ecology & heritage partners

DRAFT REPORT:

Ecological Investigations for the Pakenham East Precinct Structure Plan, Victoria

PREPARED FOR:

Cardinia Shire Council

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Ecology and Heritage Partners Pty Ltd

MELBOURNE: 292 Mt Alexander Road, Ascot Vale VIC 3032 **GEELONG:** 230 Latrobe Terrace, Geelong West Vic 3218
BRISBANE: Level 22, 127 Creek Street, Brisbane QLD 4000 **ADELAIDE:** 22 Greenhill Road, Wayville SA 5034
CANBERRA: PO Box 6067, O'Connor ACT 2602 **SYDNEY:** Level 5, 616 Harris Street, Ultimo, NSW, 2007
www.ehpartners.com.au | (03) 9377 0100

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Project Name	Ecological Investigations for the Pakenham East Precinct Structure Plan, Pakenham, Victoria
Project number	8203
Project manager	Aaron Organ (Director / Principal Ecologist)
Report author(s)	Aaron Organ (Director / Principal Ecologist), Lyndsey Vivian (Consultant Botanist)
Report reviewer	Andrew Hill (Director/Principal Ecologist), Chad Browning (Senior Zoologist)
Other EHP Staff	Shannon LeBel (Consultant Botanist), Jared McGuiness (Botanist)
Mapping	Monique Elsley (GIS Coordinator)
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Cover photo: Deep Creek (Ecology and Heritage Partners Pty Ltd)

SUMMARY

Background

Ecology and Heritage Partners Pty Ltd was commissioned by Cardinia Shire Council to undertake a flora and fauna assessment, habitat hectare assessment, and targeted significant species surveys to inform the Pakenham East Precinct Structure Plan (PSP) area, Victoria.

The PSP area was recently added to the Urban Growth Boundary (UGB) as a Logical Inclusion[1] area for future residential development. It is not covered by Melbourne's Strategic Assessment and as a result, is not subject to the Biodiversity Conservation Strategy (BCS) or the Growling Grass Frog *Litoria raniformis* and Southern Brown Bandicoot *Isoodon obesulus obesulus* Sub-regional Species Strategies. Dependant on the PSP layout, and whether the logical inclusion areas are subsequently approved under the BCS by the Commonwealth Environment Minister, a referral under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) may be necessary as part of the future development of the area. A Native Vegetation Precinct Plan (NVPP) will be required for the precinct. The survey methods undertaken as part of the ecological assessments were designed to address Commonwealth and State Government requirements.

Study Area

The study area is located approximately 60 kilometres south-east of Melbourne City and covers the suburbs of Pakenham, Nar Nar Goon and Nar Nar Goon North. The precinct comprises approximately 630 hectares of residential and agricultural land and is bound to the west by Deep Creek and Ryan Road, to the east by Mount Ararat Road and Mount Ararat Road North, to the south by the Pakenham Bypass and to the north by an electricity transmission line easement.

An additional property east of the PSP boundary and north of the Princes Highway (known as property 53), and the adjacent section of Princes Highway, has been included in the surveys, with the exception of the flora assessments. The frog ponds either side of the Pakenham Bypass, south of the PSP were also included in the 2013/14 and 2016/17 targeted Growling Grass Frog surveys.

The study area is located within the Cardinia Shire municipality, the Port Phillip and Westernport Catchment Management Authority (CMA) and the Gippsland Plain and Highlands Southern Fall bioregions.

[1] Areas appended to the original UGB in order to address a shortage of metropolitan land supply for housing and employment purposes.

Methods

A desktop assessment was undertaken and involved a review of all relevant databases, reports, literature and policies relevant to the study area. This was followed by a flora and habitat hectare assessment and targeted flora surveys undertaken between 19 to 29 November 2012 to identify the ecological values present within the study area; specifically remnant native vegetation and scattered indigenous trees, flora and fauna species, fauna habitats and ecological communities. Additional surveys were undertaken in early 2017 to account for any changes to vegetation and scattered trees since the original vegetation surveys completed in 2012.

General and targeted fauna surveys were undertaken over various dates between December 2012 and March 2013. Targeted surveys were undertaken for Growling Grass Frog, Southern Brown Bandicoot, Southern Toadlet *Pseudophryne semimarmorata,* Dwarf Galaxias *Galaxiella pusilla* and Australian Grayling *Prototroctes mareana*. Additional targeted Growling Grass Frog surveys were undertaken between October 2013 and February 2014, and between November 2016 and March 2017 to provide information on the species presence or otherwise within the study area. An additional Southern Brown Bandicoot survey was undertaken in November 2017.

Results

Vegetation Condition

The study area is highly modified within private land and is dominated by introduced pasture grasses for grazing. Good quality patches of native vegetation are present although in most instances are restricted to road side reserves and riparian/creek lines. Remnant native vegetation comprises several, poor to good quality patches, associated with a range of Ecological Vegetation Classes (EVCs). Many scattered indigenous trees are also present throughout the study area.

Remnant Native Vegetation

Current extant (2005) EVC mapping indicates that only isolated patches of EVCs occur within the study area (DELWP 2018a), mostly concentrated along Deep Creek and along the Princes Highway road reserves. The modelled EVC dataset indicates that seven EVCs occur across the study area, including Riparian Forest (EVC 18), Swampy Riparian Woodland (83), Grassy Forest (EVC 128), Grassy Woodland (EVC 175), Damp Heathy Woodland (EVC 793), Swampy Woodland (EVC 937) and Swamp Scrub (EVC 53).

Vegetation surveys completed in 2012 recorded all seven EVCs within the study area, with 81 remnant patches of poor to good quality identified. Minor changes to the extent of these patches were recorded in during subsequent vegetation surveys in 2017, with several patches identified as being cleared for farming practices. As of March 2017, 75 remnant patches representing the seven EVCs were recorded in the study area.

Scattered Remnant Trees

A total of 669 scattered indigenous trees were recorded within the study area in 2012, of which 65 are Very Large Old Trees (VLOTs), 152 are Large Old Trees (LOTs), 108 are Medium Old Trees (MOTs) and 344 are Small Trees (STs).

The 2017 survey recorded a reduced number of scattered trees with losses attributed to storm damage and clearing. A total of 530 scattered trees were recorded in the study area. Under the '*Permitted*

clearing of native vegetation - Biodiversity assessment guidelines' (the Guidelines), the size class of scattered trees is not required.

Significant Flora Species

No nationally significant flora species were recorded in the study area during the site assessments. However, two species (Veined Spear-grass *Austrostipa rudis* subsp. *australis* and Green Scentbark *Eucalyptus fulgens*) listed under the Advisory List of Threatened Flora in Victoria were identified during the targeted surveys.

Seventeen (17) plant species occur within the study area belonging to the Asteraceae (Daisy) and Epacridaceae (Heath) families, along with species from genera including *Acacia* and *Xanthorrhoea* that are declared protected on public land under Section 46 of the *Flora and Fauna Guarantee Act 1988* (FFG Act).

Significant Fauna Species

One nationally significant species (Growling Grass Frog), two state significant species (Hardhead *Aythya australis* and Australasian Shoveler *Anas rhynchotis*) and one regionally significant species (Latham's Snipe *Gallinago hardwickii*) were recorded in the study area during the initial assessments. Targeted surveys failed to detect the nationally significant Southern Brown Bandicoot, Dwarf Galaxias or Australian Grayling, or the State significant Southern Toadlet. Additional targeted surveys for Growling Grass Frog during the 2013/14 and 2016/17 active seasons failed to detect the species at previously occupied waterbodies.

Legislative Implications and Recommendations

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act – Federal)

No EPBC Act listed ecological communities are present within the study area.

One EPBC Act-listed species (Growling Grass Frog) was detected within the study area during the initial targeted surveys. Previous long-term monitoring within and surrounding the study area has repeatedly detected the species (including successful breeding and recruitment), and suitable refuge, dispersal and breeding habitat for Growling Grass Frog occurs throughout the study area. However, the results of the subsequent surveys over two active seasons suggest that the species has declined dramatically in the local area and no longer occurs within the study area. Once the PSP has been developed, a referral to the Commonwealth will not be required.

Flora and Fauna Guarantee Act 1988 (FFG Act - Victoria)

A permit from the Victorian Department of Environment, Land, Water and Planning (DELWP) is required in order to 'take' protected flora species, which are members of listed or protected flora on public land, such as road reserves, and to clear or disturb protected flora species within the study area.

Protected flora species include all members of the Asteraceae (Daisy) and Epacridaceae (Heath) families and some *Acacia* and *Xanthorrhoea* species. No FFG Act listed ecological communities were recorded in the study area or considered likely to be present.

One FFG Act-listed fauna species (Growling Grass Frog) was identified within the study area during the initial surveys. Suitable habitat also occurs within the study area for the FFG Act-listed Grey-headed Flying-fox *Pteropus poliocephalus*, Eastern Great Egret *Ardea modesta*, Swift Parrot *Lathamus discolor* and

Baillon's Crake *Porzana pusilla*. There are no permit requirements under the Act for these fauna species, although they may need to be considered as part of the PSP and future development of the site.

Permitted clearing of native vegetation – Biodiversity assessment guidelines (the Guidelines)

In December 2013, Victoria adopted the Guidelines, which replaced *Victoria's Native Vegetation Management: A Framework for Action* (the Framework). The initial fieldwork for this assessment was undertaken under the Framework. However, following additional surveys in March 2017, the results presented in this report have been adapted to cover the implications under the Guidelines.

It is noted that the Guidelines were amended in December 2017; however in accordance with the transitional arrangements, this assessment references the 2013 version.

The study area encompasses a combined area of approximately 18.24 hectares of remnant vegetation, including 13.86 hectares within the Gippsland Plain bioregion (Table 1) and 4.38 hectares within the Highlands Southern Fall bioregion (Table 2).

Table 1. Summary of on site native vegetation within the Gippsland Plain bioregion

Vegetation Type	Total extent (hectares)
Riparian Forest	1.39
Swamp Scrub	0.41
Swampy Riparian Woodland	3.77
Grassy Forest	0.72
Grassy Woodland	0.94
Damp Heathy Woodland	0.92
Swampy Woodland	5.71

Table 2. Summary of on site native vegetation within the Highlands Southern Fall bioregion

Vegetation Type	Total extent (hectares)
Grassy Forest	1.09
Grassy Woodland	0.90
Damp Heathy Woodland	1.44
Swampy Woodland	0.95

It is recommended that the three-stage approach (avoid, minimise and offset) as identified under the Guidelines, be adopted in determining the extent of native vegetation to be retained as part of the development of the precinct.

Wildlife Act 1975

Where works are likely to require the salvage and translocation or general handling of fauna species, DELWP is the relevant referral authority, and management authorisation under the *Wildlife Act 1975* will need to be granted. In addition, depending on the extent of any proposed salvage and translocation, an

application to, and if deemed appropriate, subsequent approval from DELWP's Translocation Evaluation Panel (TEP) is required prior to the commencement of any works. Management authorisation and an application to the TEP is usually prepared and submitted by a suitably qualified ecologist or zoologist, on behalf of the proponent.

Catchment and Land Protection Act 1994 (CALP Act)

Noxious weeds within the study area, including Spear Thistle *Cirsium vulgare*, Flax-leaf Broom *Genista linifolia*, Montpellier Broom *Genista monspessulana*, Radiata Pine *Pinus radiata*, Sweet Pittosporum *Pittosporum undulatum*, Sweet Briar *Rosa rubiginosa*, Blackberry *Rubus fruticosus* spp. *agg*. and Gorse *Ulex europaeus*, should be appropriately controlled to prevent their spread to any nearby areas of native vegetation.

1 INTRODUCTION

1.1 Background

Ecology and Heritage Partners Pty Ltd was commissioned by Cardinia Shire Council to undertake a flora and fauna assessment, habitat hectare assessment, and targeted significant species surveys to inform the Pakenham East Precinct Structure Plan (PSP) area, Victoria. This PSP area has recently been added to the Urban Growth Boundary (UGB) as a Logical Inclusion[2] area for future residential development. It is not covered by Melbourne's Strategic Assessment and as a result, is not subject to the Biodiversity Conservation Strategy (BCS) or the Growling Grass Frog *Litoria raniformis* and Southern Brown Bandicoot *Isoodon obesulus obesulus* Sub Regional Species Strategies.

A Native Vegetation Precinct Plan (NVPP) will be required for the precinct. The survey methods undertaken as part of the ecological assessments were designed to ensure they address Commonwealth and State Government requirements.

The purpose of this assessment was to identify the extent of native vegetation (remnant patches and scattered trees), and fauna habitat within the study area, and the presence of significant flora, fauna and/or ecological communities. This report presents the findings of the site surveys, and discusses the potential ecological and legislative implications associated with the future development of the precinct.

1.2 Study Area

The Pakenham East PSP area (the "study area") is located approximately 60 kilometres south-east of Melbourne City and covers the suburbs of Pakenham, Nar Nar Goon and Nar Nar Goon North. The precinct comprises approximately 630 hectares of residential and agricultural land and is bound to the west by Deep Creek and Ryan Road, to the east by Mount Ararat Road and Mount Ararat Road North, to the south by the Pakenham Bypass and to the north by an electricity transmission line easement.

An additional property east of the PSP boundary and north of the Princes Highway (known as property 53), and the adjacent section of Princes Highway, has been included in the surveys, with the exception of the flora assessments. The frog ponds either side of the Pakenham Bypass, south of the PSP were also included in the 2013/14 and 2016/17 targeted Growling Grass Frog surveys.

According to the Victorian Department of Environment, Land Water and Planning (DELWP) NatureKit (DELWP 2018a) the study area occurs within two bioregions; the Gippsland Plain bioregion and the Highlands Southern Fall bioregion.

The study area is located within the boundaries of Cardinia Shire Council and the Port Phillip and Westernport Catchment Management Authority (CMA). The majority of the study area is zoned Farming Zone and not covered by any planning scheme overlays. However, a small area along the western boundary, south of the Princes Highway, is zoned Low Density Residential Zone (LDRZ), and is subject to a

[2] Areas appended to the original UGB in order to address a shortage of metropolitan land supply for housing and employment purposes.

Vegetation Protection Overlay – Schedule 1 (VPO1) and a Design and Development Overlay – Schedule 1 (DDO1). One property along the eastern boundary, north of the Princes Highway is zoned Green Wedge Zone (GWZ) and is subject to an ESO1. Deep Creek Road running north of the Princes Highway and the eastern bank of Deep Creek is zoned Public Conservation and Resource Zone (PCRZ) and is subject to a Floodway Overlay (FO). The Princes Highway is zoned Road – Category 1 with no overlays applied.

1.3 Targeted Species Descriptions

Targeted surveys for several significant flora species were undertaken across areas of potential habitat within the study area. However, it should be noted that one additional significant flora species, Arching Flax-lily *Dianella* spp. aff. *longifolia* (Benambra), was also targeted despite the lack of records within the Victorian Biodiversity Atlas (VBA) (DELWP 2017) and Flora Information System (FIS) (Gullan 2017) databases. This species has previously been documented along Cardinia Rail Reserve and Rix Road, Cardinia, approximately seven kilometres west of the study area (Biosis 2005). Although Matted Flax-lily *Dianella amoena* and Arching Flax-lily were not recorded during the current surveys, descriptions have been provided below, as the latter species in particular (Arching Flax-lily) is easily confused with Smooth Flax-lily *Dianella laevis*, which commonly occurs throughout the study area. Descriptions of the targeted flora species are provided in the following sections.

Targeted surveys for significant fauna species including Growling Grass Frog, Southern Brown Bandicoot, Southern Toadlet *Pseudophryne semimarmorata*, Australian Grayling *Prototroctes mareana* and Dwarf Galaxias *Galaxiella pusilla* were also undertaken. Descriptions of these species are provided in the following sections.

1.3.1 Matted Flax-lily *Dianella amoena*

Matted Flax-lily (Plate 1) is listed as Endangered under the EPBC Act, listed under the Victorian *Flora and Fauna Guarantee Act 1988* (FFG Act) and is Endangered in the *Advisory List of Rare or Threatened Flora in Victoria* (DEPI 2014).

Matted Flax-lily is a perennial, tufted, mat-forming lily which can form patches of up to five metres width. The plant can spread vegetatively, through underground rhizomatous roots. These roots produce tillers of several leaves that may be some distance from the parent plant. The leaves of the Matted Flax-lily are generally glaucous and usually possess small hooks (teeth) along the margins and midrib.

Plate 1. Matted Flax-lily *Dianella amoena* (Ecology and Heritage Partners Pty Ltd)

The tapered leaves are approximately 45 centimetres long depending on site and climatic conditions. The leaves are arranged alternatively on tillers, with several leaves per tiller (DSE 2005b).

The species generally flowers between November and January, but may continue flowering with summer and autumn rains. It has pale blue to violet flowers with bright yellow stamens and berries, which are

generally purple in colour. The flowers and berries are born on culms typically extending to 30 centimetres in height, but this may alter depending on plant location and season (Carter 2005).

Plants typically occur in grasslands, grassy woodlands and grassy wetlands in Victoria (Carter 2005). Grasses typically dominate the understorey layer (Carr and Horsfall 1995), including native species such as Kangaroo Grass *Themeda triandra*, Weeping Grass *Microlaena stipoides*, Common Wheat Grass *Anthosachne scabra*, Common Tussock-Grass *Poa labillardierei*, and Striped Wallaby-grass *Rytidosperma racemosum.* In grassy woodlands, a variety of eucalypt species dominate, with Blackwood *Acacia melanoxylon* a common understorey component at many sites (Carter 2005). Rocks are often present on sites in the Victorian Volcanic Plain bioregion, and usually offer protection from grazing by stock, pest animals and native fauna.

The current distribution of Matted Flax-lily extends from Mortlake in western Victoria to Sale in East Gippsland, with a further disjunct population in the north-east of Victoria around Benambra (Gullan 2017). There is also a disjunct population in Canberra (Geoff Carr pers. comm.).

1.3.2 Arching Flax-lily *Dianella* sp. aff. *longifolia* (Benambra)

Arching Flax-lily is listed as Vulnerable in the *Advisory List of Rare or Threatened Flora in Victoria* (DEPI 2014).

Arching Flax-lily grow in a loose colony that can spread to a metre and can be composed of up to 10 tufts consisting of three or four leaves connected by underground rhizomes. Leaves are generally blue, 20–50 centimetres long, thick with sparse teeth on the margins and underside midrib. Flowers are pale to sky blue-violet and sepals creamy-green and have large yellow swellings (strumae) on the lower anthers. Flowers open in mid afternoon in warm and humid conditions from mid-November to early January. Flowering culms are two to three times the height of the leaves and normally exceed one metre and are arching, while its berries remain green unlike other *Dianella* species.

Arching Flax-lily occurs in lowland plains grassland and grassy woodlands as well as around rocky outcrops at higher altitudes.

1.3.3 Veined Spear-grass *Austrostipa rudis* subsp. *australis*

Veined Spear-grass is listed as Rare in the *Advisory List of Rare or Threatened Flora in Victoria* (DEPI 2014).

Veined Spear-grass is a tufted grass which grows to 1.3 metres tall. Its leaves are usually rough, sometimes with small hairs and the inflorescences are open panicles to 50 centimetres long. The flowering period is typically from November to January. Veined Spear-grass prefers sandy soils in areas of cool climate and moderate altitudes (Walsh and Entwisle 1994), and has been recorded in open-forest environments.

The current known distribution of Veined Spear-grass is across southern Victoria, from Nelson in the west to Mallacoota in the east. It is regarded as uncommon by Walsh and Entwisle (1994).

1.3.4 Green Scentbark *Eucalyptus fulgens*

Plate 2. Green Scentbark Eucalyptus fulgens (Ecology and Heritage Partners Pty Ltd)

Green Scentbark (Plate 2) is listed as Rare in the *Advisory List of Rare or Threatened Flora in Victoria* (DSE 2005).

Green Scentbark is a spreading Eucalypt species, up to 18 meters tall, with fissured, spongy bark that persists to the tree's smallest branches (Nicolle 2006; Gullan 2017). Its leaves are glossy green, up to 18 centimetres long and 1.8 centimetres wide, and it produces buds in clusters of seven (Gullan 2017).

The species generally flowers in autumn, producing pale white flowers, and the proceeding fruit are rounded, 4 to 6 mm wide, with valves slightly exerted (Nicolle 2006).

Green Scentbark is endemic to Victoria, occurring mostly in scattered populations east of Melbourne from the Yarra River Valley to the Latrobe Valley (Nicolle 2006). Throughout the species' distribution, it is often found in hilly woodlands, on loam and clay soils (Nicolle 2006).

1.3.5 Growling Grass Frog *Litoria raniformis*

Plate 3. Growling Grass Frog *Litoria raniformis* (Ecology and Heritage Partners Pty Ltd)

Growling Grass Frog (Plate 3) is listed as Vulnerable under the EPBC Act, listed under the *Flora and Fauna Guarantee Act 1988* (FFG Act), Vulnerable under the National Action Plan for Australian Frogs (Tyler 1997) and Endangered in the *Advisory List of Threatened Vertebrate Fauna in Victoria* (DSE 2013c).

Growling Grass Frog is one of the largest frog species in Australia. It reaches up to 104 mm in length, with females usually larger (60–104 mm) than males (55–65 mm) (Barker *et al.* 1995). Growling Grass Frogs vary in colour and pattern, but in general are olive to bright emerald green, with irregular gold, brown, black or bronze spotting (Plate 3). The species is commonly associated with permanent or semi-permanent still and slow flowing waterbodies (i.e. streams, lagoons, farm dams and old quarry sites) (Barker *et al.* 1995). Frogs can also use temporarily inundated waterbodies for breeding purposes provided they contain water over the breeding season (Organ 2003). Based on previous investigations there is a strong correlation between the presence of the species and key habitat attributes at a given waterbody. The species is typically associated with waterbodies supporting extensive cover of emergent, submerged and floating vegetation (Robertson 2003; Organ 2003).

Although formerly widely distributed across south-eastern Australia, including Tasmania (Littlejohn 1963, 1982), the species has declined markedly across much of its former range. This has been most evident over the past two decades and in many areas, particularly in south and central Victoria, populations have experienced apparent declines and local extinctions (Mahony 1999).

1.3.6 Southern Brown Bandicoot *Isoodon obesulus obesulus*

Southern Brown Bandicoot (Plate 4) is listed as Endangered under the EPBC Act, listed under the FFG Act, Near Threatened under the National Action Plan for Australian Marsupials and Monotremes (Maxwell *et al.* 1996) and Near Threatened in the *Advisory List of Threatened Vertebrate Fauna in Victoria* (DSE 2013c).

Plate 4. Southern Brown Bandicoot *Isoodon obesulus obsesulus* (Ecology and Heritage Partners Pty Ltd)

Southern Brown Bandicoot is a marsupial with coarse brindled dark grey to yellow-brown fur on its back, with creamy white feet and underbelly (Plate 4). The ears are short and rounded, barely extending above the head. Individuals tend to be 28-35 centimetres in length (head-body), with an 8-13 centimetre long tail. Females weigh 400-1000 grams, whilst males weigh 500-1500 grams (Menkhorst and Knight, 2004).

The diet is omnivorous consisting largely of soil invertebrates, seeds and underground (hypogeal) fungi. In the Royal Botanic Gardens, Cranbourne the species' diet is dominated by green jewel beetles and population numbers have been reported to crash when beetle numbers decline (Coates 2006). Breeding is usually seasonal, with most births occurring between July and December. Young remain in the pouch for two months, and become sexually mature at seven months, with females able to give birth to over eight young per year. The death rate of juveniles is usually high, while adults may live up to 3.5 years (Strahan 1995).

In Victoria, the species' remaining distribution is divided into five major groups, or loose sub-populations, centred around Portland-Mount Gambier, Grampians National Park, Otway Ranges, South-central (Port Phillip-Westernport-Wilson's Promontory) and East Gippsland (Coates 2006). The species is absent from Victorian Islands even though some such as French, Phillip, Snake and Sunday Islands have large areas of apparently suitable woodland habitat (Norris *et al.* 1979: In Menkhorst 1995).

The species has dramatically declined in recent decates (Coates *et al.* 2008). Threats to the species include habitat loss and fragmentation, habitat modification, predation by introduced carnivores including foxes, cats and domestic dogs, disease, increasing urbanisation and road mortality (Practical Ecology Pty Ltd 2011).

1.3.7 Southern Toadlet *Pseudophryne semimarmorata*

Southern Toadlet (Plate 5) is listed as Vulnerable under the *Advisory List of Threatened Vertebrate Fauna in Victoria* (DSE 2013c).

Plate 5. Southern Toadlet *Pseudophryne semimarmorata* (Ecology and Heritage Partners Pty Ltd)

Southern Toadlet is a small frog, with adult body length up to 30 millimetres. The back is warty and varies from brown to dark olive-green with darker flecks (Barker *et al.* 1995; Robinson 2000). The chest has black and white marbling, while the throat, lower belly and underside of the limbs are tan to orange in colour (Barker *et al.* 1995; Robinson 2000). Males have a granular belly, while the female belly is

smooth (Hero *et al.* 1991; Barker *et al.* 1995; Robinson 2000). Tadpoles are dark grey to brown, sometimes with a copper sheen and with transparent, spotted fins (Anstis 2002).

Southern Toadlet can be found in forest, woodland, shrubland, grassland and heathland. Adults shelter under leaf litter, rocks, logs and other debris in damp areas (Hero *et al.* 1991; Robinson 2000). They are a ground dwelling frog with a preference for walking (Hero *et al.* 1991).

Males of this species call from shallow burrows in low lying areas, usually near water or boggy ground (Hero *et al.* 1991; Robinson 2000). Males usually call in late summer to autumn, before and after periods of heavy rain (Robinson 2000).

Eggs are spawned in shallow burrows under leaf litter in low-lying areas or depressions that will later be flooded (Hero *et al.* 1991). Eggs do not hatch until the area is inundated with water.

The breeding season occurs from March to June and males call anytime from February to June depending on environmental conditions. The male call is a short, grating "cre-ek" repeated every few seconds (Hero *et al.* 1991).

1.3.8 Australian Grayling *Prototroctes mareana*

The Australian Grayling *Prototroctes mareana* (Plate 6) is listed as Vulnerable under the EPBC Act, listed under the FFG Act and Vulnerable in the *Advisory List of Threatened Vertebrate Fauna in Victoria* (DSE 2013c).

Plate 6: Australian Grayling *Prototctes mareana* (Ecology and Heritage Partners Pty Ltd).

The Australian Grayling is a medium fish occurring on the eastern side of Great Dividing Range, from Sydney to the Otway Ranges in Victoria, and Tasmania. It is a slender fish with a rounded body, small head, yellow eyes and silvery green to olive brown scales (McDowall 1996).

Australian Grayling were once common throughout their range and were a popular angling species. Australian Grayling are diadromous, and need to migrate between freshwater and marine environments to complete their life cycle. As such, artificial dams and weirs have had a major impact on the species survival in many river systems (McDowall 1996).

1.3.9 Dwarf Galaxias *Galaxiella pusilla*

Dwarf Galaxias (Plate 7) is listed as Vulnerable under the EPBC Act, listed under the FFG Act and is Vulnerable in the *Advisory List of Threatened Vertebrate Fauna in Victoria* (DSE 2013c).

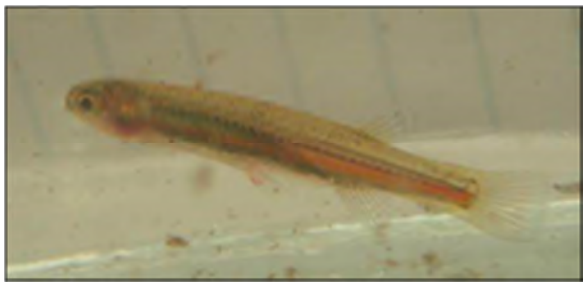


Plate 7: Dwarf Galaxias *Galaxiella pusilla* (Ecology and Heritage Partners Pty Ltd).

Dwarf Galaxias is a very small Galaxiid, with females reaching up to 40mm and males 35mm (DPIW 2006). It is a slightly stocky fish, with a deepened trunk at the belly and small head with a blunt snout (McDowall, R. 1996). The fins are small and membranous (McDowall, R 1996) with large flanges on the caudal (tail) fin that cause it to almost reach

the dorsal and anal fin (McDowall, R 1996; DPIW 2006). The colour of Dwarf Galaxias is generally transparent olive-amber on the dorsal surface, with three longitudinal black stripes (laterally) and a silvery, white underside. Males also have a vivid orange stripe between the middle and lower black lateral stripe; females lack this orange colouration (McDowall1996; DPIW 2006).

Breeding occurs in spring, where pairs will spawn eggs one by one on aquatic plants (likely less than 100 eggs), each approximately 1mm in diameter.

Larvae hatch in 2-3 weeks, with an estimated life expectancy of one year, only allowing for one spawning event per individual (Humphries 1986). Dwarf Galaxias lives its entire life cycle in freshwater (McDowall 1996; DPIW 2006).

The species is mostly found in still (McDowall 1996) or slow-flowing waters (DPIW 2006), which are often overgrown with aquatic and/ or emergent plants. They can occur within permanent waterbodies, though are commonly located within ephemeral pools (connected to permanent waterways) and are thought to be able to aestivate when waterbodies dry up (McDowall 1996).

Dwarf Galaxias occurs in southern Victoria from Gippsland east to Mount Gambier in South Australia, also on Flinders Island and in the east of the north coast of Tasmania (Humphries 1996; McDowall 1996) and is intermittent in occurrence, though often locally abundant (DPIW 2006).

2 METHODS

2.1 Nomenclature

Common and scientific names of flora and fauna follow the Victorian Biodiversity Atlas (VBA) (DELWP 2017). Vegetation community names follow DELWP's Ecological Vegetation Classes (EVC) benchmarks (DSE 2013b).

2.2 Desktop Assessment

A desktop assessment of the study area, and its surrounds, was carried out prior to undertaking the site assessments and targeted surveys. The following resources were reviewed:

- VBA (DELWP 2017), Illustrated Flora Information System of Victoria (IFLISV) (Gullan 2017) and Atlas of Victorian Wildlife (AVW) (Viridans 2011b) for documented flora and fauna records within the local area;
- NatureKits (DELWP 2017) for the extent of historic and current EVCs, and the location of sites of biological significance within the region;
- Department of the Environment and Energy (DoEE) Protected Matters Search Tool (PMST) for matters of National Environmental Significance (NES), including listed flora and fauna species, ecological communities, and Ramsar wetlands, protected under the EPBC Act within the local area (DoEE 2017);
- Planning Schemes Online maps (DELWP 2018b) for current zoning and overlays applicable to the study area;
- Relevant reports, documents and literature including previous ecological reports pertaining to the study area or part thereof (i.e. Ecology and Heritage Partners Pty Ltd 2011a; 2012);
- Aerial photography of the study area; and,
- Relevant Commonwealth and State Government legislation and policies.

2.3 Flora, Fauna and Habitat Hectare Assessment

2.3.1 Flora

A flora assessment was conducted by qualified botanists between 19 to 29 November 2012, in conjunction with a habitat hectare assessment and targeted flora surveys. The study area was traversed on foot, a list of vascular flora species was compiled, and vegetation communities and indigenous trees were identified and mapped (with reference to the pre-1750 and extant (2005) mapping (DELWP 2017) and EVC descriptions (DSE 2013b).

An additional flora survey was undertaken in March 2017 to account for any changes that had taken place over time since the initial 2012 survey (i.e. storm damage, clearing etc).

Biodiversity Assessment Guidelines (DEPI 2013) and the Native Vegetation Management: A Framework for Action

In December 2013, the *Permitted Clearing of Native Vegetation Biodiversity Assessment Guidelines* (the Guidelines) (DEPI 2013) were adopted. At the time surveys were undertaken across the precinct, the *Native Vegetation Management: A Framework for Action* (NRE 2002) (herein referred to as the Framework) applied, and all vegetation assessments followed the Framework methods.

The Framework used the habitat hectare method which is a unit of measurement which combines both quality (relative to a published Benchmark) and quantity (area in hectares of an EVC type) for a habitat zone (i.e. as described in the Vegetation Quality Assessment Manual) (DSE 2004). A habitat hectare assessment was undertaken concurrently with the flora assessment from 19 to 29 November 2012.

2.3.2 Terrestrial Fauna

A detailed terrestrial fauna assessment was undertaken by qualified zoologists between 11 December 2012 and 12 March 2013. These surveys involved both diurnal and nocturnal assessments including avian surveys, spotlighting for nocturnal fauna, owl call playback, reptile searches, ultrasonic bat call detection and targeted surveys for Growling Grass Frog and Southern Brown Bandicoot. Targeted Southern Toadlet surveys were undertaken in early May 2013. Additional surveys for Growling Grass Frog and Southern Brown Bandicoot were undertaken between November 2016 and March 2017. Extensive fauna surveys were undertaken across the entire study area (Figure 7a) and a summary table of fauna survey effort is provided below (Table 3).

Table 3: Fauna survey techniques and total survey effort within the study area

Survey technique	No. of Sites	Total survey effort
Anabat recording	3	12 Anabat nights
Spotlighting	Treed areas along roadsides, creeks and in remnants	>14 person hours over 3 nights
Owl call playback	2	~2 playback hours
Frog surveys *Growling Grass Frog* 2012/13 2013/14 2016/17 *Southern Toadlet* 2012/2013	 35 25 28 5	> 150 person hours
Hair tubes (targeted Southern Brown Bandicoot surveys)	10	10 hair tubes per site for 14 nights (1400 hair tube nights)
Cameras (targeted Southern Brown Bandicoot surveys) 2013 2016	 10 20	Total 420 camera nights 10 cameras for 14 nights (140 camera nights) 20 cameras for 14 nights (280 camera nights)

Survey technique	No. of Sites	Total survey effort
Bird census	Throughout study area	> 20 person hours
Active searching	All of the above locations	~80 person hours

2.3.3 General Fauna Searches and Habitat Assessment

General terrestrial fauna assessments were conducted by qualified zoologists in accordance with the requirements outlined in Attachment 3 of the Biodiversity Precinct Structure Planning Kit (BPSP Kit) (DSE 2010a). Diurnal and nocturnal surveys were undertaken between 11 December 2012 and 12 March 2013. Experienced zoologists assessed the entire study area by either vehicle or on foot to determine the location and value of fauna habitat types. Structural and floristic components of habitat types throughout the study area were evaluated for the resources provided to terrestrial vertebrates. Active searches for fauna and general signs of fauna presence (bones, nests, feathers, fur, scats, tracks, scratching and diggings) were undertaken in habitats throughout the study area. The presence of many species is often determined not by directly observing the species, but by finding distinct signs of their presence including bones, scats and tracks. Many species can be identified by the size and shape of their faecal material. Signs can also indicate areas where more intensive targeted survey effort should be undertaken.

