypt River-flat Forest to become isolated from other areas of habitat for this community. The proposed bridge crossing would create a permanent break in the cover of this community along the Killarney Chain of Ponds creekline, but would not prevent continuing exchange of genetic material through creek flows and by bird movements.

(iii) importance

The habitat that would be affected has previously been degraded through clearing, grazing, earthworks and pasture management, and is not of particular importance for the long-term survival of the local occurrence of Eucalypt River-flat Forest.

Conclusion

The proposed works would remove approximately 0.45 ha of habitat for Eucalypt River-flat Forest. Approximately 0.6 ha of habitat for this community would be retained and protected within the focus area. The proposed works would not cause an area of habitat to become isolated from other areas of habitat for this community. The habitat that would be affected has previously been degraded through clearing, grazing, earthworks and pasture management, and would not be of particular importance for the long-term survival of the local occurrence of Eucalypt River-flat Forest.

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

The TSC Act 1995 defines "*critical habitat*" as "*habitat declared to be critical habitat under part 3*" of the Act.

There is no declared "*critical habitat*" of relevance to the focus area. The proposed works would not affect any areas of "*critical habitat*".

(f) "*whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan*"

DECCW have prepared a '*Cumberland Plain Recovery Plan*' (Jan 2011), including actions for the recovery of Eucalypt River-flat Forest.

The plan advocates protection of 'priority conservation lands' which are identified in the plan.

The subject site is not part of any identified 'priority conservation land', nor is it in the vicinity of such areas.

The proposed works have been designed to avoid loss of native vegetation as much as practicable, with all areas of Eucalypt River-flat Forest along the Killarney Chain of Ponds vegetated corridor being retained. A small patch of this community separated from the main corridor would be removed, to allow for land filling as part of the flood management works.

Retained vegetation would be afforded greater protection and management through land zoning, and through future implementation of Vegetation Management Plans.

The proposed works are generally consistent with the objectives of the recovery plan, and would not hinder implementation of the DECCW (Jan 2011) Cumberland Plain Recovery Plan.

No threat abatement plans are of specific relevance to the proposed works.

(g) "*whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process*"

'Clearing of native vegetation', 'Loss of hollow-bearing trees', and 'Removal of dead wood and dead trees' are listed as Key Threatening Processes under the TSC Act, and are of relevance to the proposed works and Eucalypt River-flat Forest.

The extent of loss of native vegetation, hollow-bearing trees and dead wood and dead trees is minimal. Approximately 0.45 ha of Eucalypt River-flat Forest would be removed.

'Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants' is also listed as a Key Threatening Process under the TSC Act and is of potential relevance. This process would be managed through future implementation of Vegetation Management Plans.

The increase in effect of relevant key threatening processes would be minor, and would be compensated in accordance with current best practice.

Summary

In summary of the above seven parts:

(a) not applicable;

(b) not applicable;

(c) the proposed works would result in loss of 0.45 ha of Eucalypt River-flat Forest from a local occurrence of approximately 1 ha (a loss of 45%). The proposed works would not modify the composition of retained areas of this community. Retained vegetation is contiguous with the vegetated Killarney Chain of Ponds corridor, and would be protected through land zoning, and through implementation of vegetation management activities. Loss of the small southern patch of this community, and the single isolated tree, would not be likely to place the local occurrence of Eucalypt River-flat Forest at risk of extinction;

(d) the proposed works would remove approximately 0.45 ha of habitat for Eucalypt River-flat Forest. Approximately 0.6 ha of habitat for this community would be retained and protected within the focus area. The proposed works would not cause an area of habitat to become isolated from other areas of habitat for this community. The habitat that would be affected has previously been degraded through clearing, grazing, earthworks and pasture management, and would not be of particular importance for the long-term survival of the local occurrence of Eucalypt River-flat Forest;

(e) there is no declared "*critical habitat*" of relevance to the focus area. The proposed works would not affect any areas of "*critical habitat*";

(f) DECCW have prepared a '*Cumberland Plain Recovery Plan*' (Jan 2011), including actions for the recovery of Eucalypt River-flat Forest. The proposed works are generally consistent with the objectives of the recovery plan, and would not hinder implementation of the DECCW (Jan 2011) Cumberland Plain Recovery Plan. No threat abatement plans are of specific relevance to the proposed works;

(g) 'Clearing of native vegetation', 'Loss of hollow-bearing trees', 'Removal of dead wood and dead trees' and 'Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants' are listed as Key Threatening Processes under the TSC Act, and are of relevance to the proposed works and Eucalypt River-flat Forest. The increase in effect of these key threatening processes would be minor, and would be compensated in accordance with current best practice.

3 CONCLUSIONS

The seven factors which are required to be considered under Section 5A of the EP&A Act in the determination of "*whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats*" are discussed above with regard to the five threatened microchiropteran bat species, Swamp Oak Floodplain Forest and Eucalypt River-flat Forest.

Based upon the considerations detailed above, the proposed development at Box Hill would not be "*likely*" to impose "*a significant effect*" upon any of these threatened species, or endangered ecological communities.