2.3.4 Diurnal Bird Surveys

Diurnal bird surveys were undertaken in all habitat types throughout the study area. Experienced zoologists searched habitat with binoculars and identified species visually and by calls. Bird surveys particularly targeted woodland birds and waterbirds in suitable roadside reserves, patches of remnant native vegetation, waterbodies and waterways including Deep Creek and Hancock's Gully. Opportunistic sightings of birds whilst driving around the study area (particularly raptors) were also recorded.

2.3.5 Nocturnal Bird Surveys

Nocturnal owl-call playback was undertaken at two locations; along Deep Creek Road just north of the Princes Highway and on Mount Ararat Road North (Figures 7a-b). The calls of Powerful Owl *Ninox strenua*, Barking Owl *Ninox connivens* and Masked Owl *Tyto novaehollandiae* were played through a hand–held megaphone to attract them to the survey site or to elicit a response. This was followed by passive listening and spotlighting in the immediate area to locate any fauna attracted to the site. Methodology was in accordance with the recommended survey protocol for Barking Owl outlined in Attachment 4 of the BPSP Kit (DSE 2010a).

2.3.6 Spotlighting

Spotlighting surveys for arboreal mammals and nocturnal birds were undertaken over three nights within suitable habitat along Deep Creek, in roadside reserves, patches of remnant vegetation and scattered remnant trees throughout the study area. Surveys were undertaken on foot by two zoologists using 30 watt, 12 volt spotlights.

Spotlighting was conducted within the first three hours following sunset, when the activity levels of arboreal mammals and other nocturnal fauna is likely to be greatest. At sites where call playback was performed, spotlighting was conducted after the playback session was completed (Section 2.3.5).

2.3.7 Reptile Surveys

Active searches were undertaken to detect reptile species in areas of suitable habitat within roadside reserves, patches of remnant vegetation, within paddocks, next to dams and adjacent to Deep Creek and Hancocks Gully. Experienced zoologists actively searched amongst leaf and other ground litter, rolling over large rocks and logs and actively scanning likely places such as the edge of waterbodies. A minimum of 30 minutes was spent searching each location.

2.3.8 Ultrasonic Bat Call Detection

Detectors which record and log the ultrasonic echolocation calls of microchiropteran bats were deployed at three sites throughout the study area (Figures 7a and 7c). AnaBat SD1 and SD2 units (Titley Scientific) were set up for five nights at each site. Two sites were chosen which were within the potential flight corridor provided by Deep Creek and the third overlooked a large farm dam. These sites were selected in order to maximise the number of species likely to be detected. The calls were analysed to species level by bat expert Rob Gration from EcoAerial Pty Ltd.

2.4 Targeted Flora Surveys

Targeted flora surveys were undertaken concurrently with the flora and habitat hectare assessment between 19 to 29 November 2012. Species targeted included Matted Flax-lily, Arching Flax-lily, Veined Spear-grass and Green Scentbark, due to their known occurrence within the local area and the presence of suitable habitat in the study area (Appendix 2.2).

The timing of the surveys was specifically aimed to correspond with spring flowering species, including most orchid species, and the flowering season for Matted Flax-lily (generally between November and February). A Matted Flax-lily reference site known to support the species was checked prior to the November survey to confirm that flowering had commenced.

Qualified botanists traversed the study area on foot (transects of five meters to maximise detection), searching areas of suitable habitat for the target species.

2.5 Targeted Growling Grass Frog Surveys

Targeted surveys for Growling Grass Frog were undertaken in accordance with DoEE standards, as outlined in the *Significant impact guidelines for the vulnerable Growling Grass Frog (Litoria raniformis)* (DEWHA 2009). Survey techniques were also in accordance with methods prescribed in the BPSP Kit (DSE 2010a) and were undertaken during the 2012/13, 2013/14 and 2016/17 active seasons.

2.5.1 Nocturnal Surveys

Surveys were conducted in conditions considered optimal for detection (i.e. warm and humid, overnight temperature not less than 14°C) (Table 4). Nocturnal surveys involved listening for calling frogs at each survey location for approximately five minutes. Subsequently, short recordings of the advertisement call of a male Growling Grass Frog were played-back several times to elicit a response from any adult males present. Surveyors listened for a further ten minutes after call play-back for any response from calling male Growling Grass Frogs.

On completion of call play-back, surveyors used 30 Watt, 12 volt hand-held spotlights to search for any frogs on the margins and surface of open water areas of waterways and waterbodies within the study area. The accessible terrestrial habitat surrounding each survey location was searched for frogs using spotlights, while suitable ground debris was overturned to locate any sheltering individuals. All frog species observed or heard calling were recorded to inform an assessment of the suitability of the study area for breeding frogs.

2012/13 Season

During the 2012/13 active season targeted surveys were undertaken along the length of Deep Creek within the precinct and 31 other waterbodies (i.e. pools, dams and wetlands) (Figures 7a-d). Nocturnal surveys were undertaken on two separate occasions at each location, the first during December 2012 and the second during January 2013. Surveys were undertaken over nine nights on 11, 12, 18 and 20 December 2012 and 10, 15, 16, 22 and 24 January 2013. Habitat assessments were undertaken between late January and late February 2013 (Table 4).

2013/14 Season

Additional targeted surveys were undertaken during the 2013/14 active season. The survey area encompassed the PSP south of the Princes Highway as well as artificial frog ponds north and south of the Pakenham Bypass. The length of Deep Creek within this area along with an additional 11 dams and wetlands within the precinct, and 11 ponds along the Princes Freeway were surveyed. Nocturnal surveys were undertaken over four nights on 15 October, 6 and 28 November and 16 December 2013. Diurnal habitat assessments and tadpole dip-netting was undertaken on 20 January and 10 February 2014 (Table 4).

During the January and February surveys for each season dip-netting for tadpoles was undertaken at each survey location. A dip net was swept along the edge and around all types of vegetation present within each waterway or waterbody. All tadpoles caught and identified to species level.

2016/17 Season

A further round of targeted surveys was completed between November 2016 and March 2017 to further inform the EPBC Act referral for the species.

A total of 28 sites were surveyed over encompassing farm dams, areas of Deep Creek and artificial frog ponds along the Pakenham Bypass, adjacent to the study area. Nocturnal surveys were undertaken over five nights on 17 and 22 November and 1 December 2016 and 10 January and 15 March 2017.

Table 4. Timing and weather conditions of the nocturnal Growling Grass Frog surveys

Date	Survey Times	Air temp Start (°C)	Air temp Finish (°C)	Humidity Start (%)	Wind (0-4)	Rain (0-3)	Moonlight (0-4)	Cloud cover (0-8)	Rain in previous 24 hours
11/12/12	2130- 0000	19.5	14.4	56	3	0	3	0	No
12/12/12	2130- 2323	24.7	22.7	49	1	0	0	1	No
18/12/12	2118-1143	22.1	18.0	51	0	1	1	5	Yes
20/12/12	2130-2320	14.4	14.3	70	1	0	1	7	Yes
10/01/13	2130-0039	19.2	20.0	65	1	1	0	8	Yes
15/01/13	2120-0000	18.7	15.8	57	1	0	2	0	No
16/01/13	2120-2326	19.7	17.4	62	1	0	2	1	No
22/01/13	2110-2335	18.4	17.0	70	1	0	3	3	No
24/01/13	2115-2305	25.0	22.7	41	0	0	3	0	No
15/10/13	2019-2250	17.3	12.7	50	1	0	2	1	Yes
06/11/13	2047-2332	22.8	14.6	44	1	0	0	0	No
28/11/13	2047-2323	17.0	13.7	77	1	0	0	0	Yes
16/12/13	2103-2315	16.0	13.9	76	1	0	4	1	No
17/11/16	2100-2330	21.0	19.0	50	2	0	4	0	Yes
22/11/16	2110-2345	14.0	13.0	95	2	0	0	8	Yes
01/12/16	2045-2350	14.0	13.0	50	1	0	2	0	No
10/01/17	2112-2320	17.0	13.0	51	1	0	4	0	Yes
15/03/17	2133-2310	28.0	26.0	32	1	0	3	1	No

2.5.2 Habitat Assessment

Diurnal habitat assessments were undertaken at representative points along Deep Creek and all other wetland, dam and pond survey locations during the 2012/13, 2013/14 and 2016/17 survey periods (refer to Figures 7a-c and 8). At each location the percentage cover of aquatic vegetation was estimated. Aquatic vegetation was categorised as being fringing, emergent, submergent or floating. The presence of any predatory fish was also recorded during the surveys.

Based on the habitat assessment (see criteria Appendix A1.2), and known key microhabitat requirements of Growling Grass Frog (Heard *et al*. 2008), each site was then categorised as either supporting low, moderate, or high quality habitat for Growling Grass Frog.

High quality habitat was identified by the presence of key habitat characteristics favoured by Growling Grass Frog for breeding (e.g. high water quality, good hydroperiodicity, structural diversity of aquatic vegetation). Low quality habitats which lack these characteristics are unlikely to be occupied by Growling Grass Frog (Appendix A1.2).

In-situ quality measurements were taken at each habitat assessment location, with the exception of sites at which the water had dried up. Water quality data was collected using a calibrated Horiba™ multiprobe for the following parameters; dissolved oxygen, pH, electrical conductivity, temperature and total dissolved solids. Turbidity was assessed using a calibrated Hach™ Portable Turbidimeter or by visual assessment.

During the diurnal habitat assessments the areas surrounding each waterway and waterbody were actively searched for frogs.

2.6 Targeted Southern Brown Bandicoot Surveys

Targeted surveys for Southern Brown Bandicoot were undertaken in accordance with the BPSP Kit (DSE 2010a) and incorporated DoEE standards, as outlined in the *Draft Referral Guidelines for the Endangered Southern Brown Bandicoot (Eastern) (Isoodon obesulus obesulus)* (SEWPaC 2011).

Active searches and habitat assessments were undertaken in all areas likely to be suitable for Southern Brown Bandicoot, including within riparian vegetation along Deep Creek, within dense shrubby vegetation along the Princes Highway and adjacent to Hancocks Gully. During these searches, experienced zoologists searched for signs of bandicoot activity such as digging, tracks, scats, nests and conical foraging holes. From the searches it was determined that the study area contains areas of suitable habitat for Southern Brown Bandicoot.

2013 Survey

Hair tubes and cameras were deployed in suitable habitat throughout the study area (Figures 7a-c). Ten transects were sampled, with each transect containing ten hair tubes and one infrared camera (100 hair tubes and 10 cameras in total). The number of hair tubes and cameras deployed was determined using the draft referral guidelines, which recommend 10 hair tubes and one camera per two hectares for affected habitat between 10 and 30 hectares (SEWPaC 2011). Survey transects were located within riparian vegetation adjacent to Deep Creek, within vegetation along the Princes Highway and adjacent to Hancocks Gully. Hair tubes and cameras were deployed between 18 and 20 February 2013 (eight to six days before the full moon as recommended in the BPSP Kit [DSE]) and collected between 4 and 6 March 2013.

The hair tube design comprised a T-shaped section of PVC drainage piping, adapted with a central gauze-covered bait section at 90 degrees to the pipe length. A combination of 75 mm and 90 mm diameter hair tubes were used to survey for both adult and dispersing juvenile Southern Brown Bandicoots. Hair tubes were baited with a mixture of peanut butter, rolled oats, treacle and truffle oil and double-sided tape was stuck to the inside upper surface of the tube entrances. Hair samples collected on double-sided tape were analysed by Barbara Triggs (Dead Finish) to determine the species of mammals which had visited the hair tubes. In most cases hairs were identified to species level. The tubes were placed on the ground in suitable microhabitats, spaced approximately 20 metres apart and left in place for a minimum of two weeks (Table 3).

Infra-red motion detector cameras were deployed with each hair tube transect, at key locations within suitable habitat. Cameras were positioned such that their focal point was on areas of suitable micro-habitat (e.g. mammal run-ways, logs, etc.). A baited hair tube was placed at the focal point of each camera to attract fauna to the field of view. Cameras were left in the field for a minimum of two weeks

(Table 3). Images from the cameras were uploaded to a computer and a qualified zoologist examined all images individually to record which fauna species were present.

2016 Survey

A total of 20 infra-red motion detector cameras were deployed at key locations within suitable habitat between 7 and 22 November 2016 (Figure 8). The same methodology above was utilised, however hair tubes were not deployed. A bait container was placed at the focal point of each camera. Cameras were left in the field for a minimum of two weeks (Table 3). Images from the cameras were uploaded to a computer and a qualified zoologist examined all images individually to record which fauna species were present.

2.7 Targeted Southern Toadlet Surveys

Targeted surveys for Southern Toadlet were undertaken in accordance with the methodology prescribed in the BPSP Kit (DSE 2010a).

Targeted surveys were conducted in areas of suitable habitat within the Princes Highway road reserve and within property 15. Surveys focused on damp, low-lying areas (particularly shallow drainable lines and depressions) within patches of woodland and Swamp Scrub. These areas were identified during the general fauna surveys to provide suitable habitat for the species. Nocturnal surveys were undertaken on two separate nights, 2 and 8 May 2013, at each location. Habitat assessments were undertaken concurrently with the general fauna surveys, between December 2012 and March 2013.

Nocturnal surveys involved listening for calling frogs at each survey location for approximately five minutes. Subsequently, short recordings of the advertisement call of a male Southern Toadlet were played-back several times to elicit a response from any adult males present. Surveyors listened for a further ten minutes after call play-back for any response from calling Southern Toadlets.

On completion of call play-back, surveyors used 30 Watt, 12 volt hand-held spotlights to search for any frogs while suitable ground debris (rocks, logs and other debris) was overturned to locate any sheltering individuals. All frog species observed or heard calling were noted to inform an assessment of the suitability of the study area for frogs.

Weather conditions during the time of assessment were recorded. A reference site at Langwarrin Flora and Fauna Reserve, which is known to support a resident population of Southern Toadlet, was visited by the zoologists on both nights prior to the assessments of the study area to determine whether the species was calling at the time.

2.8 Targeted Aquatic Surveys

2.8.1 Habitat Assessment

A diurnal aquatic fauna habitat assessment was undertaken concurrently with targeted surveys on 29 and 30 January 2013. All waterways and waterbodies (for which access was arranged and granted) within and, where appropriate, adjacent to the study area were assessed (ten sites in total, refer to Figure 9). The aim of the habitat assessment was to identify which (if any) of the waterways and waterbodies were suitable for Australian Grayling or Dwarf Galaxias, and the requirement for targeted surveys.

The following habitat variables were recorded as part of the assessment:

- Waterbody type;
- Riparian vegetation condition and cover;
- In-stream macrophyte condition and cover;
- Other structural habitat features;
- Substrate; and,
- Connectivity within the broader catchment.

In situ water quality data was collected from the waterways and waterbodies that were identified for targeted survey. This data was recorded using a calibrated Horiba™ multi-probe, which measured dissolved oxygen, pH, electrical conductivity, temperature and turbidity.

2.8.2 Targeted Dwarf Galaxias and Australian Grayling Survey

Fish survey methods involved applying a combination of standard aquatic survey techniques, including fyke nets, seine nets, bait traps (illuminated with cyalume sticks) and dip netting. The survey techniques employed at each site was depending upon habitat variables. Each site surveyed employed at least one active diurnal technique (dip net and/or seine net), and one or more overnight passive technique (fyke nets and/or bait traps). The completed survey effort is detailed below (Table 5).

Surveys were conducted in accordance with DPI Research Permit RP958.

Table 5: Aquatic survey effort (*sites were dry at the time of assessment).

Site	Waterbody	Date	Dip net (time)	Fyke net (number)	Bait trap (number)	Habitat Assessment Only
1	Deep Creek	29/01/2013	15 mins	-	10	-
2	Deep Creek	29/01/2013	15 mins	-	10	-
3	Deep Creek	29/01/2013	15 mins	4	10	-
4	Deep Creek	29/01/2013	15 mins	-	10	-
5	Deep Creek	29/01/2013	15 mins	-	10	-
6	Hancock's Gully (online dam)	30/01/2013	15 mins	2	10	-
7	Hancock's Gully (online dam)	30/01/2013	15 mins	2	10	-
8	Hancock's Gully (online dam)	30/01/2013	-	-	-	*
9	Hancock's Gully (online dam)	30/01/2013	-	-	-	*
10	Hancock's Gully	30/01/2013	15 mins	-	10	-

2.9 Assessment Qualifications and Limitations

2.9.1 Desktop Assessment

Data and information held within the ecological databases and mapping programs reviewed in the desktop assessment (e.g. VBA, PMST, NatureKits etc.) are unlikely to represent all flora and fauna

observations within, and surrounding, the study area. It is therefore important to acknowledge that a lack of documented records does not necessarily indicate that a species or community is absent, but instead may reflect a lack of survey effort.

2.9.2 Flora and Fauna Assessment

The flora, fauna and habitat hectare assessment (19 to 29 November 2012) was undertaken in late-Spring, which is an optimal time for detecting a broad range of native flora due to many species flowering and fruiting. For flora species that emerge or flower outside of these seasons, detection may be reduced. An additional flora survey was undertaken in March 2017 to account for any changes to the extent of remnant patches and number of scattered trees that had taken place over time since the initial 2012 survey.

Furthermore, the 'snap shot' nature of standard flora and fauna site assessments reduces the likelihood of detecting mobile, migratory, seasonal, cryptic, nocturnal or uncommon fauna species. Therefore, the absence of species from the results does not necessarily mean that it is not present or does not use the study area. As with any assessment, a greater amount of time and survey effort on the site would increase the likelihood of recording these additional flora and fauna species.

2.9.3 Targeted Flora Surveys

The targeted flora surveys (19 to 29 November 2012) were undertaken in late-Spring, which coincides with the flowering time for many threatened species potentially present within the study area, in particular Matted Flax-lily, Veined Spear-grass and Green Scentbark. A reference site where Matted Flax-lily is known to occur was checked prior to the surveys to ensure that the species was in flower.

2.9.4 Targeted Growling Grass Frog Surveys

Habitat assessments are representative of the habitat value at the time of assessment. Many of the waterways and waterbodies within the study area are ephemeral and their value as habitat for Growling Grass Frog is likely to change with seasonal and climatic conditions. Aquatic vegetation grows quickly and can vary dramatically depending on water levels, seasonal conditions and stock access.

Notwithstanding the above, due to the completion of multiple visits to the study area during the day and night, as well as the targeted surveys being undertaken in the most suitable seasons for the species, information presented in this report is considered sufficient to document most of the ecological values present within the study area and inform the likelihood of significant species and communities being impacted by the proposed development. Where this has not been achieved, precautionary measures have been recommended to account for uncertainty.

2.9.5 Targeted Dwarf Galaxias and Australian Grayling Surveys

Freshwater aquatic systems are typically very dynamic, with local habitat conditions heavily influenced by seasonal changes, and localised hydrological events. As such, habitat use by fish is highly variable. This is particularly relevant to Dwarf Galaxias, a species which is known to use ephemeral habitats that are periodically inundated, and may travel upstream through catchments to access the most suitable ephemeral habitats. During dry periods, surveys focussed on refuge pools, where Dwarf Galaxias may be found to be easily detected. However, it is possible the Dwarf Galaxias may be present further

downstream in refuge pools that are more suitable than those surveyed presently. Given these limitations, likelihood of occurrence of Dwarf Galaxias is interpreted in the context of the connectivity, local hydrological conditions at the time of the survey, and previous records and survey effort throughout the broader catchment.

Australian Grayling is acknowledged as being difficult to detect. They are also a migratory species that spend the first part of their life cycle in marine waters, and their use of particular freshwater habitats may be restricted to transient occurrences between migratory phases. Therefore, likelihood of occurrence for Australian Grayling is primarily established in the context of their connectivity requirements, habitat features and previous records throughout the catchment.

3 RESULTS

3.1 Flora Assessment

3.1.1 Flora Species

A total of 223 plant species (108 indigenous, 115 introduced) were recorded within the study area (Appendix 2.1). Planted trees and shrubs were recorded as introduced unless they were seen to be naturally recruiting on site.

3.1.2 Ecological Vegetation Classes (EVC)

According to DELWP's NatureKit (DELWP 2017) the majority of the study area is located within the Gippsland Plain bioregion, with ridge lines entering into the study area from the north of the Highland Southern Fall bioregion. However, these ridge lines do not demonstrate a significant change in the geology and vegetation type or condition on site to clearly distinguish the beginning of a new bioregion.

DELWP modelled (pre-1750) EVC mapping for the region indicates that the study area was largely dominated by Swampy Woodland (EVC 937) and Swamp Scrub (EVC 53), with Swampy Riparian Woodland (EVC 83) along Deep Creek and the majority of drainage lines, and Grassy Forest (EVC 128) and Damp Heathy Woodland covering the ridge lines in the north of the study area. Current extant (2005) EVC mapping shows only isolated patches of these EVCs remain within the study area (DELWP 2017), which are mostly concentrated along Deep Creek and within the Princes Highway road reserves (Table 6). .

Table 6. The Bioregional Conservation Status of EVCs modelled to occur within the study area (DSE 2013b).

EVC	Number	Bioregional Conservation Significance
Gippsland Plain bioregion (GP)		
Riparian Forest	18	Vulnerable
Swampy Riparian Woodland	83	Endangered
Grassy Forest	128	Endangered
Grassy Woodland	175	Endangered
Damp Heathy Woodland	793	Vulnerable
Swampy Woodland	937	Endangered
Swamp Scrub	53	Endangered
Highlands Southern Fall bioregion (HSF)		
Grassy Forest	128	Vulnerable
Grassy Woodland	175	Depleted
Damp Heathy Woodland	793	Depleted
Swampy Woodland	937	Endangered

3.1.3 Vegetation Condition

Vegetation surveys completed in 2012 recorded all seven EVCs within the study area, with 81 remnant patches of poor to good quality identified. In addition, 669 scattered indigenous trees were recorded throughout the study area, including 65 Very Large Old Trees (VLOTs), 152 Large Old Trees (LOTs), 108 Medium Old Trees (MOTs) and 344 Small Trees (STs).

Following additional site assessments in March 2017, a revised total of 75 remnant patches and 530 scattered indigenous trees was recorded (Figure 2). The reduced number of remnant patches and scattered trees is a result of vegetation loss due to storm damage and on-farm clearance. The remaining sections of the study area comprised almost exclusively introduced vegetation.

Descriptions of each EVC recorded within the study area are provided in the following sections.

Riparian Forest (Gippsland Plain [GP])

Riparian Forest is described as a tall forest to 30 metres tall along river banks and associated alluvial terraces with occasional occurrences in the heads of gullies leading into creeks and rivers. The soil is fertile alluvium, regularly inundated and permanently moist. The EVC is typically dominated by tall eucalypts and generally has an open to sparse secondary tree layer of wattles and scattered dense patches of shrubs, ferns, grasses and herbs (DSE 2013b).

Remnant patches of Riparian Forest occur along both sides of Deep Creek north of the Princes Highway and contained diverse and relatively intact understorey and midstorey layers with many Large and Very Large Old Trees present in the overstorey. Key species included Manna Gum *Eucalyptus viminalis* subsp. *viminalis,* Silver Wattle *Acacia dealbata,* Blackwood *Acacia melanoxylon,* Prickly Moses *Acacia verticillata* subsp. *verticillata*, Prickly Current-bush *Coprosma quadrifda,* Snowy Daisy-bush *Olearia lirata,* Tasman Flax-lily *Dianella tasmanica,* Austral Bracken *Pteridium esculentum* and Thatch Saw-sedge *Gahnia radula.*

With exception of the immediate road edges, weed cover throughout these patches was relatively low and most patches were in moderate to good condition.

Swampy Riparian Woodland (GP)

Swampy Riparian Woodland is described as being up to 15 metres tall and generally occupying low energy streams of the foothills and plains. The lower strata are variously locally dominated by a range of large and medium shrub species on the stream levees in combination with large tussock grasses and sedges in the ground layer (DSE 2013b).

Remnant patches of Swampy Riparian Woodland occur on both sides of Deep Creek south of the Princes Highway along Ryans Road and also north of the Princes Highway for approximately 300 metres. Whilst narrow, patches of Swampy Riparian Woodland immediately north and south of Princes Highway were relatively intact and in good condition with a mature overstorey of Large and Very Large Old Trees and complex structure in both mid and ground storeys. Dominant native species in these areas included Swamp Gum *Eucalyptus ovata*, Prickly Tea-tree *Leptospermum continentale,* Swamp Paperbark *Melaleuca ericifolia,* Tall Sedge *Carex appressa* and Kidney-weed *Dichondra repens.*

Remnant patches of Swampy Riparian Woodland at the southern end of Deep Creek within the study area were less diverse and in poor to moderate condition.

In most instances the mid and overstorey layers were young and appeared to have been replanted as evidenced by non-indigenous tree species including Victorian Blue-gum *Eucalyptus globulus* subsp. *bicostata.*

Grassy Forest (GP/ Highland Southern Fall [HSF])

Grassy Forest is described as a low growing forest up to 20 metres tall with an understorey of small and medium shrubs and a rich diversity of herbs. Large shrubs and understorey trees may also be conspicuous. This EVC often grows in areas transitional between drier box stringybark forests and taller, herb-rich forests typical of more favourable environments (DSE 2013b).

Remnant patches of Grassy Forest ranging from poor to good condition are scattered throughout the study area generally at higher elevations such as along Dore Road. Grassy Forest patches were dominated by an overstorey of Bundy *Eucalyptus goniocalyx* with scattered Narrow-leaf Peppermint *Eucalyptus radiata* subsp. *radiata* and Messmate Stringybark *Eucalyptus obliqua.* In most instances the shrub layer was absent or sparse with a dense cover of both introduced and native grasses, along with native herbs. Native species included Weeping Grass *Microlaena stipoides* var. *stipoides,* Kangaroo Grass *Themeda triandra,* Bristly Wallaby-grass *Rytidosperma setacea,* Yellow Rush-lily *Tricoryne elatior,* Smooth Flax-lily and the state listed Veined Spear-grass.

Grassy Woodland (GP/HSF)

Grassy Woodland is described as a variable open eucalypt woodland up to 15 metres tall or occasionally Sheoak woodland up to 10 metres tall over a diverse ground layer of grasses and herbs. The shrub component is usually sparse. It occurs on sites with moderate fertility on gentle slopes or undulating hills on a range of geologies (DSE 2013b).

Remnant patches of Grassy Woodland were of low to moderate quality, and predominantly consisted of an overstorey consisting of Black Sheoke *Allocasuarina littoralis*, and indigenous eucalypts including Silver-leaf Stringybark *Eucalyptus cephalocarpa*, and Manna Gum. The understorey was highly modified, with the ground-layer containing few indigenous species including Kidney Weed, Veined Spear-grass, and Wattle Mat-rush *Lomandra filiformis.* Exotic species were dominant, particularly Sweet Vernal-grass *Anthroxanthum odoratum*, Wild Oat *Avena* spp., and Buck's horn Plantain *Plantago coronopus*.

Damp Heathy Woodland (GP/HSF)

Damp Heathy Woodland is described as being up to 10 metres tall with tall dense heathy understorey which becomes tall scrub if long unburnt in high rainfall areas. The ground layer consists of grasses, herbs, small shrubs and tough-leaved monocots. Developed on sandy soils of moderate to low fertility, typically wet in winter due to impeding layer in soil and dry in summer (DSE 2013b).

Remnant patches of Damp Heathy Woodland were of low to moderate quality, and predominantly consisted of an overstorey consisting of indigenous eucalypts including Swamp Gum, Silver-leaf Stringybark and Manna Gum, with a moderate cover of indigenous species such as Prickly Tea-tree, Kangaroo Grass, Austral Bracken *Pteridium esculentum*, and Common Heath *Epacris impressa*. Woody exotic species dominated the midstorey of this EVC, particularly noxious weeds such as Hawthorn *Crataegus monogyna*, Gorse and Blackberry.

Swampy Woodland (GP/HSF)

Swampy Woodland is described as open eucalypt woodland up to 15 metres tall with ground-layer dominated by tussock grasses and/or sedges and often rich in herbs. This EVC occurs on poorly drained, seasonally waterlogged heavy soils, primarily on swamp deposits but extending to suitable substrates within some landscapes of sedimentary origin (DSE 2013b).

Remnant patches of Swampy Woodland are scattered throughout the study area in association with drainage lines and low lying areas that are prone to waterlogging. The condition of Swampy Woodland patches varied from poor to moderate condition. In most instances, species diversity and structural complexity within these patches was poor and canopy trees were absent or sparse. Native flora species associated with Swampy Woodland remnants included, Swamp Gum, Mealy Stringybark, Swamp Paperbark, Tall Sedge, Thatch Saw-sedge, Joint-leaf Rush *Juncus holoschoenus* and Toad Rush *Juncus bufonius.*

Swamp Scrub (GP)

Swamp Scrub is described as a closed scrub up to eight metres tall at low elevations on alluvial deposits along streams or on poorly drained sites with higher nutrient availability. The EVC is dominated by Swamp Paperbark (or sometimes Woolly Tea-tree *Leptospermum lanigerum*) which often forms a dense thicket, out-competing other species. Occasional emergent eucalypts may be present. Where light penetrates to ground level, a moss/lichen/liverwort or herbaceous ground cover is often present. Dry variants have a grassy/herbaceous ground layer (DSE 2013b).

Remnant patches of Swamp Scrub were of low quality, and consisted of thickets of Swamp Paperbark, with emergent eucalypts present. Some indigenous species were present in the understorey, including Prickly Currant-bush *Coprosma quadrifida*¸ Swamp Starwort *Stellaria angustifolia*, Tall Rush *Juncus procerous*, and Common Tussock-grass *Poa labillardierei*. The understorey was invaded, and mostly dominated by exotic species including Blackberry, Sweet Pittosporum, Hawthorn, Gorse, Sweet Vernal-grass, and Yorkshire Fog *Holcus lanatus*. Exotic species were largely out competing indigenous species within this EVC.

Scattered trees

The 2017 survey recorded a total of 530 scattered indigenous trees within the study area (Figure 2.2). These trees comprise a mix of Swamp Gum, Narrow-leaf Peppermint, Bundy, Manna Gum, Green Scentbark, Mealy Stringy Bark and Messmate. Many Dead Stags were also scattered throughout the study area and are considered to provide habitat for fauna species (Section 3.2.2.4). The species and DBH of the scattered trees are detailed in Appendix 2.4.

Swamp Gum, Narrow-leaf Peppermint, and in some cases Green Scent bark, are most likely to have originated from Swampy Woodland, Swampy Riparian Woodland and Damp Heathy Woodland vegetation, while Manna Gums are most likely to have originated from Riparian Forest. Bundy and Messmate are most likely to have once formed the canopy component of Grassy Forest and Black Sheoak originated from Grassy Woodland vegetation.

3.1.4 Predominantly Introduced Vegetation

The remainder of the study area is highly modified and comprises predominantly introduced vegetation. This vegetation included introduced grasses and herbs, such as Panic Veldt-grass *Ehrharta erecta* var. *erecta*, Kikuyu *Cenchrus clandestinus,* Brown-top Bent *Agrostis capillaries*, Yorkshire Fog, Toowoomba Canary-grass *Phalaris aquatic*a, Couch *Cynodon dactylon* var. *dactylon*, Rat-tail Grass *Sporobolus africanus*, Paspalum *Paspalum dilatatum,* Cape Weed *Arctotheca calendula,* Bastard's Fumitory *Fumaria bastardii*, Clover *Trifolium* spp., Flatweed *Hypochaeris radicata*, Ribwort *Plantago lanceolata*, and Ox-tongue *Helminthotheca echioides*. There were also a range of noxious weeds such as Blackberry, Sweet Pittosporum, Spear Thistle, Montpellier Broom and established gardens and planted trees, including a number of non-indigenous eucalypts.

3.1.5 Significant Flora Species

National

No nationally significant flora species were identified within the study area during the site assessments. According to the VBA (DELWP 2017) and FIS (Gullan 2017), four nationally significant flora species have previously been documented within a 10 kilometre radius of the study area: Matted Flax-lily, Buxton Gum *Eucalyptus crenulata,* Clover Glycine *Glycine latrobeana*, and Maroon Leek-orchid *Prasophyllum frenchii*. According to the Protected Matters Search Tool (DoEE 2017) a further six species are predicted to occur within a 10 kilometre radius of the study area (Figure 4) (Appendix 2.2). Following targeted surveys and the modified nature of the study area, there is a low likelihood that these species occur within the study area (Appendix 2.2).

State

Two species listed under the Advisory List of Threatened Flora in Victoria (DSE 2005) were identified during the targeted surveys: Veined Spear-grass and Green Scentbark (Figure 3).

These species occurred throughout the study area and in most instances were restricted to road site sides and riparian/creek line vegetation. Veined Spear-grass occurred in moderate to good quality vegetation within a grassy understorey. Green Scentbark was recorded throughout the study area within poor to good quality vegetation and as isolated, scattered trees (Figure 3).

Seventeen (17) plant species occur within the study area belonging to the Asteraceae (Daisy) and Epacridaceae (Heath) families, along with species from genera including *Acacia* and *Xanthorrhoea* that are declared protected on public land under Section 46 of the FFG Act (Appendix 1 Table A1.1.).

According to the VBA (DELWP 2017) and FIS (Gullan 2017), a further 34 state significant species have previously been recorded within a 10 kilometre radius of the study area (Appendix 2.2, Figure 4). Following targeted surveys, there is a low likelihood that any of these species occur within the study area (Appendix 2.2).

3.1.6 Significant Ecological Communities

No ecological communities of national or state significance occur in the study area.

3.2 Fauna Assessment

3.2.1 Fauna Species

A total of 119 fauna species (or evidence thereof) were recorded within the study area during the current assessment including 19 mammals (13 native, six introduced), 78 birds (71 native, seven introduced), nine native frogs, four native reptiles, seven fish (four native, three introduced) and two native decapod crustaceans (Appendix 3.1). One species of national significance (Growling Grass Frog), two species of state significance (Hardhead *Aythya australis* and Australasian Shoveler *Anas rhynchotis*) and one species of regional significance (Latham's Snipe *Gallinago hardwickii*) were recorded during the field assessments.

A list of the fauna species previously recorded within 10 kilometres of the study area is provided in Appendix 3.1. There have been 262 terrestrial fauna species documented; the majority of which are common birds with a lower number of mammals, frogs and reptiles. This suggests the local area contains a broad range of fauna species, many of which are expected to use the study area on a regular or occasional basis.

3.2.2 Fauna Habitat

The study area supports eight broad habitat types: Riparian Forest; shrubby woodland; Swamp Scrub; scattered trees; creeks and drainage lines; dams and wetlands; planted trees and shrubs and grassland.

Riparian forest

Overall habitat value – This habitat is considered to be of high habitat value for fauna.

Description – Riparian woodland with a high level of structural complexity occurs along the banks of Deep Creek, north of the Princes Highway (Plate 8). This habitat has an overstorey of tall mature eucalypts, particularly Manna Gum, with a midstorey of scattered shrubs, including a variety of wattle species, Cherry Ballart and Snowy Daisy-Bush. The ground layer supports a dense cover of vegetation including Austral Bracken, thick swards of Tasman Flax-lily, Thatch Saw-sedge and areas of dense Kikuyu. Fallen timber including large logs and organic litter is common throughout this habitat. The eucalypts in the overstorey contain numerous small to medium sized hollows and fissures.

Fauna – This area provides high quality habitat for a variety of fauna including birds, arboreal mammals, ground dwelling mammals, microbats and reptiles. Common bird species are likely to utilise these areas for nesting and foraging. During the current survey a variety of birds including Rainbow Lorikeet *Trichoglossus haematodus*, Musk Lorikeet *Glossopsitta concinna* and White-plumed Honeyeater *Lichenostomus penicillatus* were observed foraging within the canopy. These trees provide suitable shelter and foraging habitat for a range of arboreal mammals. Many of the trees had signs of use by arboreal mammals such as possums and gliders with numerous scratches present on the trunks, hollows with marks around the entrances and scats found in these areas. Common Brushtail Possum *Trichosurus vulpecula*, Common Ringtail Possum *Pseudocheirus peregrinus* and Sugar Glider *Petaurus breviceps* were observed in this area during spotlighting surveys. Microbats are likely to forage for insects around the trees and roost within hollows and fissures. The dense ground cover in this area provides suitable habitat for native ground-dwelling mammals.

Bush Rat *Rattus fuscipes* and Swamp Rat *Rattus lutreolus* were both detected in this area during the hair-tube surveys. Common Wombat *Vombatus ursinus* utilise this habitat extensively, with several individuals

observed during the spotlighting surveys and burrows, tracks and scats of the species common through the area. Nocturnal birds are likely to roost and forage within this area. A parent and juvenile Southern Boobook *Ninox novaeseelandiae* were observed within this area on a number of occasions. Common reptiles, including skinks and snakes are likely to occur within this habitat. This vegetation provides habitat connectivity within the predominantly cleared landscape for the above mentioned fauna groups.

Shrubby woodland

Overall habitat value – This habitat is considered to be of high habitat value for fauna.

Description – Woodland with an overstorey dominated by Swamp Gum, Silver-leaf Stringybark and/or Manna Gum occurs adjacent to Deep Creek south of the Princes Highway, as linear remnants within and adjacent to the Princes Highway (Plate 9), Dore Road and Mount Ararat Road North and as a large remnant patch within Property 15. Patches dominated by Black Sheoke occur within the median strip of the Princes Highway. These areas contain a shrubby midstorey, which varies from scattered shrubs to dense thickets. Shrubs in these areas include a variety of *Acacia* species, Cherry Ballart, Swamp Paperbark and Prickly Tea-tree as well as invasive species including Sweet Pittosporum, Hawthorn and Gorse. Blackberry is common throughout these areas, forming dense thickets in some areas. The ground layer in this habitat varies considerably, from areas dominated by introduced grasses and weeds to other sections with a high cover of low native vegetation including Thatch Saw-sedge, Spiny-headed Mat-rush *Lomandra longifolia*, Hop Goodenia *Goodenia ovata* and Smooth Flax-Lily *Dianella laevis*.

Fauna – These shrubby woodland areas provide suitable habitat for a variety of fauna including birds, arboreal mammals, microbats and reptiles. Small insectivorous birds utilise these areas for nesting and foraging. During the current survey a variety of birds including Red-browed Finch *Neochmia temporalis,* Superb Fairy-wren *Malurus cyaneus,* Striated and Brown Thornbill *Acanthiza lineata* were observed foraging amongst shrubs in these areas. Seed cones of the Black Sheoke provide a food source for Yellow-tailed Black-Cockatoo *Calyptorhynchus funereus*. Hollows and fissures within mature Eucalypts provide roosting, nesting and sheltering habitat for hollow-dependent birds and mammals. Sugar Gliders were observed in this habitat type and a high abundance of Common Ringtail Possums was recorded. Microbats are likely to roost within mature eucalypts in this area and to forage within, over and around vegetation within these areas. The dense ground layer in these areas provides habitat for reptiles and small mammals. Both Swamp Rat and Echidna *Tachyglossus aculeatus* were recorded in this habitat. Shrubby woodland along Deep Creek and roadsides provides habitat connectivity within the predominantly cleared landscape for the above mentioned fauna groups.

Swamp Scrub

Overall habitat value – This habitat is considered to be of moderate habitat value for fauna.

Description – Linear patches of Swamp Scrub occur within the road reserves along the Princes Highway (Plate 10) and Canty Lane. These patches consist of dense stands of Swamp Paperbark with an undergrowth of dense Kikuyu and weeds including Blackberry.

Fauna – Areas of Swamp Scrub provide suitable habitat for small birds and mammals. Patches with dense shrubs provide suitable refuge, foraging and nesting habitat for small birds such as Superb Fairy-wren and Grey Fantail, *Rhipidura albiscarpa*. Microbats are likely to forage for insects within and around this vegetation. Swamp Rats may reside within these areas and possums are likely to utilise these areas for

foraging. Common reptiles including skinks may reside within these areas. These patches contribute to habitat connectivity within the landscape for birds, arboreal mammals and microbats.

Scattered trees

Overall habitat value – This habitat is considered to be of moderate value for fauna.

Description – Scattered remnant trees including specimens of Swamp Gum, Narrow-leaf Peppermint, Bundy, Manna Gum, Green Scentbark, Mealy Stringy Bark and Messmate occur throughout the study area. Many of these trees are relatively mature and contain hollows and fissures. Numerous dead stags also occur throughout the area. These trees primarily occur within paddocks dominated by introduced pasture (Plate 11). Fallen timber including branches has accumulated on the ground beneath some of these trees.

Fauna – These trees provide foraging, shelter, nesting and roosting habitat for a variety of fauna. Farmland tolerant bird species including Australian Magpie *Gymnorhina tibicen*, Magpie-lark *Grallina cyanoleuca*, Sulphur-crested Cockatoo *Cacatua galerita*, Galah *Eolophus roseicapilla* and Noisy Miner *Manorina melanocephala* are likely to utilise these trees extensively for perching, foraging and nesting. When flowering, the trees may also provide important foraging habitat for migratory nectarivores such as Lorikeets and Honeyeaters. These scattered trees also provide value for birds of prey as perches for scanning, roosting and nesting. Brown Falcon *Falco berigora* and Australian Hobby *Falco longipennis* were observed using scattered trees within the study area as perches from which to scan for prey. Scattered trees close to remnant patches may be used by Common Brushtail Possum and Sugar Glider. The numerous hollows and fissures within these trees provide roosting, nesting and refuge habitat for birds, arboreal mammals and microbats. Microbats are likely to forage above and around the canopy and roost within small hollows. These trees provide additional connectivity within the extensively modified landscape and are likely to be used as 'stepping stones' by birds and arboreal mammals. Fallen branches beneath these trees may provide refuge habitat for common snakes and skinks.

Creeks and drainage lines

Overall habitat value – This habitat ranges from moderate to high value for fauna.

Description – Deep Creek, Hancocks Gully and a number of minor un-named drainage lines occur within the study area. North of the Princes Highway, Deep Creek is deeply incised with steep, eroded banks. This section of the creek within the study area contained water along its entire length, including some relatively deep pools, though it was not flowing at the time of assessment. Aquatic vegetation is largely limited to Slender Knotweed *Persicaria decipiens* and some rushes and sedges. Fringing vegetation is comprised of the riparian forest described above. South of the Princes Highway Deep Creek becomes shallower with lower banks and during the current assessment had dried up to pools (Plate 12). Little aquatic vegetation occurs within this stretch of the creek. The banks are fringed by the shrubby woodland vegetation described above.

Hancock's Gully was almost completely dry during the assessment, apart from a small pool just downstream of the Princes Highway, which is fringed by Narrow-leaf Cumbungi *Typha domingensis*. The gully is dominated by introduced grasses and weeds and occurs within grazed pasture. Livestock have access to most of the gully. Several minor drainage lines occur within pasture and adjacent to roadsides throughout the study area. These were dry at the time of assessment. The drainage lines are generally

dominated by introduced pasture grasses and weeds, though some contain rushes and sedges in varying densities. Deep Creek is of high habitat value to fauna whilst Hancocks Gully and the minor drainage lines are of moderate value.

Fauna – The creek, gully and drainage line provide suitable habitat for a variety of fish, frog and bird species. Deep Creek provides suitable habitat for a variety of native fish species including Common Galaxias *Galaxias maculatus* and potential sub-optimal habitat for the nationally significant Dwarf Galaxias *Galaxiella pusilla*. Hancock's Gully is of lesser value for fish, due to the ephemeral nature of this waterway. Deep Creek, Hancock Gully and the minor drains may provide dispersal and refuge habitat for a variety of common frog species, including Growling Grass Frog. Deep Creek is likely to provide habitat for a variety of waterbird species with Buff-Banded Rail *Gallirallus philippensis* and Australian Spotted Crake *Porzana fluminea* both observed in this area during the current assessment. The waterways provide potential habitat for herons and egrets, including the state significant Eastern Great Egret *Ardea modesta*.

Dams and wetlands

Overall habitat value – These areas are considered to be of moderate to high habitat value for fauna.

Description – Numerous farm dams of varying sizes and habitat quality were recorded throughout the study area (Plate 13). During the current assessment many of the dams had little or no aquatic vegetation, were heavily pugged (trampled) through livestock access and supported visibly turbid water. However, some of the dams have moderate to high amounts of emergent, fringing and floating vegetation, increasing the habitat quality of the dam for aquatic and terrestrial fauna. These are described in detail in Section 3.3.2. Some ephemeral wetland areas were present within low-lying areas in paddocks, often associated with drainage lines or creeks and were mostly dry at the time of the assessment, though evident by the presence of *Juncus* spp. and *Poa* spp.

Terrestrial fauna – These areas provide habitat of varying quality for a range of waterbirds, fish and frog species. During the current assessment, a variety of waterbirds including Pacific Black Duck *Anas superciliosa*, Australasian Grebe *Tachybaptus novaehollandiae*, Hoary-headed Grebe *Poliocephalus poliocephalus*, Chestnut Teal *Anas castanea*, Eurasian Coot *Fulica atra* and Purple Swamphen *Porphyrio porphyrio* were observed utilising these areas. The state listed Hardhead was recorded from the large irrigation dam within Property 3 and the large dairy dam within Property 34, whilst the state listed Australasian Shoveler was recorded from the dam within Property 37. Dams with a high cover of aquatic vegetation provide potential breeding habitat for frogs, including the nationally listed Growling Grass Frog. As described below in Section 3.3.3, Growling Grass Frog was detected from the large dam within Property 44 and the species has previously been recorded breeding in other dams within the study area.

Ephemeral wetland areas (within low-lying areas in paddocks, often associated with drainage lines or creeks) support potential habitat for swamp-adapted species such as Latham's Snipe. This species was recorded within the study area during the current assessment.

Wetland areas such as this, when inundated, also provide potential habitat for frogs adapted to marshy areas such as Spotted Marsh Frog *Limnodynastes tasmaniensis.*

Planted trees and shrubs

Overall habitat value –This habitat is considered to be of moderate value for fauna.

Description – Planted trees and shrubs occur as windrows and linear revegetated areas along fence lines (Plate 14) and within established gardens surrounding residences throughout the study area. These include a mixture of indigenous and non-indigenous Australian native shrubs and trees as well as exotic trees including Monterey Cypress *Cupressus macrocarpa* and pines *Pinus* sp. Most of the plantings are relatively young and as such, most eucalypts have not yet formed hollows.

Fauna – These areas provide suitable habitat for common birds, arboreal mammals and microbats. Planted trees and shrubs provide foraging and nesting habitat for a variety of birds. During the current assessment common birds including Musk Lorikeet, White-plumed Honeyeater and Red Wattlebird *Anthochaera carunculata* were observed foraging within native trees and shrubs. Whilst the trees are not large enough to provide hollows for arboreal mammals, these species may forage within the trees and Common Ringtail Possum may build dreys (nests) within dense branches. The planted vegetation represents potential foraging habitat for microbats. This vegetation contributes to the overall connectivity of habitat within the landscape by providing dispersal habitat for birds, arboreal mammals and microbats.

Grassland

Overall habitat value – This habitat is considered to be of low value for fauna.

Description – Exotic grassland is a dominant habitat type throughout the study area. The areas comprise improved pasture species, dominated by introduced grasses including Toowoomba Canary-grass, Kikuyu, Panic Veldt-grass, Couch and Paspalum. During the current assessment, most paddocks were subject to grazing by livestock and the grass was relatively short (Plate 15).

Terrestrial fauna – These areas are likely to be utilised by birds adapted to open areas. A number of bird species common to modified, grassy or open habitats were recorded during the current assessment including Australian Magpie, Little Raven *Corvus mellori*, and Willie Wagtail *Rhipidura leucophrys*. Diurnal and nocturnal raptors are likely to forage over these areas and during the present assessment Wedge-Tailed Eagle *Aquila audax*, Brown Falcon and Black-shouldered Kite *Elanus axillaris* were observed hovering over this habitat type. Eastern Grey Kangaroo *Macropus giganteus* are likely to forage within these areas, with a mob observed within similar habitat adjacent to the study area during the current assessment.

Plate 8: Riparian forest, Deep Creek north

Plate 9: Shrubby Woodland, Princes Highway

Plate 10: Swamp Scrub, Princes Highway

Plate 11: Scattered Trees within a paddock

Plate 12: Deep Creek, south of Princes Highway

Plate 13: One of the many dams within the study area

Plate 14 : Planted trees, Mount Ararat Road South

Plate 15: Exotic grassland within the study area

3.2.3 Significant Fauna Species

National

One nationally significant fauna species (Growling Grass Frog) was recorded during the initial targeted survey (2012/13 – one individual), however two subsequent targeted surveys (2013/14 and 2016/17) failed to detect this species. Seven nationally listed fauna species have previously been recorded within the local area (within 10 kilometres of the study area) (DELWP 2017). An additional 12 species have habitat that either occurs or is predicted to occur throughout the local area by the Protected Matters Search Tool (PMST) (DoEE 2017) (Figure 5; Appendix 3.2).

It is unlikely or of low likelihood that most of these nationally listed fauna species would reside within the study area on a permanent basis, due to lack of suitable habitat. Grey-headed Flying-fox *Pteropus poliocephalus* and Swift Parrot *Lathamus discolor* may fly over the study area, or briefly forage within flowering eucalypts when moving between areas of higher quality habitat , however they are unlikely to be dependent on, or make significant use of the area. Suitable habitat exists within the study area for Growling Grass Frog, Southern Brown Bandicoot, Dwarf Galaxias and Australian Grayling, and targeted surveys were completed for these species. These are discussed in the targeted survey sections below.

The likelihood of occurrence for all nationally significant fauna species within the study area is provided in Appendix 3.2.

State

Two fauna species of state significance (Hardhead and Australasian Shoveler) were recorded within large dams during the survey period. The VBA (DELWP 2017) contains records of 27 state listed fauna species previously recorded within 10 kilometres of the study area (Figure 4) (Appendix 3.2).

Based on the landscape context, habitat present within the study area, and habitat requirements of these state significant species, it is considered unlikely that most listed fauna species would reside within the study area on a permanent basis (Appendix 3.2). Suitable habitat for Southern Toadlet is present throughout the study area by means of shallow drainage lines and depressions situated close to or within

woodland and swamp scrub patches, and targeted surveys have been undertaken for this species (Section 3.5).

Waterbirds such as Blue-Billed Duck *Oxyura australis* and Musk Duck *Biziura lobata* may occasionally forage within the large dams within the study area, when flying between areas of more suitable habitat. Powerful Owl may visit the study area on occasion; however this is likely to be part of a much larger home range which would also incorporate higher quality habitat to the north of the study area. Whilst suitable habitat exists for some significant species of woodland birds, the woodland within the area is mostly linear with substantial edge effects and are dominated by aggressive Noisy Miners. It is expected this species would actively exclude most native woodland birds from the area. The following state significant species have a moderate or high likelihood of occurrence and require further consideration:

Eastern Great Egret

Eastern Great Egret is listed as Threatened under the FFG Act and Vulnerable in the *Advisory List of Threatened Vertebrate Fauna in Victoria* (DSE 2013c). Thirteen VBA records (most recent in 1981) of Eastern Great Egret have been documented within a 10 kilometre radius of the study area (Appendix 3.2).

Potential foraging habitat for Eastern Great Egret is present within and adjacent to the study area by means of Deep Creek, drainage lines and the various dams. Being a highly mobile species, individuals are likely to visit these areas opportunistically to forage, however none are considered likely to reside in or rely upon them for persistence. Consequently, the development of the precinct will not have a significant impact on this species.

Baillon's Crake *Porzana pusilla palustris*

Baillon's Crake is listed as Threatened under the FFG Act and Vulnerable in the *Advisory List of Threatened Vertebrate Fauna in Victoria* (DSE 2013c). Three VBA records (most recent in 2003) of Ballion's Crake have been documented within a 10 kilometre of the study area (Appendix 3.2), including one within the study area in 2003 (Figure 5).

Potential habitat for Ballion's Crake is present within and adjacent to the study area by means of Deep Creek, drainage lines, dams and ephemeral wetlands. The record within the study area is from the large dairy dam in Property 34. The species is non-migratory in Australia and usually solitary. As such, it is unlikely that several individuals of this species would utilise the study area and therefore, development of the precinct will not have a significant impact on the species.

Hardhead

Hardhead is listed as Vulnerable in the *Advisory List of Threatened Vertebrate Fauna in Victoria* (DSE 2013c). During the current surveys, five individuals were recorded on two occasions from the large irrigation dam within Property 3, and two individuals were recorded on one occasion from the large dam within Property 34 (Figure 7). Seven VBA records (most recent in 2006) of Hardhead have been documented within a 10 kilometre of the study area (Appendix 3.2) including several within five kilometres of the site (Figure 5).

The numerous dams throughout the study area, in particular the large dams where the species was found, represent suitable habitat for Hardhead, including breeding habitat. Being a mobile species, individuals are likely to also visit these areas opportunistically to forage. To minimise impacts on this species, it is recommended that any drainage or removal of large dams occurs outside the breeding period for the species (August to November).

Australasian Shoveler

Australasian Shoveler is listed as Vulnerable in the *Advisory List of Threatened Vertebrate Fauna in Victoria* (DSE 2013c). During the current surveys, two individuals were recorded on one occasion from the medium sized dam within Property 37 (Figure 7). Eight VBA records (most recent in 1998) of Australasian Shoveler have been documented within a 10 kilometre of the study area (Appendix 3.2), including several from the Pakenham Sewage Lagoons within five kilometres of the site (Figure 5).

The numerous dams throughout the study area, particularly the large dams where the species was recorded, offer suitable foraging and breeding habitat for Australasian Shoveler. Being a mobile species, individuals are likely to visit areas opportunistically to forage. The dams within the study area offering a higher cover of aquatic vegetation represent suitable breeding habitat for the species. To minimise impacts on this species, it is recommended that any drainage or removal of large dams occurs outside the breeding period for the species (August to November).

Regional and Local

One regionally significant fauna species; Latham's Snipe was recorded during the present survey. The VBA (DELWP 2017) contains records of 10 regionally significant fauna species previously recorded from within 10 kilometres of the study area (Appendix 3.2).

Based on the landscape context, habitat present within the study area, and habitat requirements of these regionally significant species, it is of low likelihood or unlikely that most regionally significant fauna species would reside within the study area on a permanent basis (Appendix 3.2). However, the following species require further consideration:

Royal Spoonbill *Platalea regia*

Royal Spoonbill is listed as Near Threatened in the *Advisory List of Threatened Vertebrate Fauna in Victoria* (DSE 2013c). Two VBA records (most recent in 1980) of Royal Spoonbill have been documented within a 10 kilometre of the study area (Appendix 3.2) both within five kilometres of the site (Figure 5).

Potential foraging habitat for Royal Spoonbill is present within and adjacent to the study area by means of Deep Creek, Hancocks Gully, drainage lines and dams. Being a mobile species, individuals are likely to visit these areas opportunistically to forage, however none are considered likely to reside in or rely upon them for persistence. The development of the precinct will not have a significant impact on the species.

Latham's Snipe

Latham's Snipe is listed as Near Threatened in the *Advisory List of Threatened Vertebrate Fauna in Victoria* (DSE 2013c). Latham's Snipe was observed within a paddock within Property 52 (Figure 7). Seventeen VBA records (most recent in 2006) of the species have been documented within a 10 kilometre radius of the study area (Appendix 3.2).

Whilst the Latham's Snipe recorded during the current surveys was within a paddock, it may have been flushed from more suitable habitat surrounding nearby dams. The vegetated edges of dams, drains and ephemeral wetlands throughout the study area provide suitable habitat for the species. Being a migratory species, it is considered likely that individuals regularly visit the study area during annual visits to Australia.

The species does not breed in Australia. Provided that additional wetland habitat is created to offset the loss of suitable habitat within the study area, the development of the precinct is unlikely to significantly impact the species.

Nankeen Night Heron *Nycticorax caledonicus hillii*

Nankeen Night Heron is listed as Near Threatened in the *Advisory List of Threatened Vertebrate Fauna in Victoria* (DSE 2013a). Three VBA records (the most recent in 2008) of Nankeen Night Heron exist within 10 kilometres of the study area (Appendix 3.2), including one within five kilometres of the site in 2008 (Figure 5).

Potential habitat for Nankeen Night Heron is present within and adjacent to the study area by means of Deep Creek and the woodland and riparian forest aligning Deep Creek. These areas are likely to be maintained during the proposed precinct development and as such, the species is unlikely to be significantly impacted.

All other native fauna recorded in the local area (primarily common birds) are of local significance, as they are not listed as rare or threatened on a national, state and/or regional level.

Listed Migratory and Marine Species

Eight (8) EPBC Act-listed migratory and/or marine species were recorded within or adjacent to the study area during the course of the project. With the exception of Latham's Snipe (discussed above), the rest of these species are common bird species which are unlikely to be significantly impacted by the proposed precinct development. An additional 32 EPBC Act-listed migratory and/or marine species have been recorded within 10 kilometres (Appendix 3.1) of the study area. Based on the number and location of recent records, landscape context and habitat within the study area, it is not considered suitable to support any ecologically significant populations of these species.

3.3 Targeted Growling Grass Frog Surveys

3.3.1 Desktop Review

The database search on the VBA documented 221 records of Growling Grass Frog within 10 kilometres of the study area, the most recent being from 2008 (Figure 6, Appendix 3.2; A. Organ pers. obs.). In addition to these records, Ecology and Heritage Partners Pty Ltd has undertaken extensive surveys associated with the Pakenham Bypass (Ecology Partners Pty Ltd 2006, 2007, 2008, 2009, 2010b) and the records post 2008, have been submitted to DELWP, but are not yet on the VBA database. These records have been combined with the VBA records and are presented in Figure 6.

The Pakenham area is recognised as supporting an important population of Growling Grass Frog (Ecology and Heritage Partners Pty Ltd 2011b). Dams within the study area, between the Pakenham Bypass and Princes Highway, were extensively surveyed for Growling Grass Frog by Ecology and Heritage Partners Pty Ltd between 2005 and 2010 (Ecology Partners Pty Ltd 2006, 2007, 2008, 2009, 2010b). These surveys were carried out as a requirement under the EPBC Act for the Pakenham Bypass, and have repeatedly detected the presence of Growling Grass Frog at dams within the study area, particularly within and surrounding the dams referred to in this report as survey locations 10 and 11 (Figures 6 and 7c). Growling Grass Frog was detected from these dams during all five monitoring periods (Ecology Partners Pty Ltd 2010b).

These repeated surveys detected the presence of adult male and female individuals as well as tadpoles, metamorphs and juveniles, indicating that the species successfully breeds within these areas (Ecology Partners Pty Ltd 2006, 2007, 2008, 2009, 2010b). Additionally, the species has been shown to occur in large numbers in waterways and waterbodies immediately south of the study area (Ecology Partners Pty Ltd 2010b) and has been previously recorded from the Pakenham Golf Course (most recently from 2006), which lies adjacent to Deep Creek, downstream of the study area (Figure 6).

3.3.2 Habitat Assessment

A summary of the habitat assessments undertaken at locations along Deep Creek and each of the dams surveyed, and the results of the in-situ water quality measurements are provided below (Table 7 and Table 8). Survey sites are presented in Figures 7a-d and 8.

Table 7: Summary results of habitat assessments (2012/13 surveys normal font, 2013/14 surveys bold font, 2016/17 surveys italicised font)

Prop no	Survey point	Width / dam dimensions (m)	Emergent vegetation (%)	Submerged vegetation (%)	Open water (%)	Floating vegetation (%)	Fringing vegetation (%)	Bare edge (%)	Flow	Water depth (m)	Fish observed	Overall habitat quality
N/A	Deep Creek North	1-3	30	5	63	7	95	5	Still	0-0.8	Yes	High
15	Deep Creek South	1-3	5 **5**	1 **1**	94 **94**	1 **1**	40 **80**	60 **20**	Still **Still**	0-0.8 **0-0.5**	Yes **Yes**	Moderate to High **Moderate to High**
9	1	16 x 25	10 *50*	0 *0*	0 *15*	90 *35*	80 *100*	20 *0*	Still *Still*	0.8 *0.8*	No *No*	High *Moderate*
7	2	14 x 34	80 *40*	5 *0*	10 *60*	10 *0*	90 *95*	10 *5*	Still *Still*	0.2 *0.3*	Yes *Yes*	Moderate *Moderate*
7	3	20 x 20	0	0	N/A	0	10	90	N/A	Dry	No	Low
7	4	20 x 20	70 *100*	10 *0*	10 *0*	20 *0*	80 *95*	20 *5*	Still *N/A*	0.2 *Dry*	Yes *No*	High *Low*
8	5	18 x 18	10 *20*	2 *0*	88 *65*	2 *15*	60 *100*	40 *0*	Still *Still*	0.8 *0.8*	No *No*	High *High*
2	6	9 x 18	5	0	93	2	1	99	Still	0.2	No	Low
3	7	130 x 230	1 *2*	1 *0*	98 *98*	1 *0*	90 *40*	10 *60*	Still *Still*	2.0 *1.8*	Yes *Yes*	Moderate *Moderate*
6	8	10 x 10	70	5	15	15	50	50	Still	0.05	No	Moderate
6	9	12 x 25	25	5	50	25	80	20	Still	0.8	No	High

Prop no	Survey point	Width / dam dimensions (m)	Emergent vegetation (%)	Submerged vegetation (%)	Open water (%)	Floating vegetation (%)	Fringing vegetation (%)	Bare edge (%)	Flow	Water depth (m)	Fish observed	Overall habitat quality
34	10	60 x 90	25 **20** *20*	2 **5** *5*	70 **75** *75*	5 **5** *5*	30 **15** *15*	70 **85** *85*	Still **Still** *Still*	2.0 **2.0** *2.0*	No **Yes** *Yes*	Moderate **High** *High*
32	11	5 x 50	30 **30** *2*	30 **30** *5*	60 **40** *95*	10 **30** *5*	30 **30** *100*	70 **70** *0*	Still **Still** *Still*	1.0 **1.5** *2*	No **Yes** *No*	High **High** *Moderate*
1	12	9 x 18	5	1	94	2	55	45	Still	0.5	No	Moderate
1	13	17 x 25	0	0	100	0	1	99	Still	0.5	No	Moderate
14	14	20 x 45	0 *80*	0 *20*	N/A *10*	0 *10*	100 *100*	0 *0*	N/A *Still*	Dry *0.5*	No *No*	Low *High*
14	15	15 x 40	10 *35*	0 *10*	N/A *15*	0 *50*	100 *100*	0 *0*	N/A *Still*	Dry *0.5*	No *No*	Low *High*
14	16	9 x 23	0 *0*	0 *0*	N/A *0*	0 *100*	100 *5*	0 *95*	N/A *Still*	Dry *0.1*	No *No*	Low *Low*
36	17	22 x 29	0 **0**	0 **5**	100 **100**	0 **0**	0 **60**	100 **40**	Still **Still**	0.6 **1.0**	No **No**	Low **Low**
37	18	30 x 40	25 **10**	5 **10**	65 **80**	10 **10**	60 **80**	40 **20**	Still **Still**	1.2 **1.5**	Yes **No**	High **High**
48	19	13 x 14	0 *0*	0 *0*	100 *100*	0 *0*	0 *100*	100 *0*	Still *Still*	0.2 *0.25*	No *No*	Low *Low*
48	20	10 x 10	0 *0*	0 *0*	N/A *100*	0 *0*	0 *100*	100 *0*	N/A *Still*	Dry *1*	No *No*	Low *Low*

Prop no	Survey point	Width / dam dimensions (m)	Emergent vegetation (%)	Submerged vegetation (%)	Open water (%)	Floating vegetation (%)	Fringing vegetation (%)	Bare edge (%)	Flow	Water depth (m)	Fish observed	Overall habitat quality
43	21	10 x 10	5 *5*	0 *0*	N/A *100*	0 *0*	50 *50*	50 *50*	N/A *Still*	Dry *1*	No *No*	Low *Low*
47	22	15 x 15	10 **25**	1 **1**	89 **73**	1 **2**	10 **70**	90 **30**	Still **Still**	0.6 **0.8**	No **No**	Moderate **Moderate**
45	23	45 x 75	1 **1** *1*	1 **0** *0*	98 **99** *99*	1 **0** *0*	25 **60** *50*	75 **40** *50*	Still **Still** *Still*	2.0 **2.0** *2.0*	Yes **Yes** *Yes*	Moderate **Moderate** *Moderate*
43	24	18 x 18	1 **5** *0*	1 **2** *0*	98 **93** *100*	1 **2** *0*	70 **55** *50*	30 **45** *50*	Still **Still** *Still*	0.6 **1.2** *1.5*	No **No** *No*	Moderate **Moderate** *Low*
15	25	22 x 15	25 **30**	7 **5**	68 **60**	7 **10**	95 **100**	5 **0**	Still **Still**	1.0 **1.0**	Yes **Yes**	High **High**
15	26	4 x 4	50 **50**	5 **5**	20 **30**	30 **20**	60 **100**	40 **0**	Still **Still**	0.1 **1.0**	No **No**	Moderate **High**
53	27	20 x 20	5	1	94	1	0	100	Still	0.6	No	Low
53	28	35 x 50	5	1	94	1	5	95	Still	0.8	No	Low
44	29	5 x 7	1 **3**	0 **10**	19 **92**	80 **5**	15 **70**	85 **30**	Still **Still**	0.2 **1.0**	No **No**	Moderate **Moderate**
1	30	12 x 20	5	3	90	5	5	95	Still	0.6	No	Moderate
2	31	10 x 30	0	0	100	0	5	95	Still	0.6	No	Low

Prop no	Survey point	Width / dam dimensions (m)	Emergent vegetation (%)	Submerged vegetation (%)	Open water (%)	Floating vegetation (%)	Fringing vegetation (%)	Bare edge (%)	Flow	Water depth (m)	Fish observed	Overall habitat quality
Bypass	U24	10 x 15	30 *90*	5 *5*	60 *5*	10 *5*	90 *100*	10 *0*	Still *Still*	1.0 *1.0*	Yes *No*	High *High*
Bypass	U25	10 x 22	65	3	30	5	85	15	Still	0.8	Yes	High
Bypass	U26	6 x 25	40	1	55	5	100	0	Still	1.5	Yes	High
Bypass	U27	14 x 18	30 *40*	15 *10*	55 *5*	15 *55*	100 *100*	0 *0*	Still *Still*	1.0 *1.0*	No *No*	High *High*
Bypass	U28	10 x 20	75	3	10	15	100	0	Still	0.8	Yes	Moderate
Bypass	U29	3 x 10	10 *30*	15 *10*	80 *70*	10 *0*	90 *100*	10 *0*	Still *Still*	0.3 *0.25*	Yes *No*	Moderate *Low*
Bypass	U30	10 x 16	70	5	15	15	100	0	Still	1.5	Yes	Moderate
Bypass	U31	8 x 8	85	20	5	10	100	0	Still	0.3	Yes	High
Bypass	U32	10 x 50	45	2	50	5	100	0	Still	1.0	Yes	High
Bypass	U33	6 x 14	25	1	74	1	80	20	Still	1.5	Yes	High
Bypass	U34	8 x 25	40	20	20	40	100	0	Still	>1.0	No	High
15	Deep Creek (SBB Cam 03)	*1-3*	*0*	*0*	*100*	*0*	*100*	*0*	*Fast*	*0.25*	*No*	*Low*
15	Deep Creek (SBB Cam 05)	*1-3*	*0*	*0*	*100*	*0*	*80*	*20*	*Fast*	*0.25*	*No*	*Low*
15	Deep Creek (SBB Cam 06)	*1-3*	*0*	*0*	*100*	*0*	*100*	*0*	*Fast*	*0.25*	*No*	*Low*

Table 8: Results of in-situ water quality measurements (2012/13 surveys normal font, 2013/14 surveys bold font)

Property No	Survey point	Temperature (°C)	pH	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	Total dissolved solids (g/L)	Turbidity	Overall water quality
N/A	Deep Creek North	16.02	7.12	4.04*	4.24	-	Moderate	Moderate
15	Deep Creek South	18.5 **25.66**	7.10 **7.19**	1.98* **0.436**	2.3 **2.57**	- **1.35**	Moderate **21**	Moderate **Good**
9	1	21.27	6.31	0.268	0.27	0..174	46.1	Moderate
7	2	24.60	6.62	1.69*	1.52	1.08	32.7	Moderate
7	3	N/A	N/A	N/A	N/A	N/A	N/A	N/A
7	4	21.91	6.93	0.928*	0.00	0.594	Very high†	Poor
8	5	27.60	7.34	0.319	4.88	0.207	16	Good
2	6	26.2	7.35	0.722	0.48	0.461	High	Moderate
3	7	19.41	7.09	2.75	5.74	-	Moderate	Moderate
6	8	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6	9	28.26	7.69	0.286	6.22	0.186	52.9	Moderate
34	10	24.01 **22.55**	8.05 **7.82**	0.632 **0.963***	5.67 **11.88**	0.405 **0.617**	8.75 **22.1**	Good **Good**
32	11	24.78 **22.94**	6.99 **7.18**	0.789 **0.869***	3.86 **9.46**	0.505 **0.556**	29.3 **95**	Good **Moderate**
1	12	21.72	7.73	0.419	6.34	0.272	Moderate	Good
1	13	25.13	7.66	0.340	4.20	0.221	Moderate	Good
14	14	N/A	N/A	N/A	N/A	N/A	N/A	N/A
14	15	N/A	N/A	N/A	N/A	N/A	N/A	N/A
14	16	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Property No	Survey point	Temperature (°C)	pH	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	Total dissolved solids (g/L)	Turbidity	Overall water quality
36	17	22.84 **25.26**	7.28 **9.01**	1.81* **4.06***	1.52 **28.75**	1.16 **0.260**	1000† **359†**	Poor **Poor**
37	18	26.79	7.63	0.303	5.20	0.197	20.8	Good
48	19	26.04	7.22	0.543	2.90	0.348	1000†	Poor
48	20	N/A	N/A	N/A	N/A	N/A	N/A	N/A
52	21	N/A	N/A	N/A	N/A	N/A	N/A	N/A
47	22	27.33 **27.05**	7.19 **8.11**	0.326 **0.507**	8.12 **18.56**	0.212 **0.324**	29.7 **43**	Good **Moderate**
45	23	24.96 **24.34**	8.17 **8.24**	0.436 **0.560**	5.82 **17.32**	0.436 **0.358**	21.6 **43**	Good **Moderate**
43	24	28.32 **22.13**	7.16 **7.25**	0.350 **0.709**	4.07 **9.5**	0.224 **0.556**	Very high† **Very high**	Poor **Poor**
15	25	24.74 **25.66**	7.07 **7.19**	0.407 **0.436**	1.95 **14.70**	0.264 **0.283**	12.3 **14**	Good **Good**
15	26	23.60 **26.16**	7.10 **5.89**	1.18* **0.605**	0.63 **2.11**	0.754 **0.387**	Very high† **24**	Poor **Good**
53	27	27.98	7.54	0.321	4.68	0.209	Very high†	Poor
53	28	27.30	6.97	0.230	2.32	0.179	Very high†	Poor
43	29	33..96 **26.32**	6.59 **7.82**	0.473 **0.523**	10.71 **22.55**	0.308 **0.335**	80.8 **9**	Moderate **Good**
1	30	22.90	7.49	0.288	5.69	0.190	Moderate	Good
2	31	19.99	7.35	0.722	0.48	0.461	High†	Moderate
Bypass	U24	**21.22**	**5.74**	**0.345**	**0.92**	**0.224**	**10.7**	**Good**
Bypass	U25	**22.33**	**6.63**	**0.378**	**7.44**	**0.246**	**Moderate**	**Moderate**

Property No	Survey point	Temperature (°C)	pH	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	Total dissolved solids (g/L)	Turbidity	Overall water quality
Bypass	U26	20.98	5.82	0.314	2.73	0.204	Low	Good
Bypass	U27	21.53	5.78	0.739	4.57	0.473	11.3	Moderate
Bypass	U28	19.57	6.33	0.905*	0.00	0.579	Moderate	Moderate
Bypass	U29	22.42	6.73	0.991*	7.89	0.634	High†	Moderate
Bypass	U30	19.56	6.32	0.905*	0.02	0.579	Moderate	Moderate
Bypass	U31	21.61	5.87	0.514	8.1	0.328	Moderate	Moderate
Bypass	U32	21.46	6.07	0.460	2.66	0.299	Moderate	Moderate
Bypass	U33	22.37	6.23	0.560	4.16	0.358	Moderate	Moderate
Bypass	U34	19.91	5.82	0.944*	0.00	0.604	Moderate	Moderate

* Conductivity levels considerably exceeding SEPP WoV guidelines for water quality within the Western Port area which state that conductivity should be ≤0.50 mS/cm (EPA 2003).

†High and very high turbidity levels in comparison to SEPP WoV guidelines for water quality within the Western Port area which state that the annual median levels should be <15 NTU (EPA 2003).

Deep Creek

The wetted width of Deep Creek varies between approximately one and three metres throughout the stretch of creek within the study area (Table 7). At the time of assessment, the creek was not flowing and the stretch south of the Princes Highway had dried up to form pools. The depth of pools throughout the entire creek varied, with a maximum depth of approximately 0.8 metres. Coarse woody debris, including snags and branches, are abundant both within and on the banks of the creek along its entire length. The creek is deeply incised north of the Princes Highway, however has shallower banks south of the highway.

North of the Princes Highway the creek is lined with riparian vegetation (described above) and has a higher level of aquatic vegetation cover. Fringing vegetation includes Slender Knotweed, rushes *Juncus* spp. and grasses such as Paspalum. There is a moderate level of emergent vegetation cover including Arrowhead *Sagittaria* sp. and Narrow-leaf Cumbungi and a moderate cover of floating vegetation including Slender Knotweed, grasses and buttercup *Ranunculus* sp.

South of the Princes Highway the creek contains little aquatic vegetation. The edges of this section of the creek are relatively undercut, with little fringing vegetation and no emergent or floating vegetation present. The banks of the creek in this section support shrubby woodland (described above).

At the time of assessment, water quality within the creek was moderate, with relatively high turbidity levels and high conductivity in comparison to the EPA's guidelines for the waters of Western Port and Catchment, as outlined in the '*State Environment Protection Policy: Waters of Victoria Schedule F8*' (SEPP WoV) (EPA 2003). Eastern Gambusia *Gambusia holbrooki* were not observed during the current assessment.

Overall, Deep Creek supports high quality habitat for Growling Grass Frog and other frog species, as well as providing habitat connectivity for native fauna. The creek offers potential refuge and dispersal habitat, with the still pools north of the Princes Highway potentially offering breeding habitat for the species due to the presence of fringing, floating and emergent vegetation.

Hancock's Gully

At the time of assessment, Hancock's Gully was almost entirely dry, with the exception of a poor quality pool just south of the Princes Highway. Whilst detailed assessments were not undertaken within the gully itself, they were undertaken within several off-stream dams which contained water at the time of assessment. The gully is dominated by introduced pasture grasses and weeds and is accessed by stock along most of its length. During wetter periods, the gully may provide potential refuge and dispersal habitat for Growling Grass Frog and common frog species. The gully provides potential habitat connectivity for the species, particularly connecting areas along the Pakenham Bypass to off-stream dams to the north. Overall, the gully currently provides low quality habitat for Growling Grass Frog.

Dams

The 31 dams assessed throughout the study area vary considerably in size and habitat quality. Many dams throughout the area have high levels of stock access, resulting in largely bare banks, heavily pugged edges, a lack of emergent, floating and submerged vegetation and high turbidity.

These dams currently provide poor quality habitat for Growling Grass Frog and are unlikely to be used by the species as breeding or refuge habitat. However, these dams may provide stop-over points for frogs dispersing throughout the landscape. In contrast, other dams within the study area have either low levels of stock access or are fenced from stock. These dams contain moderate to high levels of aquatic vegetation, including floating and submergent vegetation such as Pondweed *Potamogeton* spp., Azolla *Azolla* sp., Slender Knotweed and filamentous algae and emergent and fringing vegetation including Tall Spike-sedge *Eleocharis sphacelata*, Common Spike-sedge *Eleocharis acuta* and rushes *Juncus* spp. The fenced dams have a high cover of surrounding vegetation, particularly long grasses and rushes. Water quality within these dams was generally moderate to good. These dams provide moderate to high quality habitat for Growling Grass Frog and may be used as breeding, foraging and refuge habitat by the species as well as stop-over points for dispersing individuals.

Bypass Ponds

The 11 underpass ponds assessed along the Pakenham Bypass are relatively deep and have been designed, constructed and managed in accordance with the Growling Growling Grass Frog Conservation Management Plan for the Pakenham Bypass (Organ 2005). The ponds contain a high cover of aquatic vegetation including emergent and fringing species such as sedges *Bolboschoenus* sp., Arrowhead *Sagittaria* sp., Tall Spike-sedge, Common Spike-sedge and rushes, floating vegetation including Water Ribbons *Triglochin procera*., Azolla and abundant filamentous algae. The edges of the ponds are also well vegetated, with Water Couch *Paspalum distichum* growing into the water in many areas. Water quality within these ponds was generally moderate, with moderate turbidity levels and relatively high conductivity in some ponds.

The majority of these ponds provide high quality habitat for Growling Grass Frog. The exceptions are some ponds which have become choked with emergent vegetation, including Narrow-leaf Cumbungi *Typha domingensis* and Tall Spike-sedge. These areas currently provide moderate quality habitat. The ponds are likely to be used as breeding, foraging and refuge habitat by the species as well as stop-over points for dispersing individuals.

3.3.3 Nocturnal and Tadpole Surveys

Despite extensive surveys undertaken during ideal conditions, Growling Grass Frog was detected at only one dam; Site 23 (Figure 7, Appendix 3.3) during the 2012/13 surveys. During both nocturnal surveys at this site in 2012/13, a single adult female was observed on the edge of the dam. Growling Grass Frog was not detected at any site surveyed during the 2013/14 or 2016/17 surveys. Seven common frog species, including; Common Froglet *Crinia signifera,* Plains Froglet *Crinia parinsignifera,* Southern Bullfrog *Limnodynastes dumerilii,* Spotted Marsh Frog *Limnodynastes tasmaniensis* (both northern and southern call races), Striped Marsh Frog *Limnodynastes peronii*, Southern Brown Tree Frog *Litoria ewingii* and Whistling Tree Frog *Litoria verreauxii verreauxii*, were recorded calling throughout the study area (Appendix 3.3). Whistling Tree Frog and Common Froglet were the most abundant species, each being detected at 18 of the 46 survey locations. Striped Marsh Frog, Southern Brown Tree Frog and Spotted Marsh Frog were also common throughout the study area, being detected from 14, 13 and 11 locations respectively.

No Growling Grass Frog tadpoles were detected during dip net surveys and there was no sign of breeding activity by this species.

Eight of the surveyed dams had evidence of breeding activity by common frog species with metamorphs, juveniles and tadpoles of common species detected (Appendix 3.3). Tadpoles were also detected from ann underpass pond (U27) (Appendix 3.3).

3.3.4 Significance of the Study Area for Growling Grass Frog

Growling Grass Frog was recorded from a single location during the 2012/13 targeted surveys and no evidence of breeding activity was detected, despite surveys being undertaken over three active seasons. The 2013/14 and 2016/17 surveys included the period when males of the species are known to be calling (October and November) and are readily detectable. Despite the species being detected at only a single location, many of the survey sites support high quality breeding, refuge and dispersal habitat for the species. Previous long-term monitoring has repeatedly recorded the species within the study area and has documented successful breeding by the species within these areas (Ecology Partners Pty Ltd 2006, 2007, 2008, 2009, 2010b). In addition, the availability and connectivity of waterbodies, and habitat characteristics at several sites has not changed markedly (i.e. superficially support suitable breeding habitat) from when large numbers of individuals were detected within the study area.

The very low detection rate for the species may reflect a temporary fluctuation in the population size, with numbers of individuals potentially increasing in the future. Without further detailed investigation, it is not possible to determine what processes (e.g. disease, climatic events, pollution) may have led to the apparent dramatic decrease in the local Growling Grass Frog population. The detection of seven other common frog species, including calling adults, tadpoles and metamorphs throughout the study area, confirms this area continues to provide suitable habitat for frogs.

Given one Growling Grass Frog individual was recorded at only one site in the 2012/13 season and that the species has not been recorded for a number of years since, it is considered unlikely that the species currently still persists within the study area. Consequently, this species and associated habitats are unlikely to be significantly impacted (when considering the significant impact thresholds outlined in the species' Policy Statement [SEWPaC 2011]) by the development of the precinct and an EPBC Act referral to the Commonwealth Environment Minister will not be required for this species.

3.4 Targeted Southern Brown Bandicoot Surveys

3.4.1 Desktop Review

The database search on the VBA (DELWP 2017) documented 15 records of Southern Brown Bandicoot within ten kilometres of the study area, the most recent being from 2008 (Figure 5, Appendix 3.2). Additionally, targeted surveys in 2010 associated with the development of the draft *Sub-regional Species Strategy for the Southern Brown Bandicoot* (DSE 2011) detected the species 4.2 kilometres south-west of the study area, where the Koo Wee Rup- Healesville Road crosses Deep Creek (Practical Ecology Pty Ltd 2011). This is the closest and most recent record to the study area. The closest records from the VBA are located 4.3 and 4.5 kilometres east-south-east of the study area and are from 2005 (Figure 6). No records occur to the north of the study area. The draft referral guidelines for the Southern Brown Bandicoot (SEWPaC 2011) classify the study area as being likely to support the species.

3.4.2 Habitat Assessment

Linear remnant vegetation along the Princes Highway, woodland and riparian forest vegetation adjacent to Deep Creek, weedy and grassy vegetation along the southern portion of Hancock's Gully and the woodland patch within Property 15 provide a network of suitable habitat for Southern Brown Bandicoot. Habitat conditions at the ten transect sites are summarised below. Survey sites are presented in Figures 7a-d and 8.

Deep Creek south of Princes Highway

Vegetation along the banks of Deep Creek south of the Princes Highway is fenced from stock. Much of the creek edge in this area contains dense thickets of Swamp Paperbark interspersed with blackberry canes, with emergent remnant eucalypts present. In certain sections, these thickets are dense enough to supress the growth of ground-layer vegetation. The thickets are interspersed with more open vegetation composed of remnant eucalypts with a midstorey of planted and remnant shrubs and a grassy ground layer. Introduced grasses, particularly Toowoomba Canary-grass, grow densely in the more open areas. Ground debris including logs, branches and leaf litter is abundant throughout this area. Vegetation throughout this area is structurally complex, providing a moderate to high cover of vegetation to two metres. This area represents potential high quality refuge and dispersal habitat for Southern Brown Bandicoot. Three transects (Transects 7, 8 and 9) were located within this area (Figure 7c).

Deep Creek north of Princes Highway

The riparian forest along the banks of Deep Creek north of the Princes Highway remains ungrazed. This area contains tall mature eucalypts with a mid-storey of native shrubs including Cherry Ballart and a variety of wattle species. The ground layer has a dense cover of vegetation including Austral Bracken, thick swards of Tasman Flax-lily, Thatch Saw-sedge and areas of dense Kikuyu. Coarse debris including large logs and organic litter left by flooding is common throughout this habitat. The high density of low-level vegetation and woody debris means that this area represents potential high quality refuge and dispersal habitat for Southern Brown Bandicoot. Three transects (Transects 3, 4 and 5) were located within this area (Figure 7a).

Princes Highway

The northern road reserve along the Princes Highway represents a relatively intact and continuous linear remnant. This vegetation has an overstorey of mature eucalypts with a shrubby midstorey which ranges from scattered shrubs to dense thickets. Shrubs in these areas include a variety of wattle species, Cherry Ballart, Swamp Paperbark and Prickly Tea-tree as well as invasive species including Sweet Pittosporum, Hawthorn and Gorse. Blackberry forms dense thickets to two metres in some areas, and a dense ground cover to 0.5 metres in other areas. Grasses grow densely in the more open areas whilst some of the shrubbier sections support a dense ground layer of species such as Thatch Saw-Sedge, Spiny-headed Mat-rush, Smooth Flax-Lily and weeds such as Wandering Trad *Tradescantia fluminensis.* Most of this roadside vegetation includes a dense, structurally complex understorey. This vegetation represents potential high quality refuge and dispersal habitat for Southern Brown Bandicoot. Two transects (Transects 1 and 2) were located within this area (Figures 7a-b).

Hancock's Gully south of Princes Highway

The vegetation adjacent to Hancock's Gully south of the Princes Highway primarily consists of introduced grasses and weeds. Much of this section of the gully is fenced from livestock, resulting in a narrow strip of dense grass and weeds to approximately five metres in width either side of the gully. Scattered Swamp Paperbarks and eucalypts grow along the edge of the gully, although the vegetation primarily comprises grasses and low weeds such as Spear Thistle, Blackberry and Sweet Briar *Rosa rubiginosa.* This vegetation represents low quality dispersal habitat for Southern Brown Bandicoot. One transect (Transect 6) was located within this area (Figure 7b).

Woodland patch within Property 15

This relatively intact remnant patch has a dense midstorey dominated by Swamp Paperbark with scattered emergent mature eucalypts. The area contains a dense ground layer which includes Thatch Saw-Sedge, Spiny-headed Mat-rush, Native raspberry *Rubus parvifolius,* Hop Goodenia and grasses. Abundant fallen timber including logs and branches occurs throughout the patch. The dense, structurally complex understorey in this area means that this patch represents potential high quality refuge habitat for Southern Brown Bandicoot. One transect (Transect 10) was located within this patch (Figure 7c).

3.4.3 Hair Tube and Camera Surveys

No Southern Brown Bandicoots were detected during either hair tube or camera surveys over the two survey periods (2013 and 2016). However, a variety of other native fauna, including both native and introduced species were detected. A summary of the results of the surveys is provided in Appendix 3.4. In combination, hair tubes and cameras detected 24 species, including 13 mammal species (six native, seven introduced/domestic) and 10 bird species (six native, four introduced). The most abundant species during the 2013 survey was Common Brushtail Possum, which was detected within seven of the ten transects. A high number of Red Fox were recorded during the 2016 survey, which was detected on 12 of the 20 cameras. Definite and probable detection of Swamp Rat from hair tube samples occurred at six of the ten transects, while Bush Rat *Rattus fuscipes* was detected with both hair tubes and cameras from Transect 4. A pair of locally uncommon Buff-Banded Rails *Gallirallus philippensis* were detected from the camera at Transect 4.

Although Southern Brown Bandicoot was not detected during the two surveys, the detection of six other native mammal species demonstrates the suitability of these remnants as habitat for mammals. The size of the hair tubes used precluded detecting smaller native mammals such as Antechinus *Antechinus* spp. (since hair tube size was targeted to Southern Brown Bandicoot). However, it is likely that small dasyurids also occur within the remnants surveyed. These remnants provide important refuge, foraging and dispersal habitat for a variety of mammal species. Consequently, efforts have been made to retain these areas (e.g. Deep Creek) as much as possible during development to maintain habitat connectivity for these species within the landscape.

3.4.4 Significance of the Study Area for Southern Brown Bandicoot

The failure to detect Southern Brown Bandicoot during the current surveys, combined with the distribution of previous records, means that it is unlikely that a resident population of the species currently exists within the study area.

The nearest records for the species are within approximately four kilometres to the south and south-east of the study area, with no records occurring north of the study area. There is potential, albeit limited, that individuals may disperse under the Pakenham bypass, north throughout the study area. However, based on the lack of evidence of Southern Brown Bandicoot within the study area, and the fact that the highest quality habitat is proposed to be retained (e.g. the Deep Creek corridor), and where possible enhanced, the species is unlikely to be impacted by the future development of the precinct. As such, there are no implications under the EPBC Act for this species, and therefore an EPBC Act referral to the Commonwealth Environment Minister is not necessary.

3.5 Targeted Southern Toadlet Surveys

3.5.1 Desktop Review

The database search on the VBA (DELWP 2017) documented 37 records of Southern Toadlet within ten kilometres of the study area (Appendix 3.2) (Figure 5). The most recent record of the species is from 2006 and occurs approximately two kilometres west of the study area (Appendix 3.2) (Figure 5).

3.5.2 Habitat Assessment

Suitable habitat for Southern Toadlet is present throughout the study area by means of shallow drainage lines and depressions situated close to or within woodland and Swamp Scrub patches. This habitat occurs within the Princes Highway road reserve and in Swampy Woodland patches within Property 15.

3.5.3 Nocturnal Surveys

Southern Toadlet was not detected within the study area during the nocturnal surveys, despite being recorded calling on both survey nights at the reference site in Langwarrin Flora and Fauna Reserve. No other frog species were detected during the surveys.

3.5.4 Significance of the Study Area for Southern Toadlet

The failure to detect Southern Toadlet during the current surveys, despite the presence of suitable habitat and checks at reference sites on the survey nights, means that it is unlikely that the species resides within the study area. Consequently, Southern Toadlet is unlikely to be impacted by the development of the precinct.

3.6 Targeted Aquatic Surveys

3.6.1 Aquatic Habitat Assessment

The completed aquatic habitat assessment results are provided below (Table 9). Habitat quality is generally much higher in Deep Creek than in Hancock's Gully. Deep Creek has relatively intact riparian vegetation which is protected from stock access in the road reserve. The refuge areas within Deep Creek are naturally forming deep pools within the channel, as opposed to the artificial dams along Hancock's Gully. The habitat of Deep Creek to the north of the Princes Highway is of the highest quality and most likely to be suitable for Dwarf Galaxias due to the presence of in-stream cover from small emergent macrophytes like Paspalum and Slender Knotweed, and submerged macrophytes like *Potamageton* spp. Generally, the use of this reach of habitat by fish is likely to be restricted by the presence of an artificial barrier just north of the Princes Highway (Plate 16). This barrier is particularly relevant for Australian Grayling, as it is a diadromous species that needs un-inhibited access between freshwater habitats and the sea to complete their lifecycle. Overall the habitat quality for Australian Grayling is low, as they are known to prefer areas with higher flow rates, including riffles, and with a predominantly gravel substrate providing low turbidity water.

Plate 16 : Artificial barrier, Deep Creek, north of Princes Highway

Table 9: Summary results of the Dwarf Galaxias habitat assessments within the study area.

Site	Bank Erosion (%)	Riparian Vegetation Cleared (%)	Overhanging Vegetation (%)	Large Woody Debris (%)	Coarse Particulate Organic Matter (%)	Macrophyte cover (%)	Substrate
1	0	0	30	5	1	50	Silt
2	0	0	0	5	5	50	Silt, gravel
3	0	0	0	1	10	10	Silt, gravel
4	0	0	0	5	5	20	Silt, gravel
5	5	0	40	1	2	10	Silt, sand
6	0	100	0	5	20	10	Silt
7	0	100	0	0	5	5	Silt
8	40	100	0	0	0	5	Silt
9	0	100	0	0	20	20	Silt
10	20	80	0	0	0	50	Silt, gravel

Water quality parameters from aquatic survey sites that were selected for fish surveys are provided below (Table 10). Dwarf Galaxias are tolerant to harsh physico-chemical conditions. Water quality parameters recorded across the study area are well within the physiological range for these species.

Temperatures ranged from 15.58–24.9 °C, with higher temperatures recorded within the dams and shallow pools of Hancock's Gully than the shaded drainage lines of Deep Creek. pH levels were variable between waterbodies ranging from 6.84–8.45; these levels are within the SEPP (WoV) objectives (EPA 2003). Dissolved oxygen concentrations were variable between waterbodies ranging from 1.02–14.1 mg/L (Table 10). This is likely to be due to the size and depth of the individual waterbodies, as well as the levels of vegetation. Dissolved oxygen is also typically very variable throughout the day. Sites 5 and 6 exceeded the SEPP (WoV) objectives (>6.0mg/L). Conductivity was high across most sites (Table 10), as is typical for isolated pools in a modified landscape during the dry part of the year.

Table 10: Water quality of aquatic survey sites.

Site	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Conductivity (mS/cm)	Turbidity
1	16.51	6.84	14.10	4.25	Moderate
2	16.02	7.12	4.24	4.04	Moderate
3	16.90	7.34	2.2	1.98	Moderate
4	15.58	7.16	1.56	1.82	Moderate
5	18.5	7.10	2.3	1.67	Moderate
6	19.43	7.08	5.63	2.81	Moderate
7	19.41	7.09	5.74	2.75	Moderate
10	24.9	8.45	1.02	2.43	Low

3.6.2 Targeted Aquatic Survey Results

The nationally significant Dwarf Galaxias and Australian Grayling were not detected during the current survey. Other native fish species detected include Common Galaxias *Galaxias maculatus*, Spotted Galaxias *Galaxias truttaceus,* Short-finned Eel *Anguila australis*, Tupong *Pseudophrites urvilli* and Southern Pygmy Perch *Nannoperca australis*. Exotic fish species detected include Eastern Gambusia *Gambusia hollbrooki* and Redfin Perch *Perca fluviatillus*. Complete survey results are presented in Appendix 3.5.

The higher quality habitat found in Deep Creek was reflected in the survey results, with species such as Spotted Galaxias, Tupong and Southern Pygmy Perch only being found in this system. The waterbodies in Hancock's Gully also had relatively high numbers of exotic fish, particularly an abundance of Eastern Gambusia. Eastern Gambusia are a significant threat to Dwarf Galaxias, via competitive and predation pressures (nipping the fins of native galaxias species). The high abundance of Eastern Gambusia within Hancock's Gully is likely to greatly restrict the habitat suitability for this species.

The effect of the fish barrier in Deep Creek, just north of the Princes Highway (Plate 16) is evident in the paucity of aquatic fauna detected in sites one and two, relative to sites three, four and five which are located downstream of this barrier.

3.6.3 Significance of the Study Area for Dwarf Galaxias and Australian Grayling

Based on the results of the targeted assessment and habitat assessments, it is considered unlikely that Australian Grayling occur within the study area and of low likelihood that Dwarf Galaxias occur within the study area. Consequently, these species are unlikely to be significantly impacted by the development of the precinct and an EPBC Act referral to the Commonwealth Environment Minister will not be required for these species.

4 RELEVANT LEGISLATION AND POLICY

This section identifies Commonwealth, state and local legislation and policies relevant to ecological values and the proposed rezoning. It advises if any legal or political obligations are applicable and what actions are necessary to fulfil such obligations.

4.1 *Environment Protection and Biodiversity Conservation Act 1999*

The EPBC Act institutes a Commonwealth process to assess actions that are considered likely to have a significant impact on matters of NES. The term 'likely' does not necessarily mean to have greater than 50% chance of happening; a 'real' or 'not remote' possibility of an action having a significant impact can also be considered likely (DoE 2013). A significant impact is defined as an impact which is important, notable, or of consequence, having regard to its context and intensity (DoE 2013).

Matters of NES are defined as (DoE 2013):

- Nationally threatened species and ecological communities;
- Migratory species protected under international agreements;
- Ramsar wetlands of international importance;
- The Commonwealth marine environment;
- World Heritage properties;
- National Heritage places;
- Water resources in relation to coal seam gas and large coal mining developments;
- The Great Barrier Reef Marine Park; and,
- Nuclear Actions.

If an action is considered likely to have a significant impact on a matter of NES, it is necessary to refer the action to the Commonwealth Environment Minister who will determine if the action is a:

- *Controlled action* whereby the action is subject to the assessment and approval process under the EPBC Act controlled action whereby the action is subject to the assessment and approval process under the EPBC Act;
- *Non controlled action* 'particular manner' whereby approval is not required if the action is taken in accordance with the manner specified; or,
- *Non-controlled action* whereby approval is not required if the action is taken in accordance with the referral (DoE 2013).

4.1.1 Nationally threatened species and communities

Flora - No EPBC Act-listed flora species were identified within the study area during the flora assessment. Four species listed under the EPBC Act have previously been recorded within 10 kilometres of the study area (Appendix 2.2). A further six species are predicted to occur within a 10 kilometre radius of the study area. Following targeted surveys and the modified nature of the study area, there is a low likelihood that these species will occur within the study area (Appendix 2.2).

Fauna – One EPBC Act-listed fauna species; one individual Growling Grass Frog, was detected within the study area during the 2012/13 season survey. Although suitable habitat for the species is present within the study area, the species was not detected during subsequent 2013/14 and 2016/17 targeted surveys undertaken during optimal conditions.

It is therefore considered unlikely that the species currently still persists within the study area. Consequently an EPBC Act referral to the Commonwealth Environment Minister will not be required for this species.

Ecological Communities - No EPBC Act listed ecological communities were recorded in the study area or are considered likely to be present.

4.1.2 Ramsar Wetlands of International Importance

The study area is connected via Deep Creek to Western Port which is a Ramsar wetland of international significance (DoEE 2017), located approximately 16 kilometres south of the study area. Through construction activities within and adjacent to Deep Creek some downstream impacts could be experienced. However, there is a substantial distance between the study area and Western Port, through already substantially modified landscapes and waterways. Provided that best practice sediment, pollutant and runoff control measures (including stormwater treatment) are implemented during and post construction, it is considered unlikely the development of the proposed precinct will have a significant impact on the Western Port Ramsar site. Mitigation measures are outlined in Section 6.2. Assuming appropriate control measures are implemented, an EPBC Act referral will not be required for impacts to the Ramsar wetland.

4.1.3 Implications

The proposed rezoning of approximately 630 hectares of residential and agricultural land as part of the Pakenham East PSP was referred under the EPBC Act to the Minister for the Environment and Energy (EPBC Act referral 2017/8069). The decision under Section 75 of the EPBC Act determined the proposed action was not a controlled action (Appendix 4).

4.2 *Flora and Fauna Guarantee Act 1988*

The primary legislation for the protection of flora and fauna in Victoria is the FFG Act. The broad objectives of the FFG Act are to: 1) ensure native flora and fauna survive, flourish and maintain in situ evolutionary potential; 2) manage threatening processes; 3) encourage the conserving of flora and fauna through cooperative community endeavours; and 4) establish a regulatory structure for the conservation of flora and fauna in Victoria.

The FFG Act contains lists of threatened flora and fauna species, lists of threatened vegetation communities, action statements to protect the long-term viability of these values, and lists of 'protected flora species'.

The FFG Act applies to the removal of listed threatened species and communities, as well as protected flora species. Protected flora species include any of the Asteraceae (Daisies), all orchids, ferns (excluding *Pteridium esculentum*) and Acacia species (excluding *Acacia dealbata, Acacia decurrens, Acacia implexa, Acacia melanoxylon* and *Acacia paradoxa*), as well as any taxa that may be a component of a listed FFG Act vegetation community. A species may be both listed and protected.

Proponents are required to apply for an FFG Act Permit to 'take' listed and/or protected flora species and listed vegetation communities in areas of public land (i.e. within road reserves and drainage lines), whereas an FFG Act permit is generally not required for removal of listed and/or protected flora species and communities on private land.

There are currently no requirements for proponents to apply for a permit under the FFG Act where the proposed works will require the removal of habitat for a listed terrestrial fauna species. However, the Act regulates the removal, salvage, temporary holding, translocation, taking, trading and keeping of FFG Act-listed fish species, which means that a permit or a licence under the FFG Act is required if fish species listed under the Act are likely to be affected by the proposed works.

Flora – Twenty-seven (27) state significant species have previously been recorded within a 10 kilometre radius of the study area (Appendix 2.2). Following the targeted surveys, there is a low likelihood that any of these species occur within the study area (Appendix 2.2).

Seventeen (17) plant species also occur within the study area belonging to the Asteraceae (Daisy) and Epacridaceae (Heath) families, along with species from genera including *Acacia* and *Xanthorrhoea* which are declared protected on public land under Section 46 of the FFG Act (Appendix 1 Table A1.1.).

Fauna – One FFG Act-listed fauna species; Growling Grass Frog was recorded within the study area during the current assessment. There is a moderate to high likelihood of occurrence within the study area and immediate surrounds for five fauna species listed under the FFG Act: Growling Grass Frog, Grey-headed Flying-fox, Eastern Great Egret, Swift Parrot and Baillon's Crake (see Section 3.2.3.1 and Section 3.2.3.2).

Ecological Communities - No FFG Act listed ecological communities were recorded in the study area or are considered likely to be present following targeted surveys.

Threatening processes - Threatening process listed under Schedule 3 of the FFG Act that require consideration include:

- The invasion of native vegetation by environmental weeds;
- Invasion of native vegetation by Blackberry;
- Habitat fragmentation as a threatening process for fauna in Victoria;
- Alteration to the natural flow regimes of rivers and streams;
- Degradation of riparian vegetation along Victorian rivers and streams;
- Increase in sediment input into Victorian rivers and streams due to human activities; and,
- Loss of hollow-bearing trees from Victorian native forests.

The above threatening processes should be addressed in a Construction Environmental Management Plan prior to the commencement of works.

4.2.1 Implications

Under Clause 15.09 of the State Planning Policy Framework, the local planning authority should have regard for flora, fauna and communities listed under the FFG Act when making decisions regarding the use and development of land.

An FFG Act permit from DELWP is required in order to 'take' listed and/or protected flora and vegetation communities in areas of public land (i.e. within road reserves and creek lines) and to clear or disturb protected flora species within the study area. Protected flora species include all members of the Asteraceae (Daisy) and Epacridaceae (Heaths) family and some *Acacia* and *Xanthorrhoea* species.

No FFG Act listed ecological communities were recorded in the study area or are considered likely to be present following targeted surveys.

There is suitable habitat within the study area for several fauna species listed under the FFG Act. An FFG Act permit is required if listed fish species are likely to be affected by the proposed works. However an FFG Act permit is not required for the removal of habitat for any listed terrestrial fauna species. Based on the outcomes of targeted fish surveys, no listed fish species are likely to be affected by the proposed works.

Where works are likely to require the salvage and translocation or general handling of FFG Act-listed terrestrial fauna species, DELWP is the relevant referral authority, and management authorisation under the *Wildlife Act 1975* will need to be granted prior to the commencement of any works (Section 4.5).

4.3 Permitted Clearing of Native Vegetation - Biodiversity Assessment Guidelines

In December 2013, the Permitted Clearing of Native Vegetation - Biodiversity assessment guidelines (DEPI 2013) superseded the Framework in the Victorian Planning Provisions. The amendment reflected the new 'no net loss' approach rather than the previous 'Net Gain' approach. Clause 52.16 (Native Vegetation Precinct Plan) was amended to reflect the intent of the native vegetation and biodiversity reform package and amending Clause 52.17 (Native vegetation) to rationalise information requirements, implement the new risk-based assessment pathways, include a simplified approach for applications under a low-risk based pathway and streamline the determination of offset requirements.

The State Planning Policy Framework and the decision guidelines at Clause 52.17 (Native Vegetation) and Clause 12.01 require Planning and Responsible Authorities to have regard for 'Permitted clearing of native vegetation - Biodiversity assessment guidelines' (the Guidelines) (DEPI 2013). Where the clearing of native vegetation is permitted, the quantity and type of vegetation to be offset is determined using methodology specified in the Guidelines. The primary objective of the regulations is "no net loss in the contribution made by native vegetation to Victoria's biodiversity".

It is noted that the State Planning Policy Framework in regards to Native Vegetation Removal were amended in December 2017; however in accordance with the transitional arrangements, this assessment references the 2013 State Planning Policy Framework.

4.3.1 Implications

The study area is within Location C, with 28.371 hectares (3.123ha remnant patch, 359 scattered trees) of native vegetation proposed to be impacted.

The offset requirement for the proposed extent of clearance within the precinct is 2.968 General Biodiversity Equivalence Units (BEU) and 1.770 Specific Biodiversity Equivalence Units (SBEU) for Tufted Club-sedge. Specific details relating to offset requirements are provided within the Pakenham East NVPP (Ecology and Heritage Partners Pty Ltd 2017).

A Planning Permit from Cardinia Shire Council is required to remove, destroy or lop any native vegetation not identified for removal in the Pakenham East NVPP.

4.4 *Port Phillip and Westernport Native Vegetation Plan*

The *Port Phillip and Westernport Native Vegetation Plan* (PPWCMA 2006) is a guide for local government in assessing planning applications for vegetation removal and determining permit conditions (Net Gain requirements) to ensure that ecological values across the region are not compromised.

The Plan provides information on biodiversity values across the region and gives guidance to local municipalities on how clearing applications should be assessed. The document also outlines actions to ensure there is more strategic and coordinated approach to address ongoing degradation in quantity and quality of native vegetation across the catchment.

4.4.1 Implications

Information within this policy may be used by DELWP and Cardinia Shire Council when assessing an application for a permit in relation to the site.

4.5 *Wildlife Act 1975* and *Wildlife Regulations 2002*

The *Wildlife Act 1975* is the primary legislation in Victoria providing for protection and management of wildlife. The Act requires people engaged in wildlife research (e.g. fauna surveys, salvage and translocation activities) to obtain a permit under the Act to ensure that these activities are undertaken in a manner consistent with the appropriate controls.

The *Wildlife Act 1975* has the following objectives:

- To establish procedures for the promotion of protection and conservation of wildlife, the prevention of species extinctions, and the sustainable use and access to wildlife and;
- To prohibit and regulate the conduct of those involved in wildlife related activities.

The *Wildlife Regulations 2002* make further provision in relation to the licensing system established by section 22 of the Wildlife Act in order to:

- Prescribe fees, offences, royalties and various other matters for the purposes of the Wildlife Act; and,
- Provide for exemptions from certain provisions of the *Wildlife Act 1975*.

4.5.1 Implications

If fauna habitat is to be removed within the study area, a permit will be required. However, this is often covered concurrently by a permit to remove native vegetation under the *Planning and Environment Act 1987*. Where any fauna species require removal, salvage, holding or relocation during the development, a permit under the *Wildlife Act 1975* specific to the project will be required.

Depending on the extent of any proposed salvage and translocation, an application to, and if deemed appropriate, subsequent approval from DELWP's Translocation Evaluation Panel (TEP) is required prior to the commencement of any works. Management authorisation and an application to the TEP is usually prepared and submitted by a suitably qualified ecologist or zoologist, on behalf of the proponent.

4.6 *Catchment and Land Protection Act 1994*

The *CALP Act* contains provisions relating to catchment planning, land management, noxious weeds and pest animals. This Act also provides a legislative framework for the management of private and public land and sets out the responsibilities of land managers, stating that they must take all reasonable steps to:

- Avoid causing or contributing to land degradation which causes or may cause damage to land of another land owner;
- Protect water resources;
- Conserve soil;
- Eradicate regionally prohibited weeds;
- Prevent the growth and spread of regionally controlled weeds; and,
- Prevent the spread of, and as far as possible eradicate, established pest animals.

Essentially, the Act establishes a framework for the integrated management and protection of catchments, and provides a framework for the integrated and coordinated management, which aims to ensure that the quality of the State's land and water resources and their associated plant and animal life are maintained and enhanced.

4.6.1 Implications

Noxious weeds within the study area, including Spear Thistle, Flax-leaf Broom, Montpellier Broom, Radiata Pine, Sweet Pittosporum, Sweet Briar, Blackberry and Gorse, should be appropriately controlled to prevent weed spread to any nearby areas of native vegetation.

5 HABITAT HECTARE ASSESSMENT

In total seven EVCs within two bioregions were recorded during the field assessment. Remnant patches were largely restricted to roadside reserves, creek lines and waterways and consisted of 75 separate Habitat Zones (Appendix 2.3). Remnant patches generally differed with regard to understorey condition and cover. Any planted trees and isolated remnant shrubs that are located amongst areas dominated by introduced species do not have any formal offset requirement if removed. The calculation of the habitat hectare assessment is presented in Appendix 2.3.

The study area contains a combined area of approximately 18.24 hectares of remnant vegetation (Figure 2; Table 11; Appendix 2.3). The total consists of 4.57 habitat hectares of remnant native vegetation within the Gippsland Plain bioregion, and 1.53 habitat hectares within the Highlands Southern Fall bioregion. A summary of the habitat hectare assessment is presented below (Table 11).

Table 11. Summary of Habitat Hectare assessment within the study area

EVC	Total Area within the Study Area (ha)	Total habitat hectares within the Study Area
Gippsland Plain bioregion		
Riparian Forest (EVC: 18)	1.39	0.62
Swamp Scrub (EVC: 53)	0.41	0.15
Swampy Riparian Woodland (EVC: 83)	3.77	1.42
Grassy Forest (EVC: 128)	0.72	0.30
Grassy Woodland (EVC: 175)	0.94	0.28
Damp Heathy Woodland (EVC: 793)	0.92	0.25
Swampy Woodland (EVC: 973)	5.71	1.55
Highland Southern Fall bioregion		
Grassy Forest (EVC: 128)	1.09	0.43
Grassy Woodland (EVC: 175)	0.90	0.33
Damp Heathy Woodland (EVC: 793)	1.44	0.61
Swampy Woodland (EVC: 973)	0.95	0.17
Total	**18.24**	**6.10**

5.1 Scattered Tree Assessment

Five-hundred and thirty (530) scattered indigenous trees were recorded within the study area.

All scattered trees, species names and DBH are listed in Appendix 2.4 (Table A2.4).

6 POTENTIAL IMPACTS AND MITIGATION MEASURES

6.1 Potential Ecological Impacts

Potential ecological impacts of the development may include:

- Removal or disturbance of Riparian Forest, Swamp Scrub, Swampy Riparian Woodland, Grassy Forest, Grassy Woodland and Swampy Woodland within the Gippsland Plain bioregion;
- Removal or disturbance of Grassy Forest, Grassy Woodland, Damp Heathy Woodland and Swampy Woodland within the Gippsland Plain and Highlands Southern Fall bioregions;
- Removal or disturbance of 359 scattered trees within the study area;
- Loss or disturbance to state listed Green Scentbark and Veined Spear-grass recorded during the targeted surveys and loss of habitat that supports these species;
- Loss or disturbance to 17 plant species that belong to protected family Asteraceae (Daisies) and Epacridaceae (Heaths), and members of protected genera *Acacia* and *Xanthorrhoea* that are declared protected, on public land, under the FFG Act;
- Injury and mortality of wildlife currently using habitat within the study area;
- Contribution to a cumulative loss of locally common flora and fauna species, and their habitats within the local area; and,
- Contribution to fragmentation of habitat for flora and fauna species within the local area.

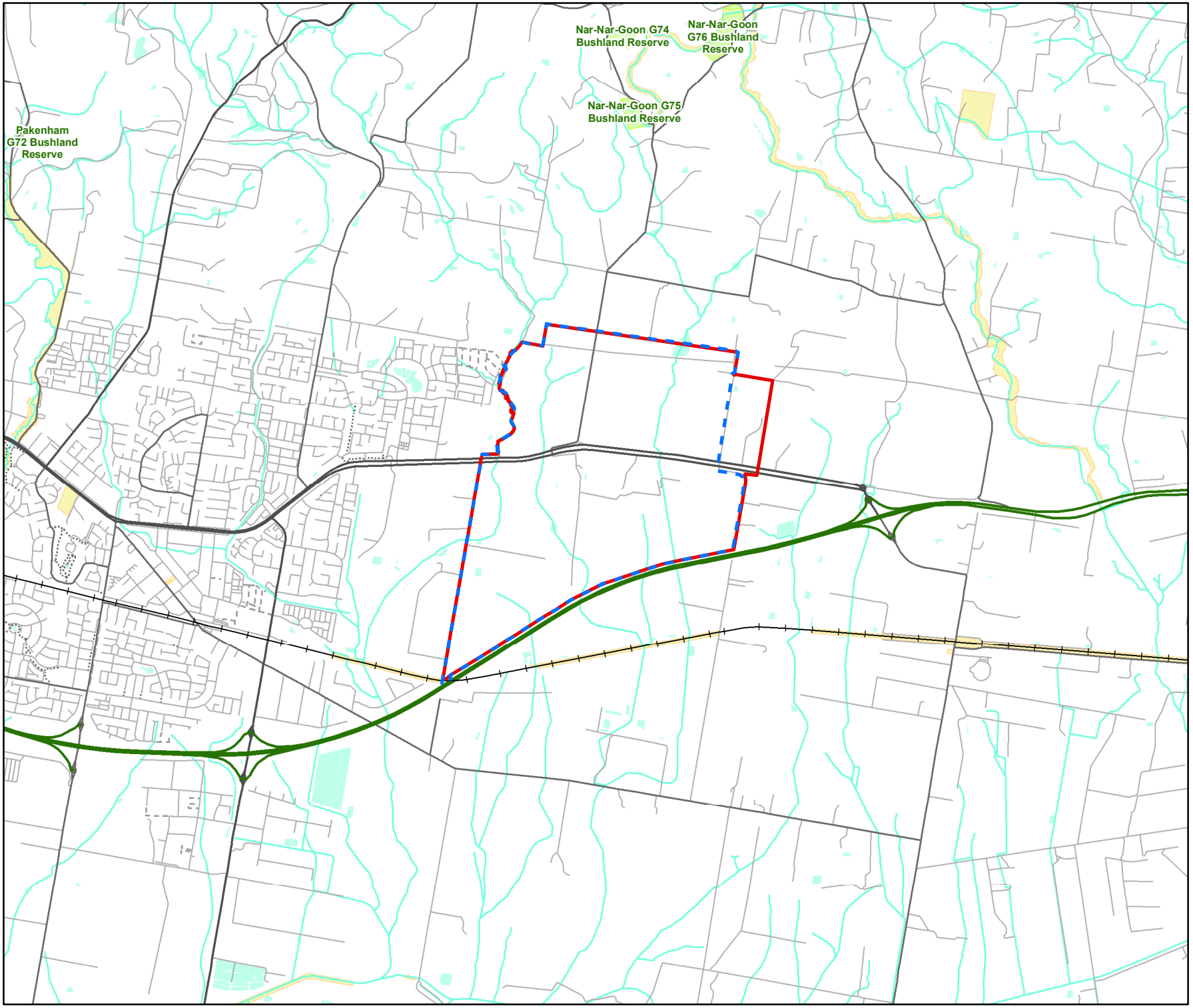
6.2 Mitigation Measures

Measures to minimise impacts upon terrestrial values present within the study area associated with any development include:

- Any future development should avoid if possible, and then minimise, impacts to remnant native vegetation, in particular areas identified as having high conservation significance and provides habitat for state listed species (Green Scentbark and Veined Spear-grass);
- Where possible, Green Scentbark trees and areas where Veined Spear-grass has been recorded should be retained. If areas cannot be avoided than a species translocation plan should be considered;
- Native vegetation, including remnant patches, scattered trees and state listed species to be retained should be fenced off and identified as 'no go' areas during construction. The retention of indigenous trees will require construction works not to encroach within more than 10% of their tree protection zones;

- Where the removal of native vegetation (including remnant patches and scattered trees) cannot be avoided, appropriate offsets are to be secured prior to development commencing;
- A fauna salvage and relocation plan should be prepared and implemented to reduce the likelihood of native fauna mortality and displacement;
- During vegetation and topsoil removal within and around waterways and waterbodies, a zoologist/wildlife handler should be present as appropriate, to undertake salvage and translocation for both common and significant fauna species. Any injured wildlife should be taken to an appropriate veterinary clinic, a wildlife shelter or translocated into suitable nearby habitat;
- During removal of large mature eucalypts, a zoologist/wildlife handler should be present as appropriate, to undertake salvage and translocation for both common and significant fauna species. Any injured wildlife should be taken to an appropriate veterinary clinic, a wildlife shelter or translocated into suitable nearby habitat;
- Removal and/or drainage of large dams should be undertaken outside the breeding season for Hardhead and Australasian Shoveler (August-November); and,
- A Construction Environment Management Plan should be developed prior to any works commencing on the project. This plan should include:
    - A Weed Management Plan to control listed noxious and environmental weeds during and post each construction phase;
    - Best practice sedimentation and pollution control measures to protect in-stream habitat adjacent and downstream of the development. Management practices and construction techniques should be consistent with *Construction Techniques for Sediment Pollution Control* (EPA 1991) and *Environmental Guidelines for Major Construction Sites* (EPA 1996);
    - Where construction is proposed adjacent to areas of ecological value, these sites should be fenced and identified as 'no go' areas to avoid disturbance during the construction phase of the project;
    - Where possible, construction stockpiles, machinery, roads, and other infrastructure should be placed away from areas supporting native vegetation, large old trees, waterbodies or drainage channels;
    - Undertake appropriate post construction clean-up of the site in accordance with environmental best practices, including the stabilisation of exposed soils with local native vegetation from the appropriate EVCs; and,
    - Incorporate an assortment of locally indigenous tree, shrub and undertstorey plants from the appropriate EVCs as part of landscaping associated with future development.
- If construction within Tree Protection Zones (TPZs) cannot be avoided, the physical structure of indigenous trees should be retained where possible during construction, even though the long term health of these trees cannot be guaranteed (unless an arborist can confirm otherwise); and,
- If the removal or disturbance of scattered indigenous trees cannot be avoided, their loss must be offset.

FIGURES



Legend

- Study Area
- PEP Boundary
- Railway
- Freeway
- Major Road
- Collector Road
- Minor Road
- Proposed Road
- Walking Track
- Minor Watercourse
- Permanent Waterbody
- Parks and Reserves
- Crown Land

Figure 1

Location of the study area

Pakenham East PSP

N

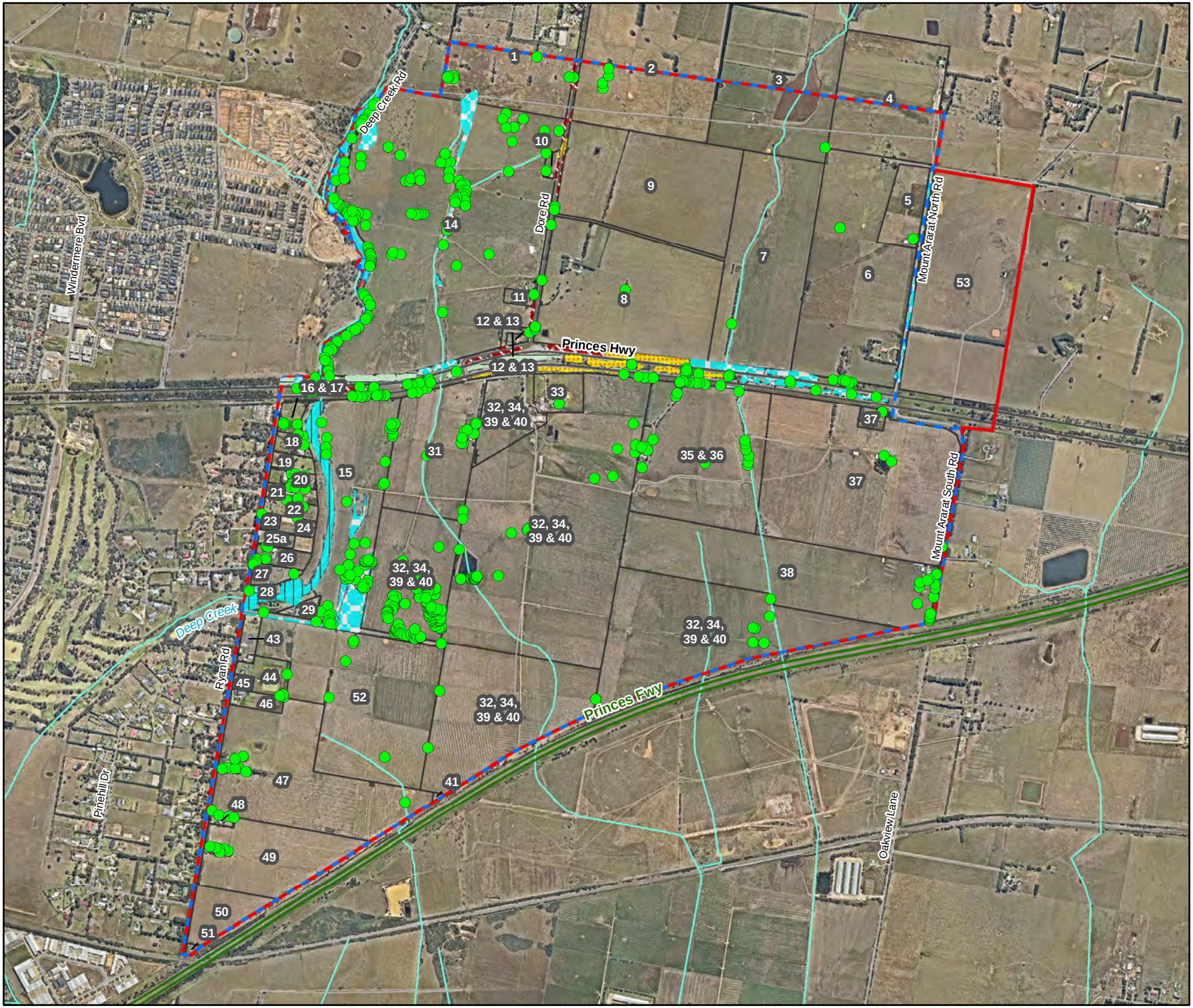
0 495 990

Metres

ecology & heritage partners

Table 12. *Summary of EVCs shown on Figure 2*

EVC number	EVC Classification	Extent within the Study Area (ha)
18	Riparian Forest	1.39
53	Swamp Scrub	0.41
83	Swampy Riparian Woodland	3.77
128	Grassy Forest	1.81
175	Grassy Woodland	1.84
793	Damp Heathy Woodland	2.36
973	Swampy Woodland	6.66
Total		**18.24**



Legend

- Study Area
- PEP Boundary
- 39 Landowner ID
- Scattered trees

Ecological Vegetation Classes

- Damp Heathy Woodland
- Grassy Forest
- Grassy Woodland
- Riparian Forest
- Swamp Scrub
- Swampy Riparian Woodland
- Swampy Woodland

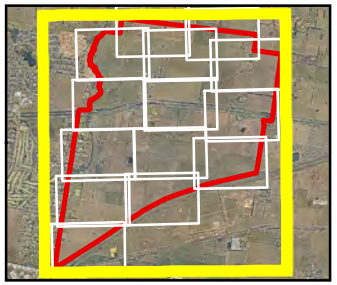


Figure 2 Overview

Ecological features

Pakenham East PSP

N

0 225 450

Metres

ecology & heritage partners

8203_Fig02_MB_EcoFeatures_f4221 11/01/2018 melsley

Aerial source: Nearmap, 2017

Legend

- Study Area
- PEP Boundary
- 39 Landowner ID
- Scattered trees

Ecological Vegetation Classes

- Damp Heathy Woodland
- Grassy Forest
- Swampy Woodland

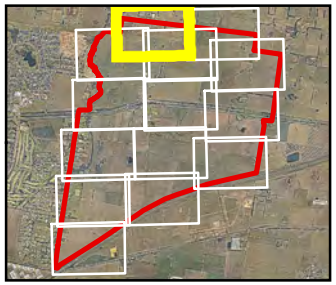


Figure 2a

Ecological features

Pakenham East PSP

N

0 50 100

Metres

ecology & heritage partners

8203_Fig02_MB_EcoFeatures_f4221 11/01/2018 melsley

Aerial source: Nearmap, 2017

Legend

- Study Area
- PEP Boundary
- 39 Landowner ID
- Scattered trees

Ecological Vegetation Classes

- Swampy Woodland

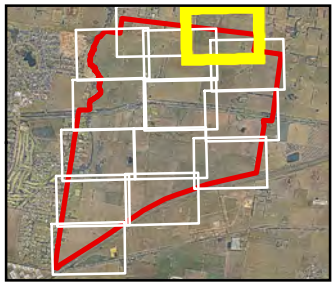


Figure 2b

Ecological features

Pakenham East PSP

N

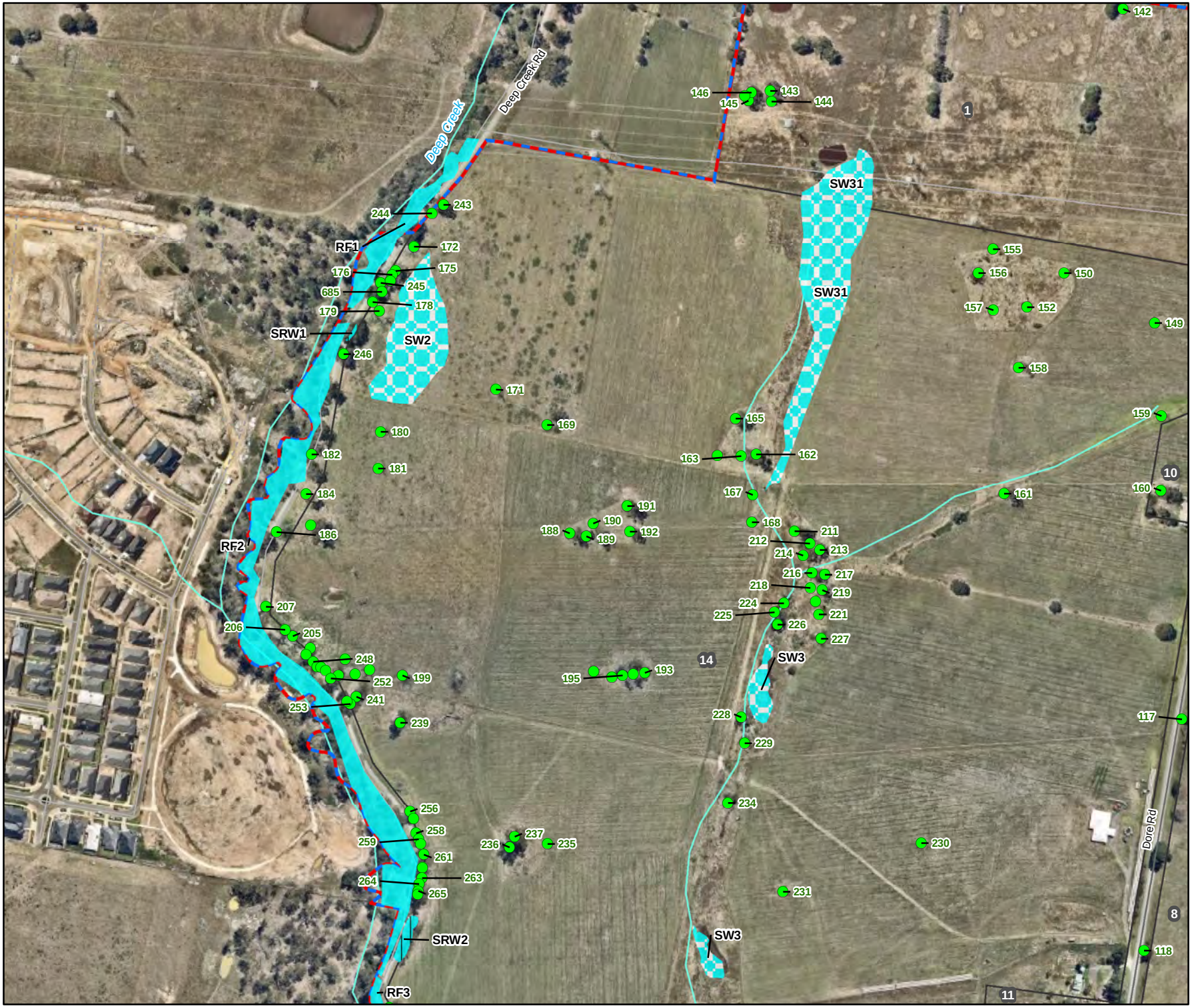
0 50 100

Metres

ecology & heritage partners

8203_Fig02_MB_EcoFeatures_f4221 11/01/2018 melsley

Aerial source: Nearmap, 2017



Legend

- Study Area
- PEP Boundary
- 39 Landowner ID
- Scattered trees

Ecological Vegetation Classes

- Riparian Forest
- Swampy Riparian Woodland
- Swampy Woodland

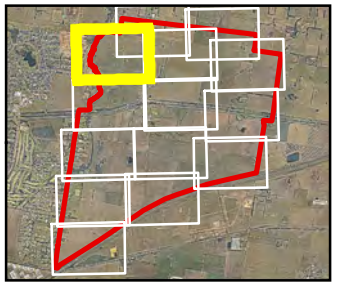


Figure 2c

Ecological features

Pakenham East PSP

N

0 50 100

Metres

ecology & heritage partners

8203_Fig02_MB_EcoFeatures_f4221 11/01/2018 melsley

Aerial source: Nearmap, 2017

Legend

- Study Area
- PEP Boundary
- 39 Landowner ID
- Scattered trees

Ecological Vegetation Classes

- Damp Heathy Woodland
- Grassy Forest

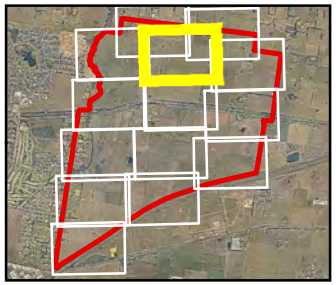


Figure 2d

Ecological features

Pakenham East PSP

N

0 50 100

Metres

ecology & heritage partners

8203_Fig02_MB_EcoFeatures_f4221 11/01/2018 melsley

Aerial source: Nearmap, 2017

Legend

- Study Area
- PEP Boundary
- 39 Landowner ID
- Scattered trees

Ecological Vegetation Classes

- Swampy Woodland

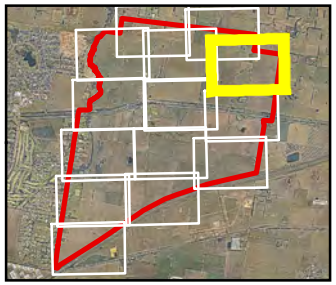


Figure 2e

Ecological features

Pakenham East PSP

N

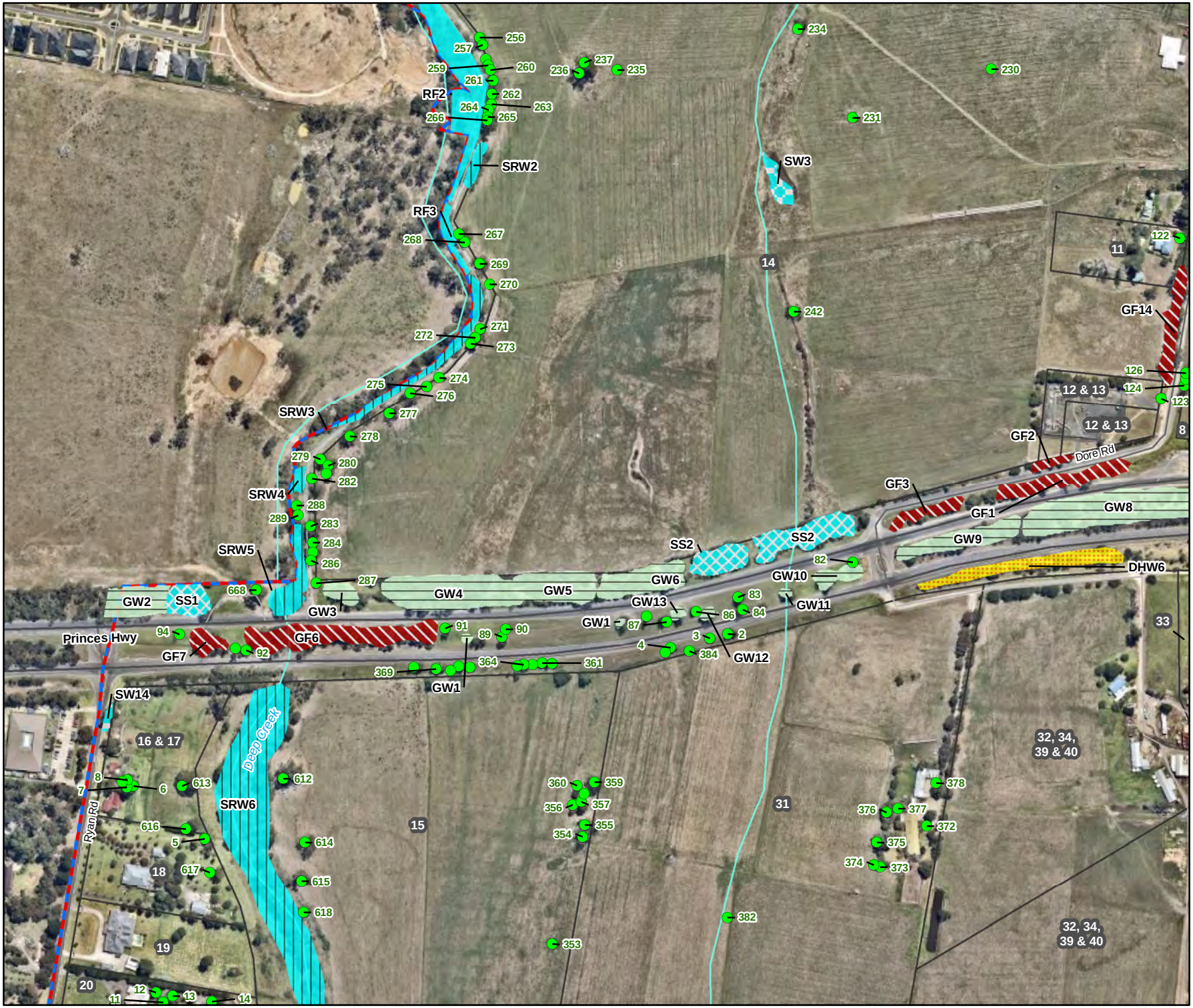
0 50 100

Metres

ecology & heritage partners

8203_Fig02_MB_EcoFeatures_f4221 11/01/2018 melsley

Aerial source: Nearmap, 2017



Legend

- Study Area
- PEP Boundary
- 39 Landowner ID
- Scattered trees

Ecological Vegetation Classes

- Damp Heathy Woodland
- Grassy Forest
- Grassy Woodland
- Riparian Forest
- Swamp Scrub
- Swampy Riparian Woodland
- Swampy Woodland

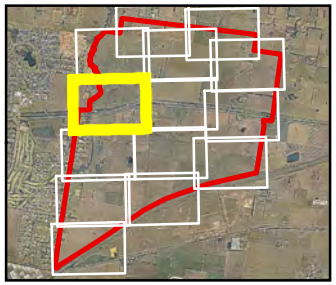


Figure 2f

Ecological features

Pakenham East PSP

N

0 50 100

Metres

ecology & heritage partners

Aerial source: Nearmap, 2017

Legend

- Study Area
- PEP Boundary
- 39 Landowner ID
- Scattered trees

Ecological Vegetation Classes

- Damp Heathy Woodland
- Grassy Forest
- Grassy Woodland
- Swampy Woodland

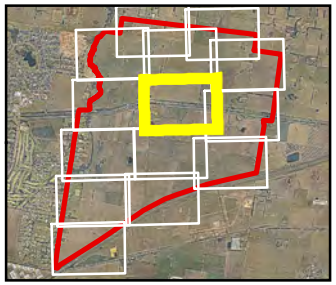


Figure 2g

Ecological features

Pakenham East PSP

N

0 50 100

Metres

ecology & heritage partners

8203_Fig02_MB_EcoFeatures_f4221 11/01/2018 melsley

Aerial source: Nearmap, 2017

Legend

- Study Area
- PEP Boundary
- 39 Landowner ID
- Scattered trees

Ecological Vegetation Classes

- Swampy Woodland

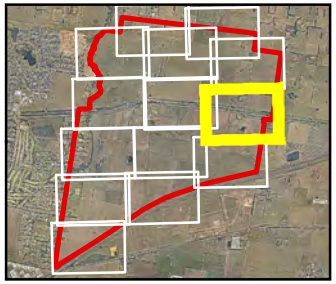


Figure 2h

Ecological features

Pakenham East PSP

N

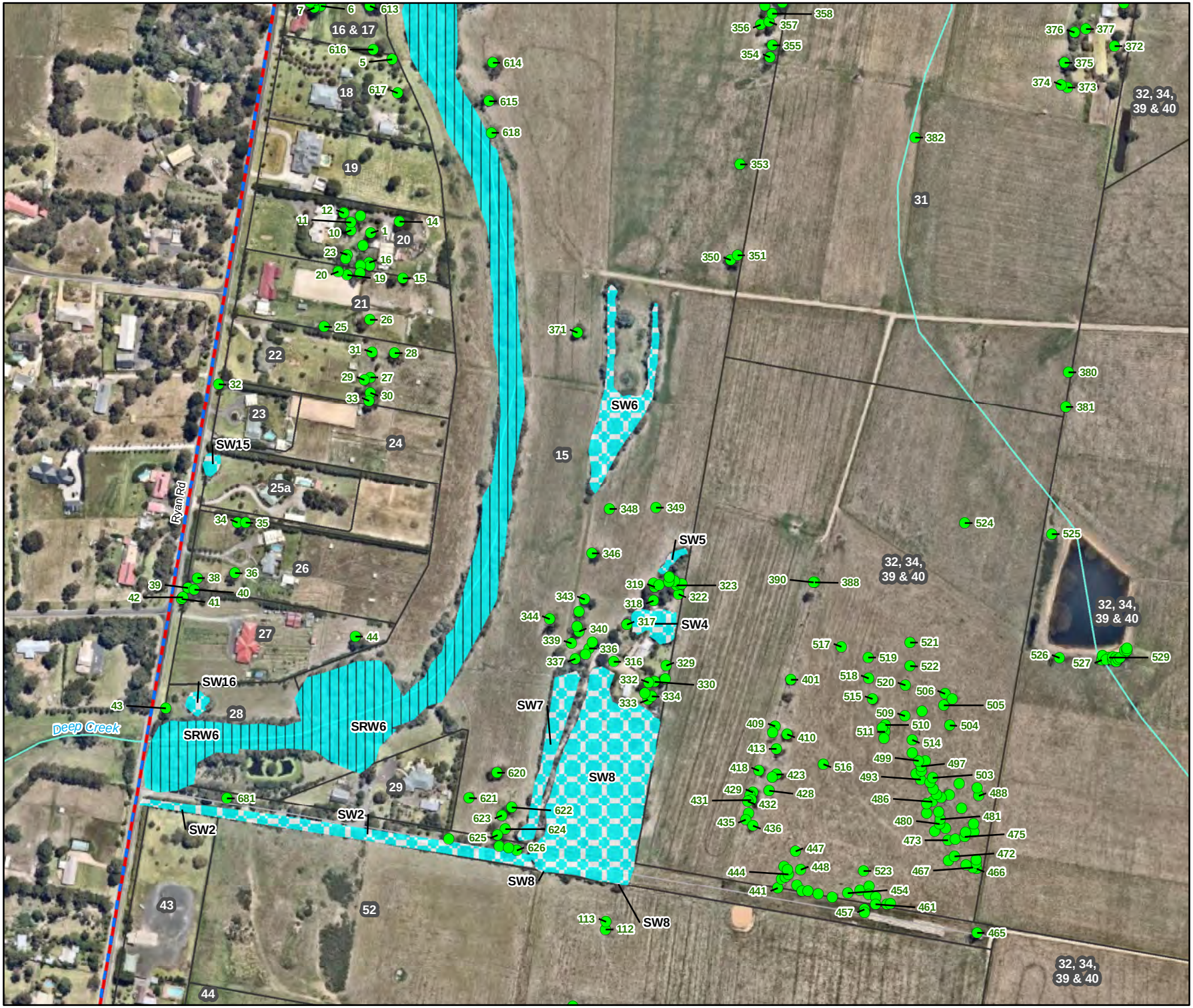
0 50 100

Metres

ecology & heritage partners

8203_Fig02_MB_EcoFeatures_f4221 11/01/2018 melsley

Aerial source: Nearmap, 2017



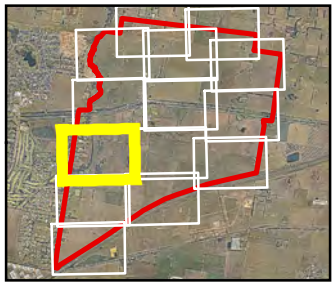


Figure 2i

Ecological features

Pakenham East PSP

8203_Fig02_MB_EcoFeatures_f4221 11/01/2018 melsley

Aerial source: Nearmap, 2017

Legend

- Study Area
- PEP Boundary
- 39 Landowner ID
- Scattered trees

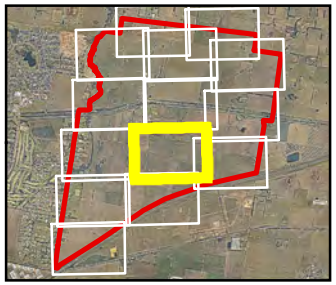


Figure 2j

Ecological features

Pakenham East PSP

N

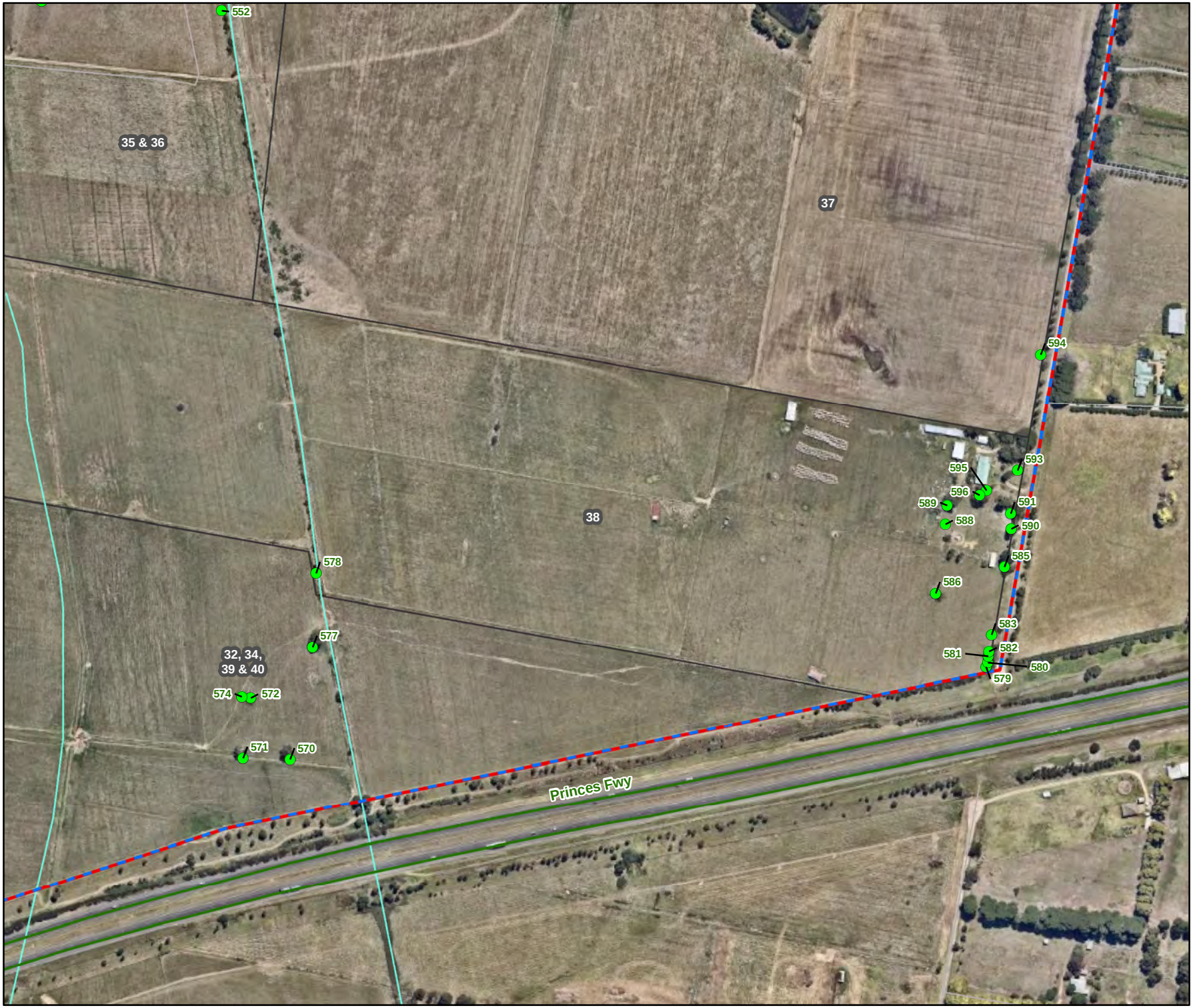
0 50 100

Metres

ecology & heritage partners

8203_Fig02_MB_EcoFeatures_f4221 11/01/2018 melsley

Aerial source: Nearmap, 2017



Legend

- Study Area
- PEP Boundary
- 39 Landowner ID
- Scattered trees

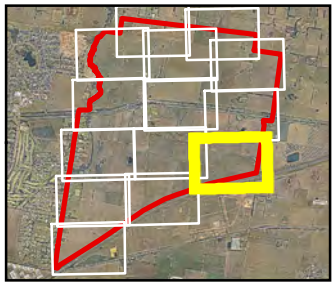


Figure 2k

Ecological features

Pakenham East PSP

N

0 50 100

Metres

ecology & heritage partners

8203_Fig02_MB_EcoFeatures_f4221 11/01/2018 melsley

Aerial source: Nearmap, 2017

Legend

- Study Area
- PEP Boundary
- 39 Landowner ID
- Scattered trees

Ecological Vegetation Classes

- Swampy Riparian Woodland
- Swampy Woodland

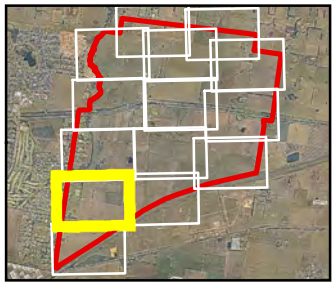


Figure 2l

Ecological features

Pakenham East PSP

N

0 50 100

Metres

ecology & heritage partners

Aerial source: Nearmap, 2017

Legend

- Study Area
- PEP Boundary
- 39 Landowner ID
- Scattered trees

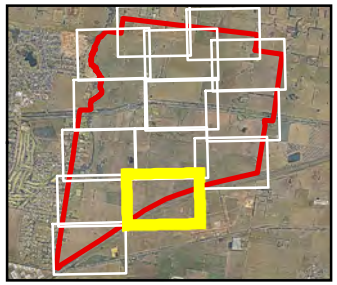


Figure 2m

Ecological features

Pakenham East PSP

N

0 50 100

Metres

ecology & heritage partners

8203_Fig02_MB_EcoFeatures_f4221 11/01/2018 melsley

Aerial source: Nearmap, 2017

Legend

- Study Area
- PEP Boundary
- 39 Landowner ID
- Scattered trees

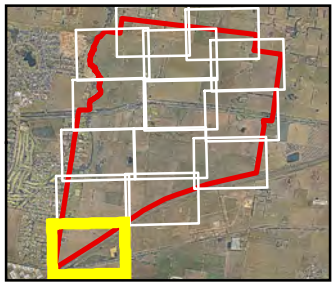


Figure 2n

Ecological features

Pakenham East PSP

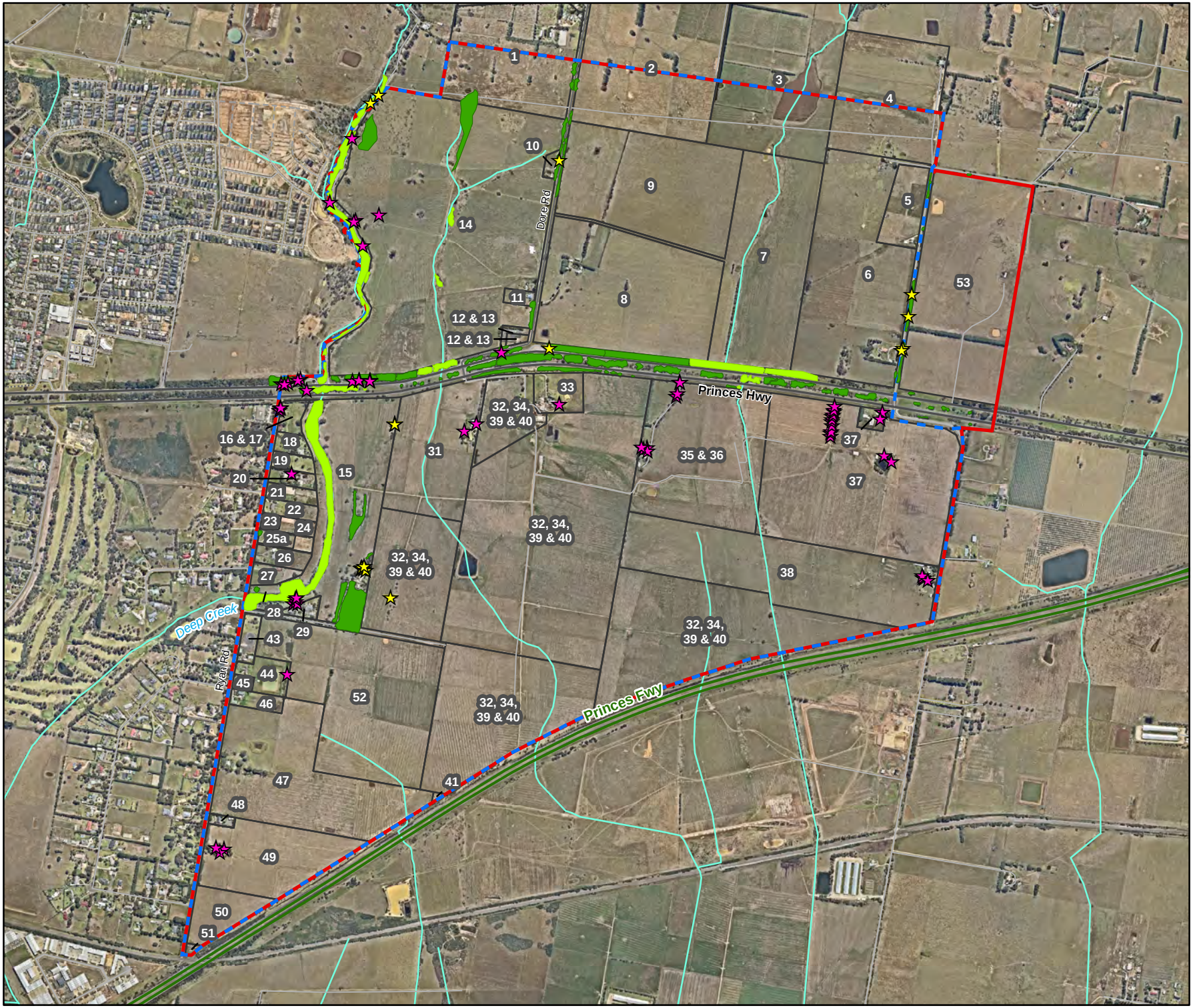
N

0 50 100

Metres

ecology & heritage partners

Aerial source: Nearmap, 2017



Legend

- Study Area
- PEP Boundary
- 39 Property ID

Threatened flora

- Green Scentbark
- Veined Spear-grass

Conservation significance

- Very High
- High

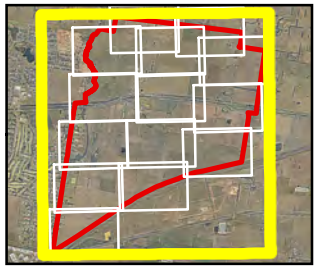


Figure 3 Overview

Conservation Significance and Threatened Species

Pakenham East PSP

N

0 205 410

Metres

ecology & heritage partners

8203_Fig03_MB_ConsSig_ThrSp_f4221 11/01/2018 melsley

Aerial source: Nearmap 2017

Legend

- Study Area
- PEP Boundary
- 39 Property ID

Threatened flora

- Green Scentbark
- Veined Spear-grass

Conservation significance

- Very High
- High

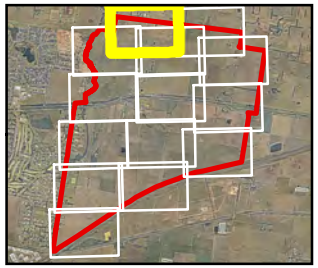


Figure 3a

Conservation Significance and Threatened Species

Pakenham East PSP

N

0 45 90

Metres

ecology & heritage partners

8203_Fig03_MB_ConsSig_ThrSp_f4221 11/01/2018 melsley

Aerial source: Nearmap 2017

Legend

- Study Area
- PEP Boundary
- 39 Property ID

Threatened flora

- Green Scentbark
- Veined Spear-grass

Conservation significance

- Very High
- High

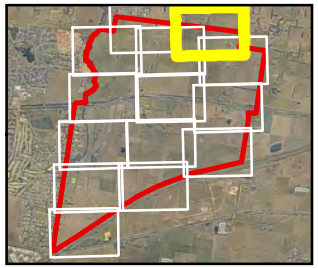


Figure 3b

Conservation Significance and Threatened Species

Pakenham East PSP

N

0 45 90

Metres

ecology & heritage partners

8203_Fig03_MB_ConsSig_ThrSp_f4221 11/01/2018 melsley

Aerial source: Nearmap 2017

Legend

- Study Area
- PEP Boundary
- 39 Property ID

Threatened flora

- Green Scentbark
- Veined Spear-grass

Conservation significance

- Very High
- High

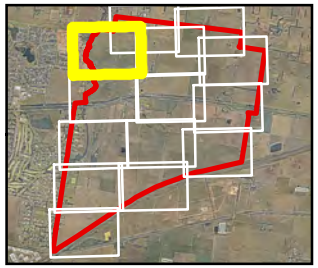


Figure 3c

Conservation Significance and Threatened Species

Pakenham East PSP

N

0 45 90

Metres

ecology & heritage partners

8203_Fig03_MB_ConsSig_ThrSp_f4221 11/01/2018 melsley

Aerial source: Nearmap 2017

Legend

- Study Area
- PEP Boundary
- 39 Property ID

Threatened flora

- Green Scentbark
- Veined Spear-grass

Conservation significance

- Very High
- High

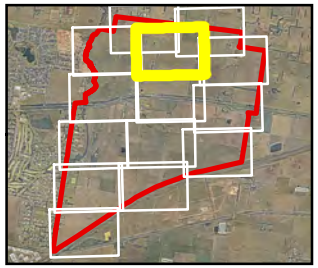


Figure 3d

Conservation Significance and Threatened Species

Pakenham East PSP

N

0 45 90

Metres

ecology & heritage partners

8203_Fig03_MB_ConsSig_ThrSp_f4221 11/01/2018 melsley

Aerial source: Nearmap 2017

Legend

- Study Area
- PEP Boundary
- 39 Property ID

Threatened flora

- Green Scentbark
- Veined Spear-grass

Conservation significance

- Very High
- High

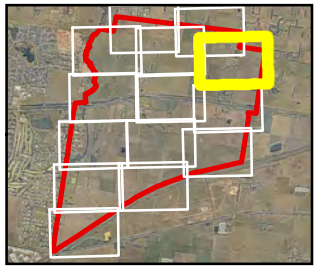


Figure 3e

Conservation Significance and Threatened Species

Pakenham East PSP

N

0 45 90

Metres

ecology & heritage partners

8203_Fig03_MB_ConsSig_ThrSp_f4221 11/01/2018 melsley

Aerial source: Nearmap 2017

Legend

- Study Area
- PEP Boundary
- 39 Property ID

Threatened flora

- Green Scentbark
- Veined Spear-grass

Conservation significance

- Very High
- High

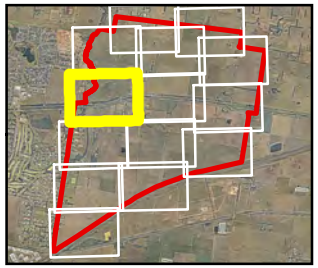


Figure 3f

Conservation Significance and Threatened Species

Pakenham East PSP

N

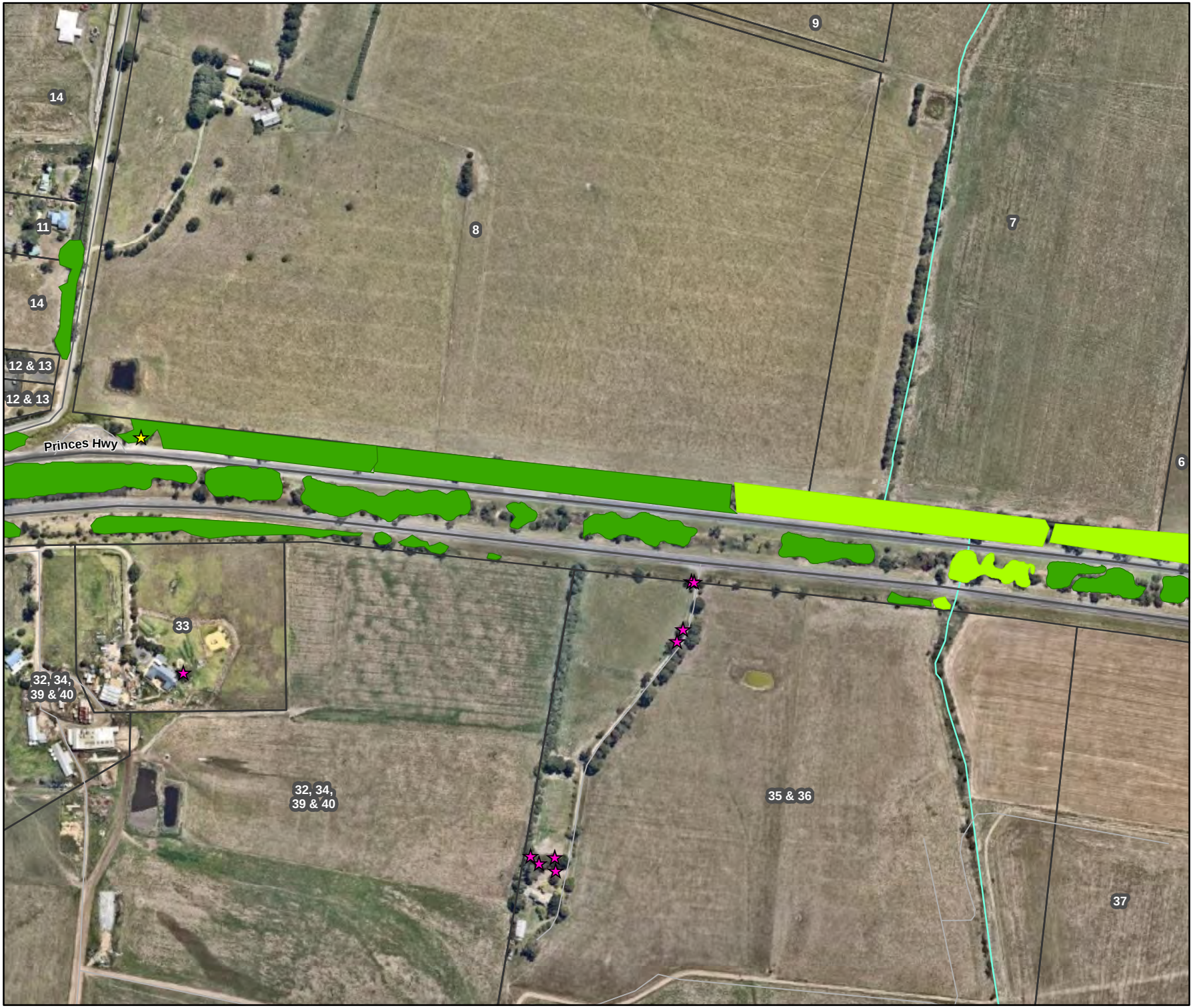
0 45 90

Metres

ecology & heritage partners

8203_Fig03_MB_ConsSig_ThrSp_f4221 11/01/2018 melsley

Aerial source: Nearmap 2017



Legend

- Study Area
- PEP Boundary
- 39 Property ID

Threatened flora

- Green Scentbark
- Veined Spear-grass

Conservation significance

- Very High
- High

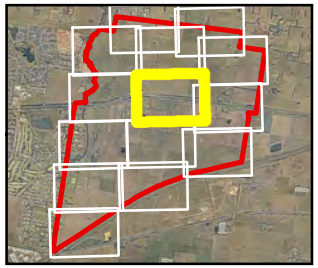


Figure 3g

Conservation Significance and Threatened Species

Pakenham East PSP

N

0 45 90

Metres

ecology & heritage partners

8203_Fig03_MB_ConsSig_ThrSp_f4221 11/01/2018 melsley

Aerial source: Nearmap 2017

Legend

- Study Area
- PEP Boundary
- 39 Property ID

Threatened flora

- Green Scentbark
- Veined Spear-grass

Conservation significance

- Very High
- High

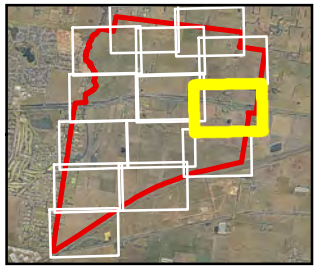


Figure 3h

Conservation Significance and Threatened Species

Pakenham East PSP

N

0 45 90

Metres

ecology & heritage partners

8203_Fig03_MB_ConsSig_ThrSp_f4221 11/01/2018 melsley

Aerial source: Nearmap 2017

Legend

- Study Area
- PEP Boundary
- 39 Property ID

Threatened flora

- Green Scentbark
- Veined Spear-grass

Conservation significance

- Very High
- High

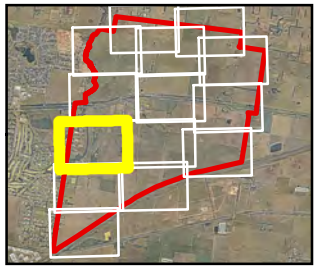


Figure 3i

Conservation Significance and Threatened Species

Pakenham East PSP

N

0 45 90

Metres

ecology & heritage partners

8203_Fig03_MB_ConsSig_ThrSp_f4221 11/01/2018 melsley

Aerial source: Nearmap 2017

Legend

- Study Area
- PEP Boundary
- 39 Property ID

Threatened flora

- Green Scentbark
- Veined Spear-grass

Conservation significance

- Very High
- High

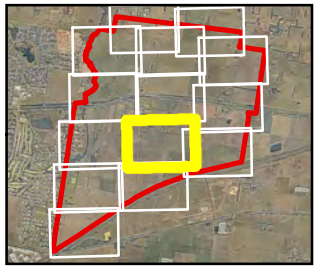


Figure 3j

Conservation Significance and Threatened Species

Pakenham East PSP

N

0 45 90

Metres

ecology & heritage partners

8203_Fig03_MB_ConsSig_ThrSp_f4221 11/01/2018 melsley

Aerial source: Nearmap 2017

Legend

- Study Area
- PEP Boundary
- 39 Property ID

Threatened flora

- Green Scentbark
- Veined Spear-grass

Conservation significance

- Very High
- High

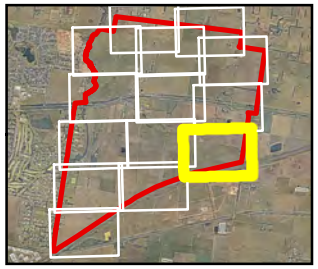


Figure 3k

Conservation Significance and Threatened Species

Pakenham East PSP

N

0 45 90

Metres

ecology & heritage partners

8203_Fig03_MB_ConsSig_ThrSp_f4221 11/01/2018 melsley

Aerial source: Nearmap 2017

Legend

- Study Area
- PEP Boundary
- 39 Property ID

Threatened flora

- Green Scentbark
- Veined Spear-grass

Conservation significance

- Very High
- High

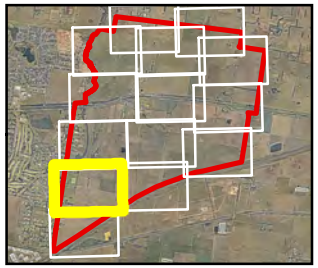


Figure 3l

Conservation Significance and Threatened Species

Pakenham East PSP

N

0 45 90

Metres

ecology & heritage partners

8203_Fig03_MB_ConsSig_ThrSp_f4221 11/01/2018 melsley

Aerial source: Nearmap 2017

Legend

- Study Area
- PEP Boundary
- 39 Property ID

Threatened flora

- Green Scentbark
- Veined Spear-grass

Conservation significance

- Very High
- High

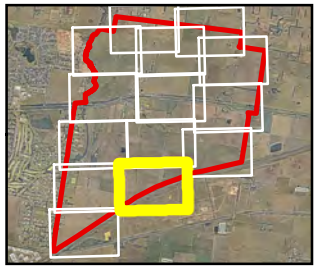


Figure 3m

Conservation Significance and Threatened Species

Pakenham East PSP

N

0 45 90

Metres

ecology & heritage partners

8203_Fig03_MB_ConsSig_ThrSp_f4221 11/01/2018 melsley

Aerial source: Nearmap 2017

Legend

- Study Area
- PEP Boundary
- 39 Property ID

Threatened flora

- Green Scentbark
- Veined Spear-grass

Conservation significance

- Very High
- High

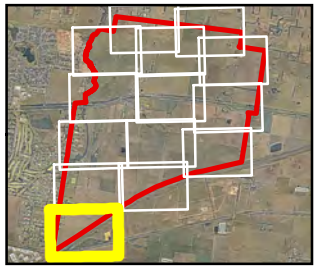


Figure 3n

Conservation Significance and Threatened Species

Pakenham East PSP

N

0 45 90

Metres

ecology & heritage partners

8203_Fig03_MB_ConsSig_ThrSp_f4221 11/01/2018 melsley

Aerial source: Nearmap 2017

Legend

- Study Area
- PEP Boundary

Significant Flora

- Arching Flax-lily
- Austral Crane's-bill
- Buxton Gum
- Cobra Greenhood
- Filmy Maidenhair
- Giant Honey-myrtle
- Green Scentbark
- Grey Billy-buttons
- Maroon Leek-orchid
- Matted Flax-lily
- Purple Blown-grass
- Southern Blue-gum
- Studley Park Gum
- Swamp Bush-pea
- Valley Crane's-bill
- Veined Spear-grass

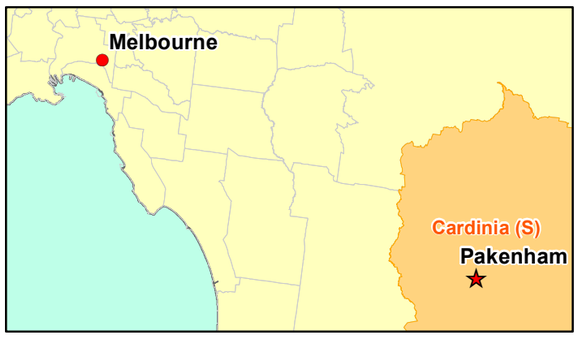


Figure 4

Previously documented significant flora within 5km of the study area

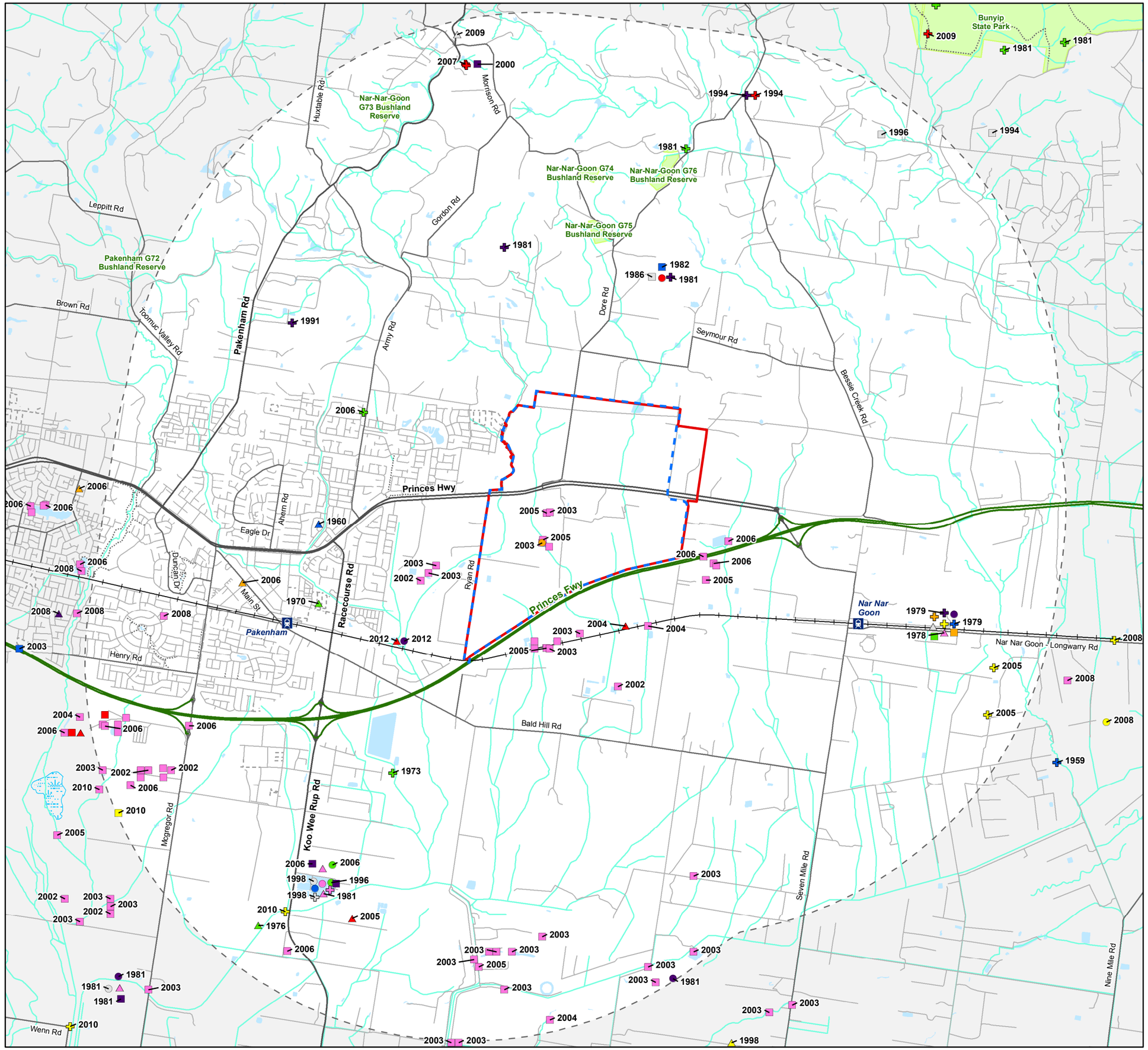
Pakenham East PSP

N

0 1 2

Kilometres

ecology & heritage partners



Legend

- Study Area
- PEP Boundary

Significant Fauna

- Australasian Shoveler
- Azure Kingfisher
- Baillon's Crake
- Black Bittern
- Blue-billed Duck
- Caspian Tern
- Common Sandpiper
- Eastern Great Egret
- Eastern Pygmy-possum
- Eastern Snake-necked Turtle
- Freckled Duck
- Glossy Grass Skink
- Grey Goshawk
- Grey-headed Flying-fox
- Growling Grass Frog
- Hardhead
- Hooded Robin
- Latham's Snipe
- Little Bittern
- Little Egret
- Macquarie Perch
- Murray Cod
- Musk Duck
- Nankeen Night Heron
- Pectoral Sandpiper
- Powerful Owl
- Royal Spoonbill
- Southern Brown Bandicoot
- Southern Toadlet
- Spotted Quail-thrush
- Whiskered Tern
- White-throated Needletail

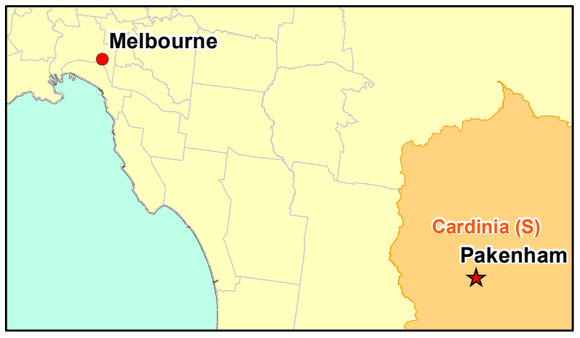


Figure 5

Previously documented significant fauna within 5km of the study area

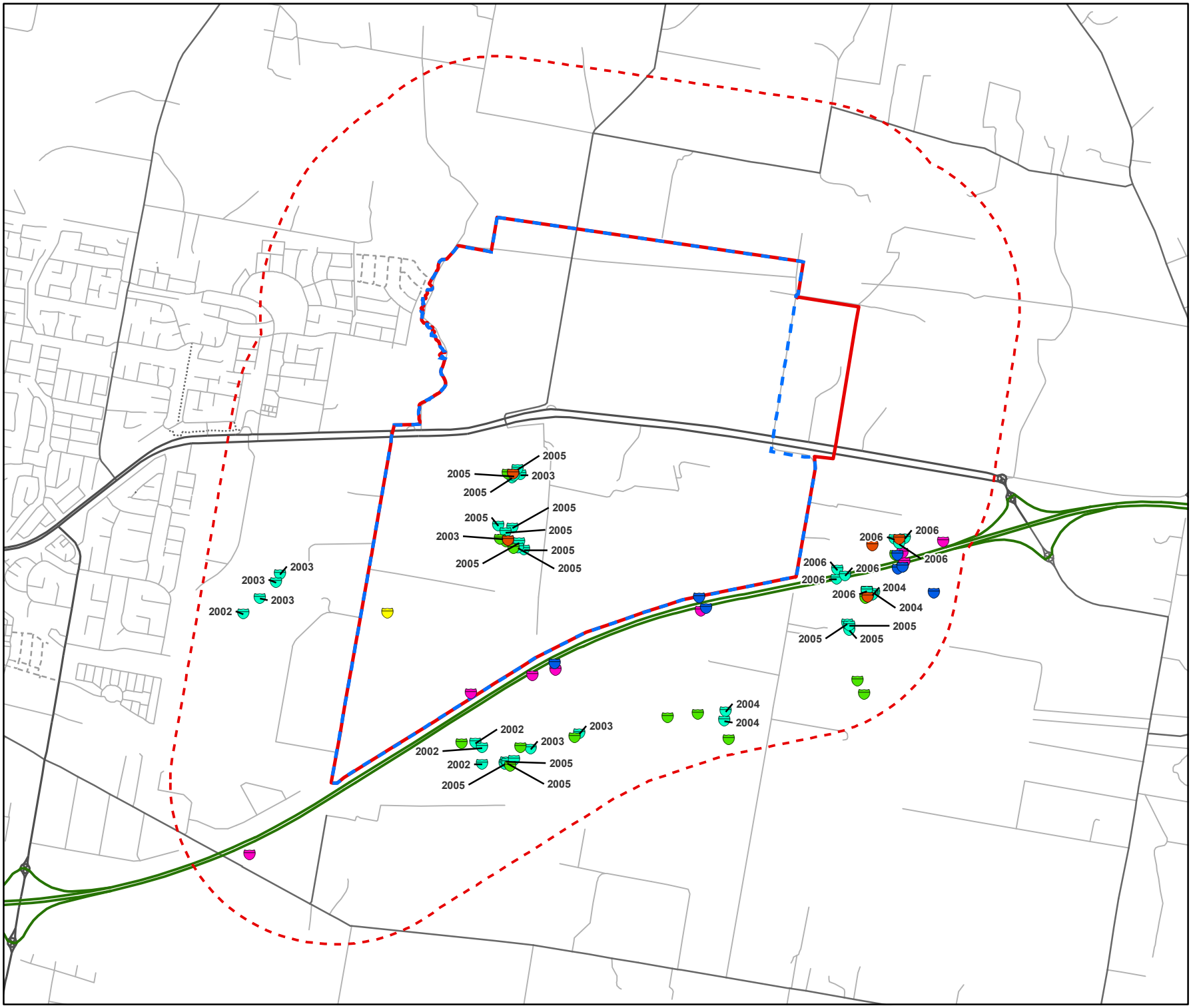
Pakenham East PSP

N

0 1 2

Kilometres

ecology & heritage partners



Legend

- Study Area
- PEP Boundary
- 1km buffer

Growling Grass Frog records

- Victorian Biodiversity Atlas 2011

Ecology & Heritage Partners:

- 2013 records
- 2011 records
- 2010 records
- 2009 records
- 2008 records

Figure 6

Growling Grass Frog records within 1km of the study area

Pakenham East PSP

N

0 400 800

Metres

ecology & heritage partners

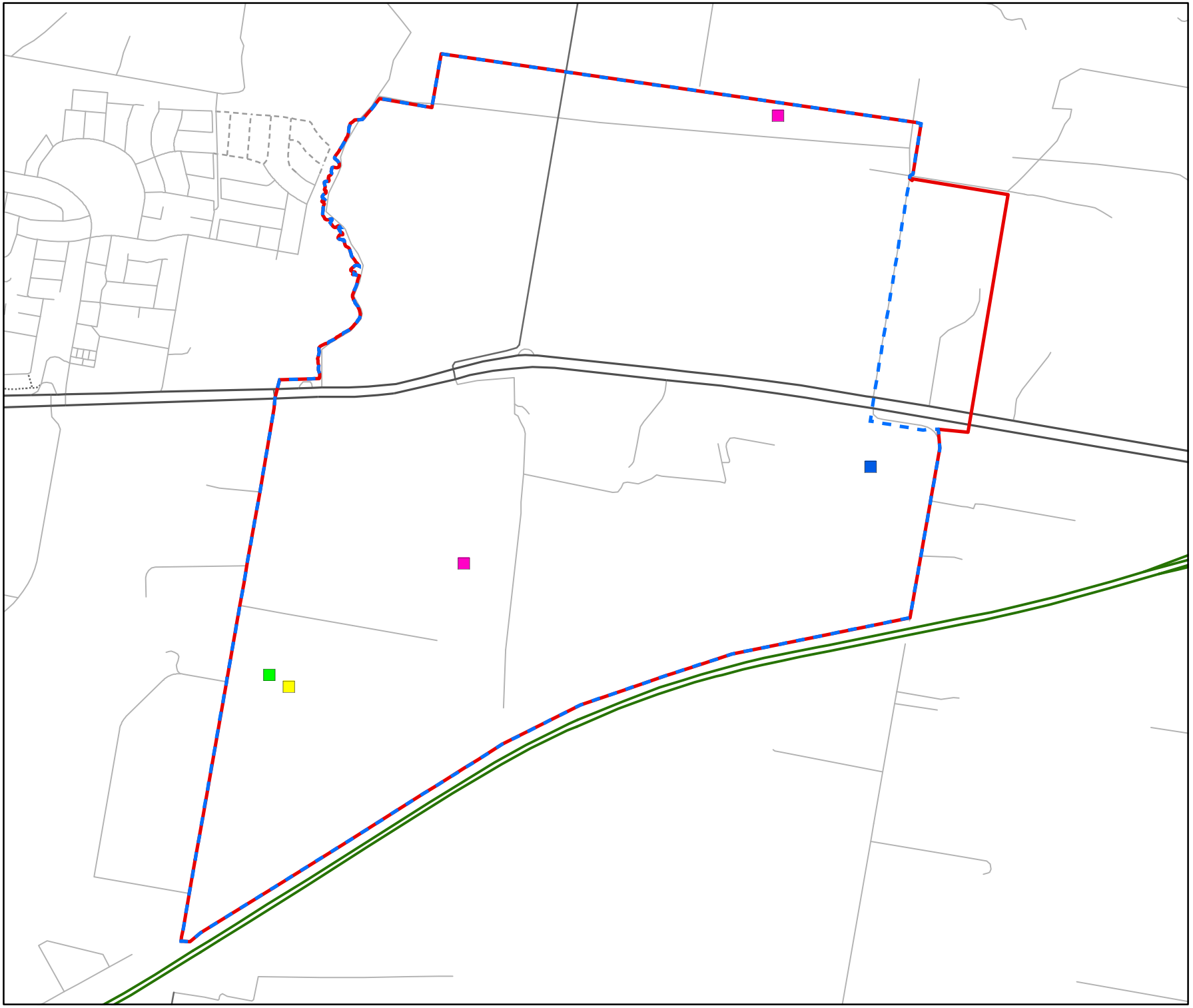
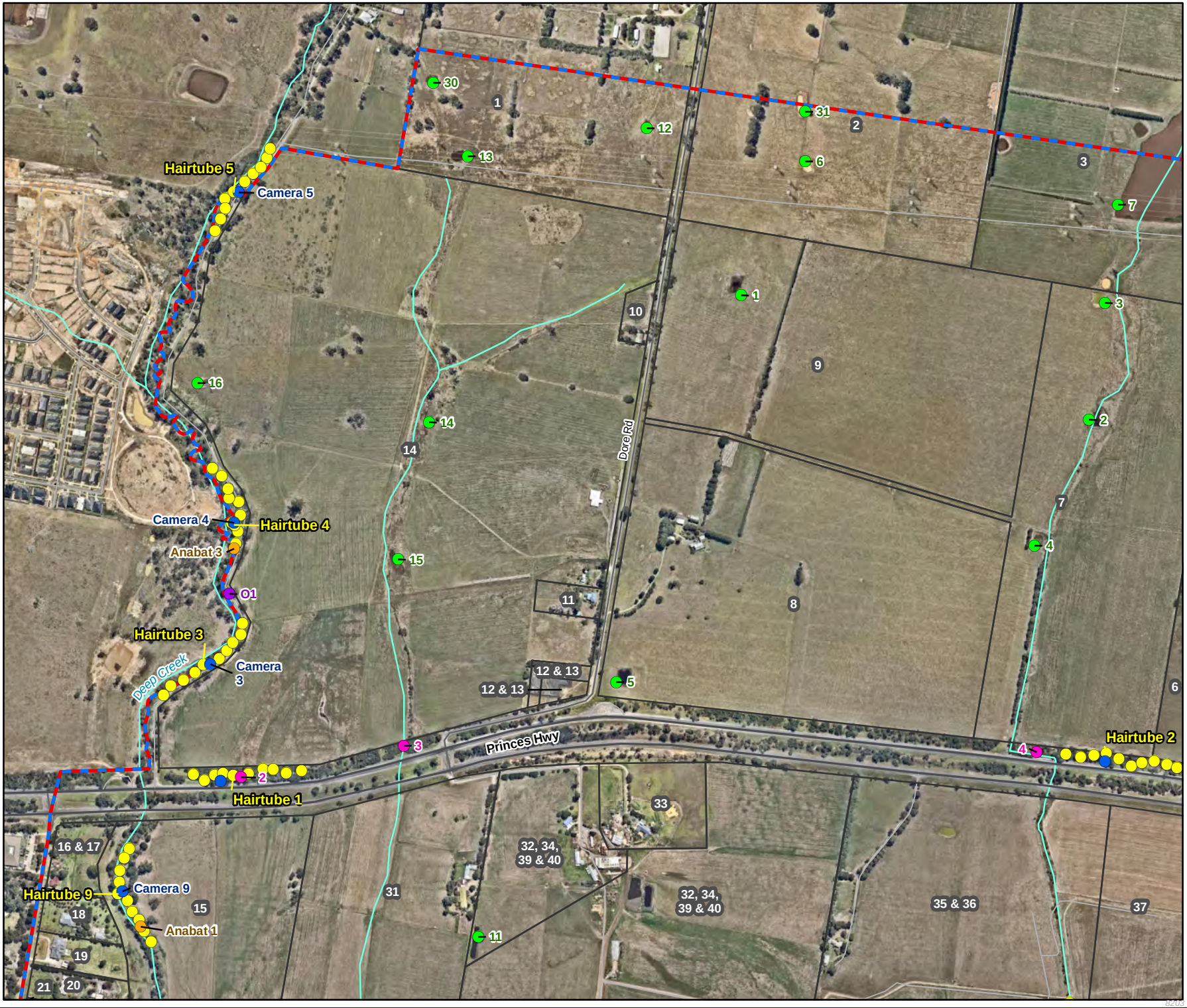


Figure 7

Significant fauna species recorded during the 2012/2013 surveys

Pakenham East PSP

ecology & heritage partners



Legend

- Study Area not turned on
- PEP Boundary
- Property ID (14)

Survey locations

- Growling Grass Frog
- Anabat
- Owl call playback
- Hairtube
- Camera
- Southern Toadlet

Growling Grass Frog surveys were also undertaken along the entire length of Deep Creek

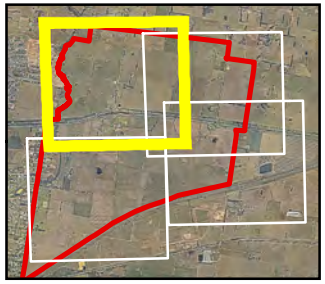


Figure 7a

Fauna survey locations - 2012-2014 surveys

Pakenham East PSP

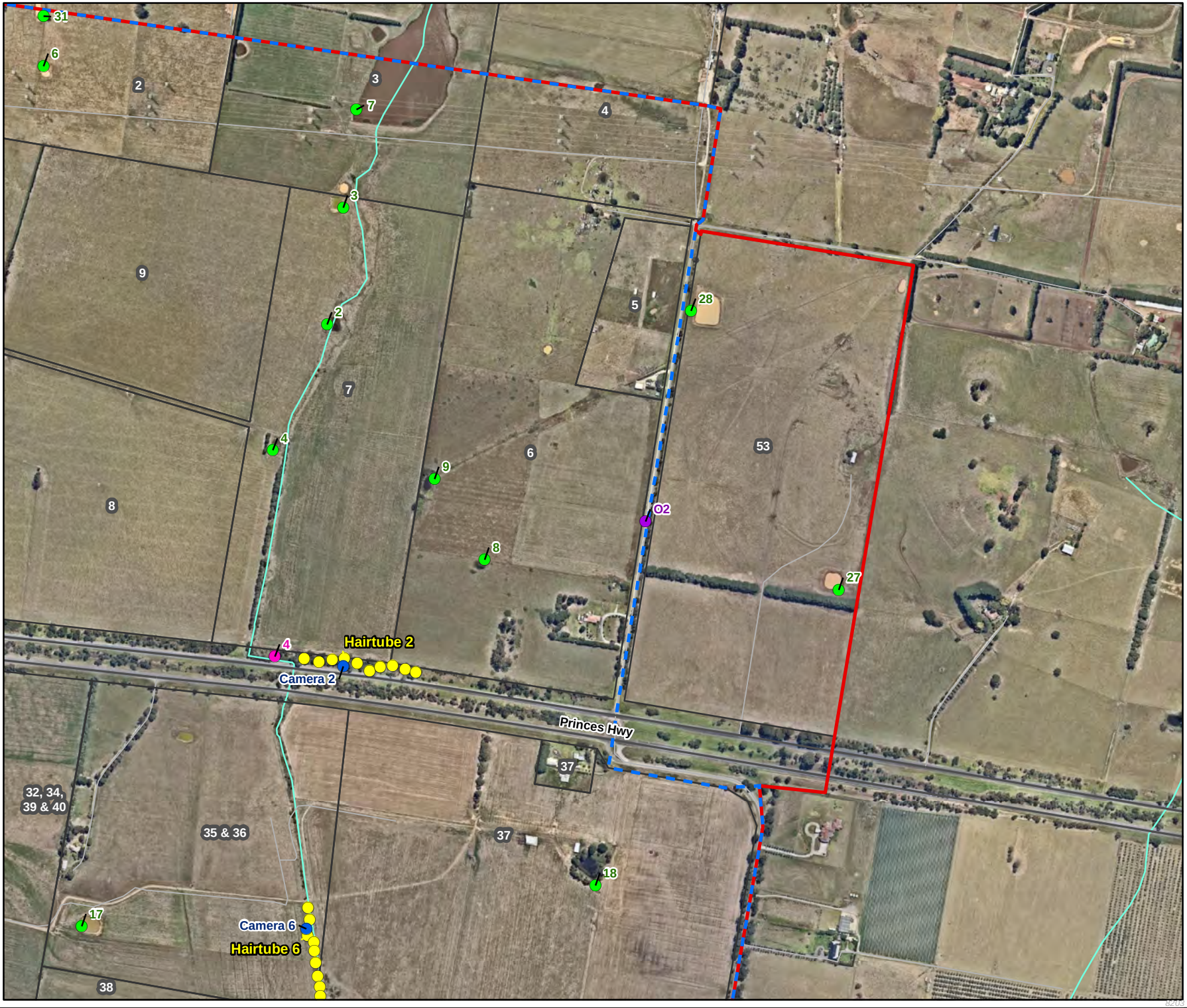
N

0 100 200

Metres

ecology & heritage partners

Aerial source: Nearmap, 2017



Legend

- Study Area not turned on
- PEP Boundary
- Property ID (14)

Survey locations

- Growling Grass Frog
- Anabat
- Owl call playback
- Hairtube
- Camera
- Southern Toadlet

Growling Grass Frog surveys were also undertaken along the entire length of Deep Creek

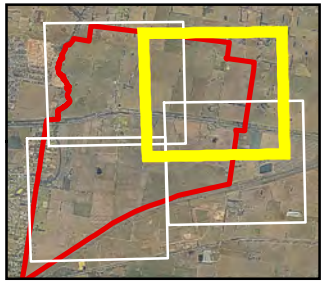


Figure 7b

Fauna survey locations - 2012-2014 surveys

Pakenham East PSP

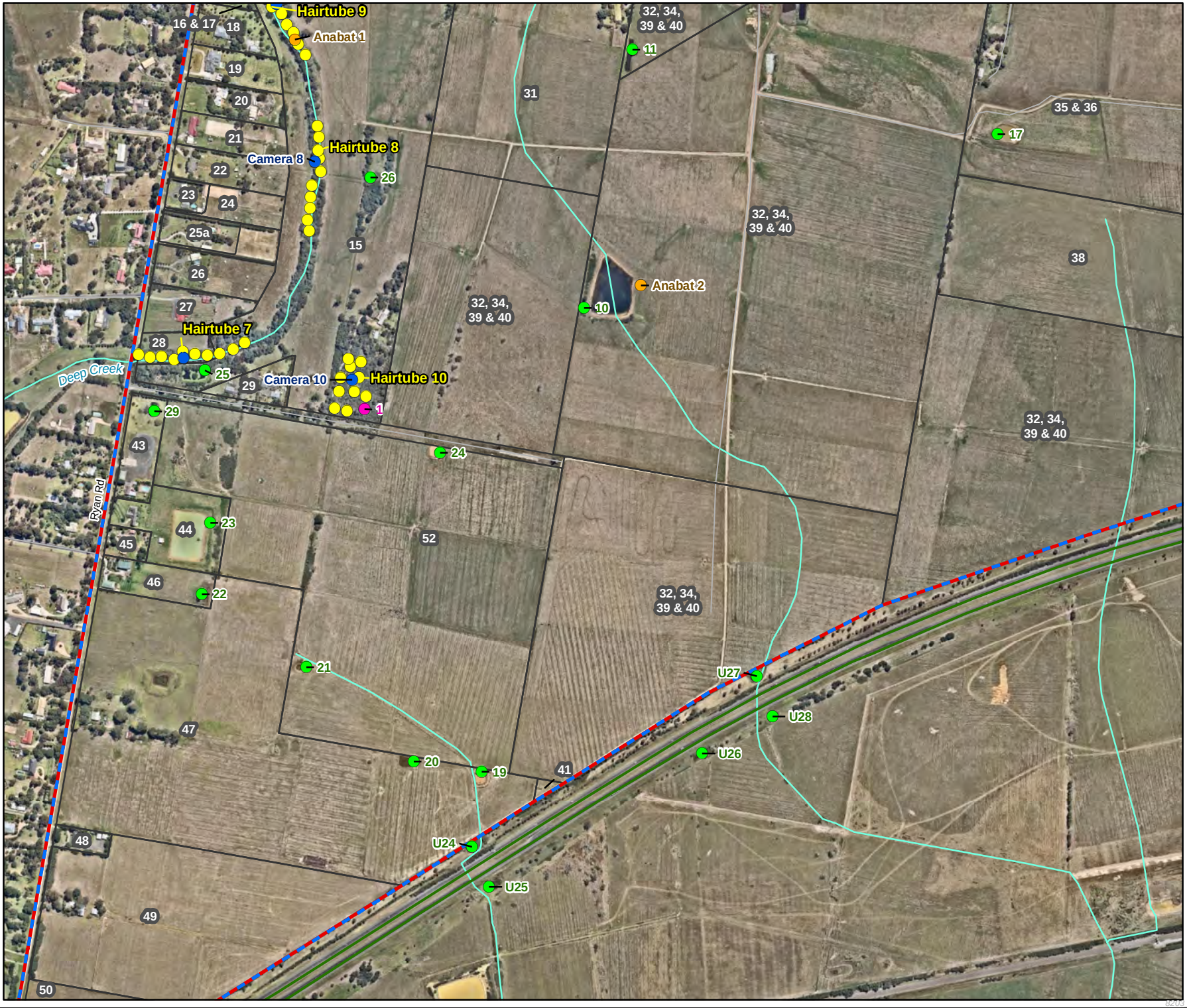
N

0 100 200

Metres

ecology & heritage partners

Aerial source: Nearmap, 2017



Legend

- Study Area not turned on
- PEP Boundary
- Property ID (14)

Survey locations

- Growling Grass Frog
- Anabat
- Owl call playback
- Hairtube
- Camera
- Southern Toadlet

Growling Grass Frog surveys were also undertaken along the entire length of Deep Creek

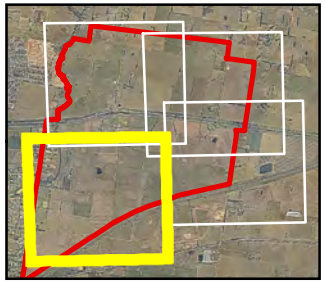


Figure 7c

Fauna survey locations - 2012-2014 surveys

Pakenham East PSP

N

0 100 200

Metres

ecology & heritage partners

3215_Fig07a_FaunaSurveyLocations_MB_f4221 11/01/2018 melsley

Aerial source: Nearmap, 2017

Legend

- Study Area not turned on
- PEP Boundary
- Property ID (14)

Survey locations

- Growling Grass Frog
- Anabat
- Owl call playback
- Hairtube
- Camera
- Southern Toadlet

Growling Grass Frog surveys were also undertaken along the entire length of Deep Creek

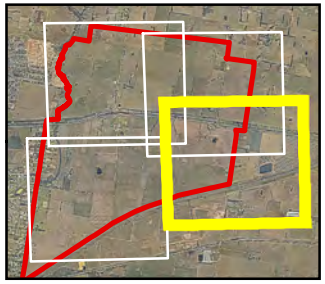


Figure 7d

Fauna survey locations - 2012-2014 surveys

Pakenham East PSP

N

0 100 200

Metres

ecology & heritage partners

Aerial source: Nearmap, 2017

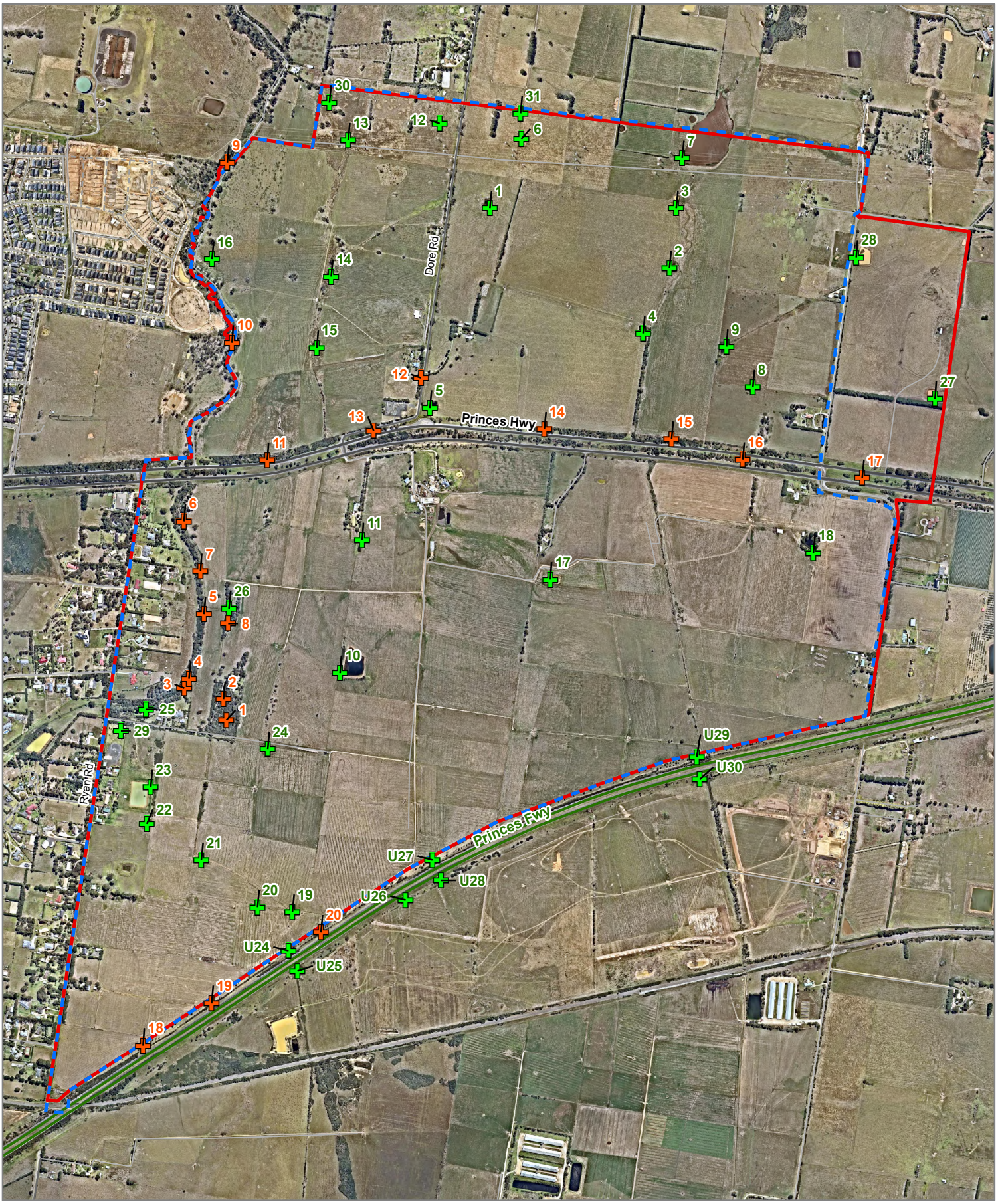


Figure 8
Fauna surveys locations 2016/2017 surveys
Pakenham East PSP

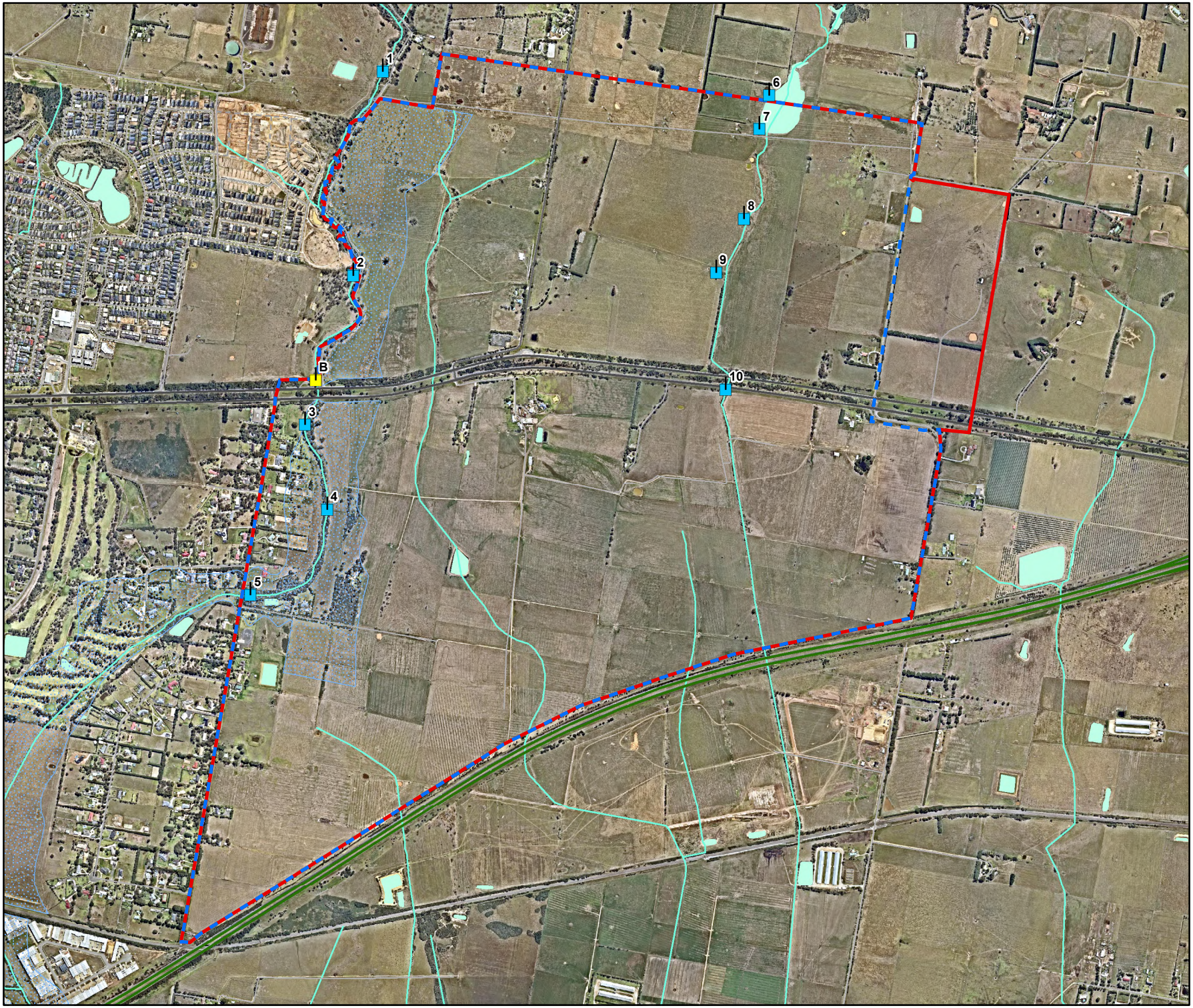
Legend

- PEP Boundary
- Study Area
- Southern Brown Bandicoot survey sites
- Growling Grass Frog survey sites

ecology & heritage partners

8203_Fig08_SurvResults_2016_2017 29/03/2017 lroy

Aerial source: Nearmap 2017



Legend

- Study Area
- PEP Boundary
- Survey location
- Fish barrier
- Land subject to inundation
- Permanent waterbody
- Minor watercourse

Figure 9

Aquatic survey sites

Pakenham East PSP

N

0 200 400

Metres

ecology & heritage partners

8203_Fig09_AquaSurvSites_f4221 29/03/2017 lroy

Aerial source: Nearmap, 2017

APPENDICES

APPENDIX 1

Appendix 1.1 – Rare or Threatened Categories for Listed Victorian Taxa

Table A1.1. Rare or Threatened categories for listed Victorian taxa.

Rare or Threatened Categories
Conservation Status in Australia (Based on the EPBC Act 1999)
EX - Extinct: Extinct is when there is no reasonable doubt that the last individual of the species has died.
CR - Critically Endangered: A species is critically endangered when it is facing an extremely high risk of extinction in the wild in the immediate future.
EN - Endangered: A species is endangered when it is not critically endangered but is facing a very high risk of extinction in the wild in the near future.
VU - Vulnerable: A species is vulnerable when it is not critically endangered or endangered but is facing a high risk of extinction in the wild in the medium-term future.
R* - Rare: A species is rare but overall is not currently considered critically endangered, endangered or vulnerable.
K* - Poorly Known: A species is suspected, but not definitely known, to belong to any of the categories extinct, critically endangered, endangered, vulnerable or rare.
Conservation Status in Victoria (Based on DEPI 2014, DSE 2009 or2013)
x - Presumed Extinct in Victoria: not recorded from Victoria during the past 50 years despite field searches specifically for the plant, or, alternatively, intensive field searches (since 1950) at all previously known sites have failed to record the plant.
e - Endangered in Victoria: at risk of disappearing from the wild state if present land use and other causal factors continue to operate.
v - Vulnerable in Victoria: not presently endangered but likely to become so soon due to continued depletion; occurring mainly on sites likely to experience changes in land-use which would threaten the survival of the plant in the wild; or, taxa whose total population is so small that the likelihood of recovery from disturbance, including localised natural events such as drought, fire or landslip, is doubtful.
r - Rare in Victoria: rare but not considered otherwise threatened - there are relatively few known populations or the taxon is restricted to a relatively small area.
k - Poorly Known in Victoria: poorly known and suspected, but not definitely known, to belong to one of the above categories (x, e, v or r) within Victoria. At present, accurate distribution information is inadequate.

Appendix 1.2 – Defining Ecological Significance

Table A1.2. Criteria for defining Ecological Significance ratings for significant flora, fauna and communities.

National Significance
Flora: National conservation status is based on the EPBC Act list of taxa considered threatened in Australia (i.e. extinct, critically endangered, endangered, vulnerable).
Fauna: National conservation status is based on the EPBC Act list of taxa considered threatened in Australia (i.e. Extinct, Critically Endangered, Endangered, Vulnerable). Fauna listed as Extinct, Critically Endangered, Endangered, Vulnerable, or Rare under National Action Plans for terrestrial taxon prepared for DoE: mammals (Woinarski *et al.* 2014), bats (Duncan *et al.* 1999), birds (Garnett *et al.* 2011), reptiles (Cogger *et al*. 1993), amphibians (Tyler 1997) and butterflies (Sands and New 2002).
Communities: Vegetation communities considered critically endangered, endangered or vulnerable under the EPBC Act and considering vegetation condition.
State Significance
Flora: Threatened taxa listed under the provisions of the FFG Act. Flora listed in the State Government's Advisory List of Rare or Threatened Plants in Victoria (DEPI 2014).
Fauna: Threatened taxon listed under Schedule 2 of the FFG Act. Fauna listed as Extinct, Critically Endangered, Endangered and Vulnerable on the State Government's Advisory List of Threatened Vertebrate Fauna in Victoria (DSE 2013). Listed as Lower Risk (Near Threatened, Conservation Dependent or Least concern) or Data Deficient under National Action Plans for terrestrial species prepared for the DoE: mammals (Woinarski *et al*. 2014), bats (Duncan *et al*. 1999), birds (Garnett *et al.* 2011), reptiles (Cogger *et al*. 1993), amphibians (Tyler 1997) and butterflies (Sands and New 2002).
Communities: Ecological communities listed as threatened under the FFG Act (DELWP 2017h). EVC listed as threatened (i.e. endangered, vulnerable) or rare in a Native Vegetation Plan for a particular bioregion and considering vegetation condition.
Regional Significance
Fauna: Fauna with a disjunct distribution, or a small number of documented recorded or naturally rare in the particular Bioregion in which the study area is located. A particular taxon that is has an unusual ecological or biogeographical occurrence or listed as Lower Risk – Near Threatened, Data Deficient or Insufficiently Known on the State Government's Advisory List of Threatened Vertebrate Fauna in Victoria (DSE 2013).
Communities: EVC listed as depleted or least concern in a Native Vegetation Plan for a particular bioregion) and considering vegetation condition. EVC considered rare by the author for a particular bioregion.
Local Significance
Local significance is defined as flora, fauna and ecological communities indigenous to a particular area, which are not considered rare or threatened on a national, state or regional level.

Appendix 1.3 – Defining Site Significance

Table A1.3. Criteria for defining Site Significance ratings.

National Significance
A site is of National significance if: • It regularly supports, or has a high probability of regularly supporting individuals of a taxon listed as 'Critically Endangered' or 'Endangered' under the EPBC Act and/or under National Action Plans for terrestrial taxon prepared for the DoE. • It regularly supports, or has a high probability of supporting, an 'important population' as defined under the EPBC Act of one or more nationally 'vulnerable' flora and fauna taxon. • It is known to support, or has a high probability of supporting taxon listed as 'Vulnerable' under National Action Plans. • It is known to regularly support a large proportion (i.e. greater than 1%) of a population of a taxon listed as 'Conservation Dependent' under the EPBC Act and/or listed as Rare or Lower Risk (near threatened, conservation dependent or least concern) under National Action Plans. • It contains an area, or part thereof designated as 'critical habitat' under the EPBC Act, or if the site is listed under the Register of National Estate compiled by the Australian Heritage Commission. • It is a site which forms part of, or is connected to a larger area(s) of remnant native vegetation or habitat of national conservation significance such as most National Park, and/or a Ramsar Wetland(s).
State Significance
A site is of State significance if: • It occasionally (i.e. every 1 to 5 years) supports, or has suitable habitat to support taxon listed as 'Critically Endangered' or 'Endangered' under the EPBC Act and/or under National Action Plans. • It regularly supports, or has a high probability of regularly supporting (i.e. high habitat quality) taxon listed as 'Vulnerable', 'Near threatened', 'Data Deficient' or 'Insufficiently Known' in Victoria (,DSE 2013; DEPI 2014), or species listed as 'Data Deficient' or 'Insufficiently Known' under National Action Plans. • It contains an area, or part thereof designated as 'critical habitat' under the FFG Act. • It supports, or likely to support a high proportion of any Victorian flora and fauna taxa. • It contains high quality, intact vegetation/habitat supporting a high species richness and diversity in a particular bioregion. • It is a site which forms part of, or connected to a larger area(s) of remnant native vegetation or habitat of state conservation significance such as most State Parks and/or Flora and Fauna Reserves.
Regional Significance
A site is of Regional significance if: • It regularly supports, or has a high probability of regularly supporting regionally significant fauna as defined in Table 1.2. • Is contains a large population (i.e. greater than 1% or 5%) of flora considered rare in any regional Native Vegetation Plan for a particular bioregion. • It supports a fauna population with a disjunct distribution, or a particular taxon that has an unusual ecological or biogeographical occurrence. • It is a site which forms part of, or is connected to a larger area(s) of remnant native vegetation or habitat of regional conservation significance such as most Regional Parks and/or Flora and Fauna Reserves.
Local Significance
Most sites are considered to be of at least local significant for conservation, and in general a site of local significance can be defined as: • An area which supports indigenous flora species and/or a remnant EVC, and habitats used by locally significant fauna species. • An area which currently acts, or has the potential to act as a wildlife corridor linking other areas of higher conservation significance and facilitating fauna movement throughout the landscape.

Appendix 1.4 – Vegetation Condition and Habitat Quality

Table A1.4.1 Defining Vegetation Condition ratings.

Criteria for defining Vegetation Condition
High Quality: Vegetation dominated by a diversity of indigenous species, with defined structures (where appropriate), such as canopy layer, shrub layer, and ground cover, with little or few introduced species present.
Moderate Quality: Vegetation dominated by a diversity of indigenous species, but is lacking some structures, such as canopy layer, shrub layer or ground cover, and/or there is a greater level of introduced flora species present.
Low Quality: Vegetation dominated by introduced species, but supports low levels of indigenous species present, in the canopy, shrub layer or ground cover.

Table A1.4.2 Defining Habitat Quality.

Criteria for defining Habitat Quality
High Quality: • High degree of intactness (i.e. floristically and structurally diverse), containing several important habitat features such as ground debris (logs, rocks, vegetation), mature hollow-bearing trees, and a dense understorey component. • High species richness and diversity (i.e. represented by a large number of species from a range of fauna groups). • High level of foraging and breeding activity, with the site regularly used by native fauna for refuge and cover. • Habitat that has experienced, or is experiencing low levels of disturbance and/or threatening processes (i.e. weed invasion, introduced animals, soil erosion, salinity). • High contribution to a wildlife corridor, and/or connected to a larger area(s) of high quality habitat. • Provides known, or likely habitat for one or more rare or threatened species listed under the EPBC Act, FFG Act, or species considered rare or threatened according to DEPI 2014; DSE 2009 or 2013.
Moderate Quality: • Moderate degree of intactness, containing one or more important habitat features such as ground debris (logs, rocks, vegetation), mature hollow-bearing trees, and a dense understorey component. • Moderate species richness and diversity - represented by a moderate number of species from a range of fauna groups. • Moderate levels of foraging and breeding activity, with the site used by native fauna for refuge and cover. • Habitat that has experienced, or is experiencing moderate levels of disturbance and/or threatening processes. • Moderate contribution to a wildlife corridor, or is connected to area(s) of moderate quality habitat. • Provides potential habitat for a small number of threatened species listed under the EPBC Act, FFG Act, or species considered rare or threatened according to DEPI 2014; DSE 2009 or 2013.
Low Quality: • Low degree of intactness, containing few important habitat features such as ground debris (logs, rocks, vegetation), mature hollow-bearing trees, and a dense understorey component. • Low species richness and diversity (i.e. represented by a small number of species from a range of fauna groups). • Low levels of foraging and breeding activity, with the site used by native fauna for refuge and cover. • Habitat that has experienced, or is experiencing high levels of disturbance and/or threatening processes. • Unlikely to form part of a wildlife corridor, and is not connected to another area(s) of habitat. • Unlikely to provide habitat for rare or threatened species listed under the EPBC Act, FFG Act, or considered rare or threatened according to DEPI 2014; DSE 2009 or 2013.

Appendix 1.5 – Offsets and Exemptions

Table A1.5.1. Calculation of Biodiversity Equivalence Scores and General or Specific Offsets (DEPI 2013)

Pathway	Biodiversity Assessment Tools	Information Source
Low Risk-based pathway	Condition Score	Modelled data, NVIM Tool (DELWP 2018a)
	Habitat Hectares	= Condition Score x Extent (ha)
	Strategic Biodiversity Score	Modelled data, NVIM Tool (DELWP 2018a)
	General Biodiversity Equivalence Score	= Habitat Hectares x Strategic Biodiversity Score
Moderate or High Risk-based pathway	Condition Score	Habitat hectare assessment
	Habitat Hectares	= Condition Score x Extent (ha)
	Strategic Biodiversity Score and Habitat Importance Score	Modelled data, determined by DEPI
	Specific Biodiversity Equivalence Score **(A)**	= Habitat Hectares x Habitat Importance Score
	Sum of Specific Biodiversity Equivalence Scores of remaining habitat **(B)**	Data gathered during the field assessment is provided to DEPI for analysis and a resulting assessment offset report is provided by the Department.
	Specific Offset Threshold **(C)**	
	General/Specific Threshold Test: If **A ÷ B > C** a **Specific** offset is required If **A ÷ B < C** a **General** offset required	

Table A1.5.2. Summary of offset requirements (DEPI 2013)

Risk –based Pathway	Offset Type	Offset Amount (Risk adjusted biodiversity equivalence score)	Offset Attributes		
			Habitat for Species	Vicinity	Strategic Biodiversity Score
Low Risk	General offset	1.5 times the general biodiversity equivalence score of the native vegetation to be removed.	No restrictions	In the same Catchment Management Authority or Local Government Area boundary as the native vegetation to be removed.	At least 80 per cent of the strategic biodiversity score of the native vegetation to be removed.
Moderate or High Risk	General offset	1.5 times the general biodiversity equivalence score of the native vegetation to be removed.	No restrictions	In the same Catchment Management Authority or Local Government Area boundary as the native vegetation to be removed.	At least 80 per cent of the strategic biodiversity score of the native vegetation to be removed.
Moderate or High Risk	Specific offset	For each species impacted, 2 times the specific biodiversity equivalence score of the native vegetation to be removed.	Likely habitat for each rare or threatened species that a specific offset is required for, according to the specific-general offset test.	No restrictions	No restrictions

Appendix 1.6 – *Flora and Fauna Guarantee Act 1988* Protected Species

Protected flora and fauna under the *Flora and Fauna Guarantee Act 1988* (FFG Act) are defined as those that have legal protection under the Act. Protected taxa includes plants and animals from three sources:

- Plant or animal taxa (species, subspecies or varieties) listed as threatened under the FFG Act;
- Plant taxa belonging to communities listed as threatened under the FFG Act; and,
- Plant taxa which are not threatened but require protection for other reasons.

Note that representative plants of a given community are protected as well as the community itself (for example scattered Wallaby-grasses *Rytidosperma* spp. are protected in degraded areas previously supporting the listed Western [Basalt] Plains Grassland Community.

Table A1.6 provides a list of plant groups protected under the FFG Act. For threatened plant species likely to occur within the study area refer to Appendix and for listed communities (or representative species) likely to occur within the study area refer to Sections 3.1.5 and 3.1.6.

Table A1.6. Plant groups (Families, Genera and Kingdom Divisions) protected under the FFG Act (DELWP 2016).

Family/Genera	Common Name	Exclusions
Pteridophyta	Clubmosses, ferns and fern allies	Austral Bracken *Pteridium esculentum*
Asteraceae	Daisies	N/A
Ericaceae (formerly Epacridaceae)	Heaths	N/A
Orchidaceae	Orchids	N/A
Acacia	Wattles	*Acacia dealbata, Acacia decurrens, Acacia implexa, Acacia melanoxylon and Acacia paradoxa*
Baeckea	Baeckeas	N/A
Boronia	Boronias	N/A
Calytrix	Fringe-myrtles	N/A
Correa -	Correas	N/A
Darwinia	Darwinias	N/A
Eremophila	Emu-bushes	N/A
Eriostemon	Wax-flowers	N/A
Gompholobium	Wedge-peas	N/A
Grevillea	Grevilleas	N/A
Prostanthera	Mint-bushes	N/A
Sphagnum	Sphagnum mosses	N/A
Stylidium	Trigger-plants	N/A
Thryptomene	Thryptomenes	N/A
Thysanotus	Fringe-lilies	N/A
Xanthorrhoea	Grass-trees	N/A

APPENDIX 2

Appendix 2.1 - Flora Recorded During Site Assessment

Legend:

I Protected under the FFG Act (DELWP 2016);

L Listed under the FFG Act (DELWP 2017e);

e/r Listed as endangered/rare in Victoria under the Advisory List of Rare or Threatened Plants in Victoria (DEPI 2014);

***** Listed as a noxious weed under the CaLP Act;

w Weed of National Significance;

Planted Victorian and non-Victorian species;

+ Planted indigenous species that also occur in remnant native vegetation in the study area; and,

- Not applicable

Table A2.1. Flora recorded within the study area.

Scientific Name	Common Name	Conservation Status/Notes
INDIGENOUS SPECIES		
Acacia dealbata	Silver Wattle	-
Acacia genistifolia	Spreading Wattle	I
Acacia mearnsii	Black Wattle	I
Acacia melanoxylon	Blackwood	-
Acacia paradoxa	Hedge Wattle	-
Acacia pravissima	Ovens Wattle	I
Acacia provincialis	Wirilda	I
Acacia verticillata subsp. verticillata	Prickly Moses	I
Acaena echinata	Sheep's Burr	-
Acaena novae-zelandiae	Bidgee-widgee	-
Acrotriche serrulata	Honey-pots	I
Adiantum aethiopicum	Common Maidenhair	I
Alisma plantago-aquatica	Water Plantain	-
Allocasuarina littoralis	Black Sheoak	-
Amyema pendula	Drooping Mistletoe	-
Austrostipa rudis subsp. australis	Veined Spear-grass	r

Scientific Name	Common Name	Conservation Status/Notes
Austrostipa rudis subsp. rudis	Veined Spear-grass	-
Azolla filiculoides	Pacific Azolla	-
Banksia marginata	Silver Banksia	-
Banksia spinulosa var. cunninghamii	Hairpin Banksia	-
Bursaria spinosa	Sweet Bursaria	-
Callitriche spp.	Water Starwort	-
Calystegia sepium subsp. roseata	Large Bindweed	-
Carex appressa	Tall Sedge	-
Carex brownii	Stream Sedge	-
Carex inversa	Knob Sedge	-
Cassinia arcuata	Drooping Cassinia	I
Cassinia longifolia	Shiny Cassinia	I
Cassytha melantha	Coarse Dodder-laurel	-
Coprosma quadrifida	Prickly Currant-bush	-
Crassula decumbens var. decumbens	Spreading Crassula	-
Daucus glochidiatus	Australian Carrot	-
Dianella admixta	Black-anther Flax-lily	-
Dianella laevis	Smooth Flax-lily	-
Dianella tasmanica	Tasman Flax-lily	-
Dichondra repens	Kidney-weed	-
Dillwynia glaberrima	Smooth Parrot-pea	-
Drosera auriculata	Tall Sundew	-
Eleocharis acuta	Common Spike-sedge	-
Eleocharis sphacelata	Tall Spike-sedge	-
Epacris impressa	Common Heath	I
Eucalyptus cephalocarpa s.l.	Silver-leaf Stringybark	-
Eucalyptus fulgens	Green Scentbark	r
Eucalyptus goniocalyx s.l.	Bundy	-
Eucalyptus obliqua	Messmate Stringybark	-
Eucalyptus ovata	Swamp Gum	-
Eucalyptus radiata subsp. radiata	Narrow-leaf Peppermint	-
Eucalyptus viminalis subsp. viminalis	Manna Gum	-
Euchiton involucratus s.l.	Common Cudweed	I
Exocarpos cupressiformis	Cherry Ballart	-
Gahnia radula	Thatch Saw-sedge	-
Geranium retrorsum s.l.	Grassland Crane's-bill	-
Geranium spp.	Crane's Bill	-

Scientific Name	Common Name	Conservation Status/Notes
Glyceria australis	Australian Sweet-grass	-
Gonocarpus tetragynus	Common Raspwort	-
Goodenia ovata	Hop Goodenia	-
Goodia lotifolia s.l.	Golden Tip	-
Hakea decurrens	Bushy Needlewood	-
Isolepis cernua	Nodding Club-sedge	-
Isolepis marginata	Little Club-sedge	-
Juncus amabilis	Hollow Rush	-
Juncus bufonius	Toad Rush	-
Juncus capitatus	Capitate Rush	-
Juncus holoschoenus	Joint-leaf Rush	-
Juncus planifolius	Broad-leaf Rush	-
Juncus procerus	Tall Rush	-
Juncus spp.	Rush	-
Juncus subsecundus	Finger Rush	-
Kunzea ericoides spp. agg.	Burgan	-
Lachnagrostis filiformis s.l.	Common Blown-grass	-
Leptospermum continentale	Prickly Tea-tree	-
Lilaeopsis polyantha	Australian Lilaeopsis	-
Lobelia anceps	Angled Lobelia	-
Lomandra filiformis subsp. coriacea	Wattle Mat-rush	-
Lomandra filiformis subsp. filiformis	Wattle Mat-rush	-
Lomandra longifolia subsp. longifolia	Spiny-headed Mat-rush	-
Lycopus australis	Australian Gipsywort	-
Lythrum hyssopifolia	Small Loosestrife	-
Melaleuca decussata	Totem-poles	-
Melaleuca ericifolia	Swamp Paperbark	-
Melaleuca parvistaminea	Rough-barked Honey-myrtle	-
Microlaena stipoides var. stipoides	Weeping Grass	-
Olearia lirata	Snowy Daisy-bush	I
Ottelia ovalifolia subsp. ovalifolia	Swamp Lily	-
Ozothamnus ferrugineus	Tree Everlasting	I
Persicaria decipiens	Slender Knotweed	-
Pittosporum bicolor	Banyalla	-
Poa sieberiana var. hirtella	Grey Tussock-grass	-
Poa tenera	Slender Tussock-grass	-
Pomaderris aspera	Hazel Pomaderris	-

Scientific Name	Common Name	Conservation Status/Notes
Pomaderris spp.	Pomaderris	-
Pteridium esculentum	Austral Bracken	-
Rumex bidens	Mud Dock	-
Rumex brownii	Slender Dock	-
Rytidosperma duttonianum	Brown-back Wallaby-grass	-
Rytidosperma setaceum	Bristly Wallaby-grass	-
Schoenus apogon	Common Bog-sedge	-
Senecio glomeratus	Annual Fireweed	I
Senecio hispidulus s.l.	Rough Fireweed	I
Senecio quadridentatus	Cotton Fireweed	I
Spergularia media s.l.	Coast Sand-spurrey	-
Themeda triandra	Kangaroo Grass	-
Tricoryne elatior	Yellow Rush-lily	-
Triglochin procera s.s.	Common Water-ribbons	-
Typha domingensis	Narrow-leaf Cumbungi	-
Veronica gracilis	Slender Speedwell	-
Wahlenbergia stricta subsp. stricta	Tall Bluebell	-
Xanthorrhoea minor subsp. lutea	Small Grass-tree	I
INTRODUCED SPECIES		
Acacia baileyana	Cootamundra Wattle	#
Acacia kybeanensis	Kybean Wattle	# r
Acacia terminalis	Sunshine Wattle	#
Acetosella vulgaris	Sheep Sorrel	-
Agapanthus praecox subsp. orientalis	Agapanthus	-
Agrostis capillaris	Brown-top Bent	-
Aira spp.	Hair Grass	-
Allium triquetrum	Angled Onion	*
Amsinckia calycina	Hairy Fiddle-neck	-
Anthoxanthum odoratum	Sweet Vernal-grass	-
Arctotheca calendula	Cape weed	-
Asparagus asparagoides	Bridal Creeper	* w
Aster subulatus	Aster-weed	-
Avena barbata	Bearded Oat	-
Brassica rapa	White Turnip	-
Briza maxima	Large Quaking-grass	-
Briza minor	Lesser Quaking-grass	-
Bromus catharticus	Prairie Grass	-

Scientific Name	Common Name	Conservation Status/Notes
Bromus diandrus	Great Brome	-
Bromus hordeaceus subsp. hordeaceus	Soft Brome	-
Callitriche stagnalis	Common Water-starwort	-
Callitriche stagnalis	Common Water-starwort	-
Cenchrus clandestinus	Kikuyu	-
Centaurium erythraea	Common Centaury	-
Cerastium glomeratum s.l.	Common Mouse-ear Chickweed	-
Chenopodium murale	Sowbane	-
Cirsium vulgare	Spear Thistle	*
Conyza bonariensis	Flaxleaf Fleabane	-
Cotoneaster pannosus	Velvet Cotoneaster	-
Crassula multicava subsp. multicava	Shade Crassula	-
Crataegus monogyna	Hawthorn	-
Cynodon dactylon	Couch	-
Cynosurus echinatus	Rough Dog's-tail	-
Cyperus eragrostis	Drain Flat-sedge	-
Dactylis glomerata	Cocksfoot	-
Daucus carota	Carrot	-
Dipogon lignosus	Common Dipogon	-
Ehrharta calycina	Perennial Veldt-grass	-
Ehrharta erecta var. erecta	Panic Veldt-grass	-
Eragrostis cilianensis	Stink Grass	-
Eucalyptus botryoides	Southern Mahogany	#
Eucalyptus globulus subsp. bicostata	Eurabbie	#
Erica lusitanica	Spanish Heath	-
Eucalyptus cladocalyx	Sugar Gum	-
Euphorbia peplus	Petty Spurge	-
Festuca arundinacea	Tall Fescue	-
Fraxinus angustifolia subsp. angustifolia	Desert Ash	-
Freesia spp.	Freesia	-
Fumaria bastardii	Bastard's Fumitory	-
Galium aparine	Cleavers	-
Gaudinia fragilis	Fragile Oat	-
Genista linifolia	Flax-leaf Broom	* w
Genista monspessulana	Montpellier Broom	* w
Gladiolus spp.	Gladiolus	-
Hedera helix	English Ivy	-

Scientific Name	Common Name	Conservation Status/Notes
Holcus lanatus	Yorkshire Fog	-
Hordeum murinum s.l.	Barley-grass	-
Hypochaeris radicata	Flatweed	-
Isolepis levynsiana	Tiny Flat-sedge	-
Lactuca serriola	Prickly Lettuce	-
Leontodon taraxacoides subsp. taraxacoides	Hairy Hawkbit	-
Lolium perenne	Perennial Rye-grass	-
Lotus cruentus	Red Bird's-foot Trefoil	-
Lycium ferocissimum	African Box-thorn	* w
Lysimachia arvensis	Pimpernel	-
Malus spp.	Apple	-
Malva parviflora	Small-flower Mallow	-
Medicago minima	Little Medic	-
Melaleuca armillaris subsp. armillaris	Giant Honey-myrtle	-
Mentha X piperita	Peppermint	-
Oxalis corniculata s.l.	Yellow Wood-sorrel	-
Oxalis incarnata	Pale Wood-sorrel	-
Oxalis purpurea	Large-flower Wood-sorrel	-
Paspalum distichum	Water Couch	-
Phalaris aquatica	Toowoomba Canary-grass	-
Phalaris minor	Lesser Canary-grass	-
Pinus radiata	Radiata Pine	#
Pittosporum undulatum	Sweet Pittosporum	-
Plantago coronopus subsp. coronopus	Buck's-horn Plantain	-
Plantago lanceolata	Ribwort	-
Plantago major	Greater Plantain	-
Poa annua	Annual Meadow-grass	-
Polycarpon tetraphyllum	Four-leaved Allseed	-
Polygonum aviculare s.l.	Prostrate Knotweed	-
Polypogon monspeliensis	Annual Beard-grass	-
Prunus spp.	Prunus	-
Quercus robur	English Oak	-
Ranunculus repens	Creeping Buttercup	-
Romulea rosea var. australis s.s.	Common Onion-grass	-
Rosa rubiginosa	Sweet Briar	*
Rubus fruticosus spp. agg.	Blackberry	* w
Rumex conglomeratus	Clustered Dock	-

Scientific Name	Common Name	Conservation Status/Notes
Rumex crispus	Curled Dock	-
Salix spp.	Willow	* w
Silene dioica	Red Campion	-
Silene gallica var. quinquevulnera	Spotted Catchfly	-
Sisyrinchium iridifolium	Striped Rush-leaf	-
Solanum nigrum s.s.	Black Nightshade	-
Sonchus asper s.l.	Rough Sow-thistle	-
Sonchus oleraceus	Common Sow-thistle	-
Spergularia rubra s.l.	Red Sand-spurrey	-
Sporobolus africanus	Rat-tail Grass	-
Stellaria media	Chickweed	-
Tradescantia fluminensis	Wandering Jew	-
Trifolium angustifolium var. angustifolium	Narrow-leaf Clover	-
Trifolium fragiferum var. fragiferum	Strawberry Clover	-
Trifolium repens var. repens	White Clover	-
Ulex europaeus	Gorse	*w
Urtica urens	Small Nettle	-
Veronica persica	Persian Speedwell	-
Vicia sativa	Common Vetch	-
Vulpia myuros	Rat's-tail Fescue	-
Vulpia myuros	Rat's-tail Fescue	-
Watsonia meriana var. bulbillifera	Bulbil Watsonia	*
Zantedeschia aethiopica	White Arum-lily	-

Appendix 2.2 – Flora Database Results

Table A2.2 Significant flora recorded within 10 kilometres of the study area

Likelihood: Habitat characteristics of significant flora species previously recorded within 10 kilometres of the study area, or that may potentially occur within the study area were assessed to determine their likelihood of occurrence. The likelihood of occurrence rankings are defined below.

1 - Known occurrence
- Recorded within the study area recently (i.e. within ten years)

2 - High Likelihood
- Previous records of the species in the local vicinity; and/or,
- The study area contains areas of high quality habitat.

3 - Moderate Likelihood
- Limited previous records of the species in the local vicinity; and/or,
- The study area contains poor or limited habitat.

4 - Low Likelihood
- Poor or limited habitat for the species however other evidence (such as a lack of records or environmental factors) indicates there is a very low likelihood of presence.

5 – Unlikely
- No suitable habitat and/or outside the species range.

Scientific name	Common name	Total # of records	Last documented record	EPBC	FFG	DEPI	Likely occurrence in study area
NATIONAL SIGNIFICANCE							
#Amphibromus fluitans	River Swamp Wallaby-grass	-	-	VU	-	-	5
#Caladenia orientalis	Eastern Spider Orchid	-	-	EN	L	e	4
#Dianella amoena	Matted Flax-lily	18	2014	EN	L	e	3
Eucalyptus crenulata	Buxton Gum	1	2007	EN	L	e	5
Glycine latrobeana	Clover Glycine	1	2003	VU	L	v	5
#Pomaderris vacciniifolia	Round-leaf Pomaderris	-	-	CR	L	e	5
#Prasophyllum frenchii	Maroon Leek-orchid	6	2001	EN	L	e	4
#Pterostylis cucullata	Leafy Greenhood	-	-	VU	L	V	4

Scientific name	Common name	Total # of records	Last documented record	EPBC	FFG	DEPI	Likely occurrence in study area
#Thelymitra epipactoides	Metallic Sun-orchid	-	-	EN	L	e	4
#Xerochrysum palustre	Swamp Everlasting	-	-	VU	L	v	5
STATE SIGNIFICANCE							
Acacia stictophylla	Dandenong Wattle	16	2006	-	-	r	4
Adiantum diaphanum	Filmy Maidenhair	1	1972	-	L	e	5
Asterolasia asteriscophora subsp. *albiflora*	White Star-bush	1	1933	-	L	e	4
Austrostipa rudis subsp. *australis*	Veined Spear-grass	4	2003	-	-	r	1
Caladenia oenochila	Wine-lipped Spider-orchid	4	2012	-	-	v	4
Caladenia vulgaris	Slender Pink-fingers	1	1999	-	-	r	4
Cardamine tenuifolia	Slender Bitter-cress	2	1906	-	-	k	4
Carex alsophila	Forest Sedge	1	1980	-	-	r	5
Carex chlorantha	Green-top Sedge	1	1903	-	-	k	5
Chiloglottis jeanesii	Mountain Bird-orchid	1	1999	-	-	r	4
Correa reflexa var. *lobata*	Powelltown Correa	5	2005	-	-	r	5
Craspedia canens	Grey Billy-buttons	1	2001	-	L	e	4
Desmodium varians	Slender Tick-trefoil	5	1999	-	-	k	4
Dianella sp. aff. longifolia (Benambra)	Arching Flax-lily	2	2013	-	-	V	3
Diuris punctata	Purple Diuris	3	1935	-	L	v	4
Eucalyptus fulgens	Green Scentbark	27	2013	-	-	r	1
Eucalyptus globulus subsp. *globulus*	Southern Blue-gum	1	2004	-	-	r	4
Eucalyptus X studleyensis	Studley Park Gum	1	2010	-	-	e	5
**Geranium potentilloides* var. *1*	Soft Crane's-bill	1	2010	-	-	k	3

Scientific name	Common name	Total # of records	Last documented record	EPBC	FFG	DEPI	Likely occurrence in study area
Geranium solanderi var. *solanderi* s.s.	Austral Crane's-bill	5	2008	-	-	v	3
Geranium sp. aff. retrorsum (Nillumbik)	Valley Crane's-bill	2	2001	-	-	k	3
**Lachnagrostis punicea* subsp. *punicea*	Purple Blown-grass	1	2002	-	-	r	5
**Lastreopsis hispida*	Bristly Shield-fern	1	1996	-	-	r	4
Lepidosperma canescens	Hoary Rapier-sedge	3	1992	-	-	r	4
Melaleuca armillaris subsp. *armillaris*	Giant Honey-myrtle	8	2014	-	-	R	4
**Metzgeria submarginata*	Slender Veilwort	1	2005	-	-	k	4
Olearia asterotricha	Rough Daisy-bush	1	1980	-	-	r	3
Olearia speciosa	Netted Daisy-bush	1	1996	-	-	k	3
Platylobium reflexum	Victorian Flat-pea	1	2011	-	-	r	3
Pterostylis grandiflora	Cobra Greenhood	8	2012	-	-	r	4
Pterostylis sp. aff. *parviflora* (Southern Victoria)	Red-tip Greenhood	1	2003	-	-	r	4
Pultenaea weindorferi	Swamp Bush-pea	5	1999	-	-	r	3
**Senecio campylocarpus*	Floodplain Fireweed	1	2006	-	-	r	4
Tetratheca stenocarpa	Long Pink-bells	7	2011	-	-	r	3
Thelymitra longiloba	Marsh Sun-orchid	4	1941	-	-	e	4
Thelymitra X irregularis	Crested Sun-orchid	1	1770	-	-	r	4

Notes: EPBC = *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), FFG = *Flora and Fauna Guarantee Act 1988* (FFG Act), DEPI= Advisory List of Rare or Threatened Plants in Victoria (DEPI 2014), L = Listed, # = Records identified from EPBC Act Protected Matters Search Tool, Data source: Victorian Biodiversity Atlas (DELWP 2017); Protected Matters Search Tool (DoEE 2017). Order: Alphabetical. .

Appendix 2.3 – Habitat Hectare Assessment

Table A2.3. Habitat hectare assessment

Notes: DHW = Damp Heathy Woodland, GF = Grassy Forest, GW = Grassy Woodland, RF = Riparian Forest, SRW = Swampy Riparian Woodland, SS = Swamp Scrub, SW = Swampy Woodland, GipP = Gippsland Plain, HSF = Highlands – Southern Fall.

Vegetation Zone		RF1	RF2	RF3	SS1	SS2	SRW1
Bioregion		GipP	GipP	GipP	GipP	GipP	GipP
EVC / Tree		RF	RF	RF	SS	SS	SRW
EVC Number		18	18	18	53_61	53_61	83
Patch Condition	Large Old Trees /10	6	8	10	0	0	0
	Canopy Cover /5	5	5	3	4	4	4
	Under storey /25	5	15	5	15	15	5
	Lack of Weeds /15	2	4	4	0	0	6
	Recruitment /10	1	10	3	3	5	3
	Organic Matter /5	2	2	2	4	4	2
	Logs /5	0	2	0	0	0	0
	Treeless EVC Multiplier	1.00	1.00	1.00	1.15	1.15	1.00
	Subtotal =	21.00	46.00	27.00	29.90	32.20	20.00
Landscape Value /25		4	4	4	6	4	4
Habitat Points /100		25	50	31	36	36	24
Habitat Score		**0.25**	**0.50**	**0.31**	**0.36**	**0.36**	**0.24**
Total Area (ha)		0.247	1.094	0.049	0.101	0.313	0.005
Total habitat hectares		**0.062**	**0.547**	**0.015**	**0.036**	**0.113**	**0.001**

Vegetation Zone		SRW2	SRW3	SRW4	SRW5	SRW6	GF1
Bioregion		GipP	GipP	GipP	GipP	GipP	GipP
EVC / Tree		SRW	SRW	SRW	SRW	SRW	GF
EVC Number		18	83	83	83	83	83
Patch Condition	Large Old Trees /10	10	10	9	10	4	5
	Canopy Cover /5	5	5	5	5	5	4
	Under storey /25	5	10	5	5	15	15
	Lack of Weeds /15	2	2	4	4	4	6
	Recruitment /10	1	1	1	1	0	10
	Organic Matter /5	4	4	4	0	4	5
	Logs /5	0	0	0	0	2	0
	Treeless EVC Multiplier	1.00	1.00	1.00	1.00	1.00	1.00
	Subtotal =	27.00	32.00	28.00	25.00	34.00	45.00
Landscape Value /25		4	6	4	6	6	4
Habitat Points /100		25	33	36	34	31	38
Habitat Score		**0.33**	**0.36**	**0.34**	**0.31**	**0.38**	**0.49**
Total Area (ha)		0.247	0.040	0.128	0.026	0.128	3.441
Total habitat hectares		**0.013**	**0.046**	**0.009**	**0.040**	**1.307**	**0.079**

Vegetation Zone		GF2	GF3	GF6	GF7	GW1	GW2
Bioregion		GipP	GipP	GipP	GipP	GipP	GipP
EVC / Tree		GF	GF	GF	GF	GW	GW
EVC Number		18	128	128	128	128	175
Patch Condition	Large Old Trees /10	0	0	9	7	0	6
	Canopy Cover /5	4	2	4	4	5	4
	Under storey /25	5	15	15	5	5	5
	Lack of Weeds /15	0	0	6	6	2	2
	Recruitment /10	1	1	3	3	1	3
	Organic Matter /5	2	2	4	2	4	4
	Logs /5	0	0	2	0	0	0
	Treeless EVC Multiplier	1.00	1.00	1.00	1.00	1.00	1.00
	Subtotal =	12.00	20.00	43.00	27.00	17.00	24.00
Landscape Value /25		4	4	4	6	6	6
Habitat Points /100		25	16	24	49	33	23
Habitat Score		**0.16**	**0.24**	**0.49**	**0.33**	**0.23**	**0.30**
Total Area (ha)		0.247	0.029	0.144	0.322	0.061	0.014
Total habitat hectares		**0.005**	**0.034**	**0.158**	**0.020**	**0.003**	**0.045**

Vegetation Zone		GW3	GW4	GW5	GW6	DHW1	DHW2
Bioregion		GipP	GipP	GipP	GipP	GipP	GipP
EVC / Tree		GW	GW	GW	GW	DHW	DHW
EVC Number		18	175	175	175	175	793
Patch Condition	Large Old Trees /10	10	8	0	0	8	0
	Canopy Cover /5	4	4	2	2	4	4
	Under storey /25	5	10	10	10	5	5
	Lack of Weeds /15	2	0	0	0	6	0
	Recruitment /10	1	3	1	3	3	3
	Organic Matter /5	4	4	4	4	4	4
	Logs /5	0	2	2	0	2	0
	Treeless EVC Multiplier	1.00	1.00	1.00	1.00	1.00	1.00
	Subtotal =	26.00	31.00	19.00	19.00	32.00	16.00
Landscape Value /25		4	6	6	6	4	4
Habitat Points /100		25	32	37	25	23	36
Habitat Score		**0.32**	**0.37**	**0.25**	**0.23**	**0.36**	**0.20**
Total Area (ha)		0.247	0.051	0.352	0.188	0.184	0.157
Total habitat hectares		**0.016**	**0.130**	**0.047**	**0.042**	**0.057**	**0.047**

Vegetation Zone		DHW3	DHW4	DHW5	DHW6	SW1	SW2
Bioregion		GipP	GipP	GipP	GipP	GipP	GipP
EVC / Tree		DHW	DHW	DHW	DHW	SW	SW
EVC Number		18	793	793	793	793	937
Patch Condition	Large Old Trees /10	0	0	0	0	0	0
	Canopy Cover /5	4	5	2	2	1	0
	Under storey /25	15	5	5	5	15	5
	Lack of Weeds /15	6	0	4	0	0	2
	Recruitment /10	3	1	6	6	10	0
	Organic Matter /5	4	4	5	5	4	4
	Logs /5	0	0	2	2	2	0
	Treeless EVC Multiplier	1.00	1.00	1.00	1.00	1.00	1.00
	Subtotal =	32.00	15.00	24.00	20.00	32.00	11.00
Landscape Value /25		4	4	4	4	4	4
Habitat Points /100		25	36	19	28	24	36
Habitat Score		**0.36**	**0.19**	**0.28**	**0.24**	**0.36**	**0.15**
Total Area (ha)		0.247	0.042	0.014	0.272	0.202	1.184
Total habitat hectares		**0.015**	**0.003**	**0.076**	**0.049**	**0.426**	**0.138**

Vegetation Zone		SW3	SW4	SW5	SW6	SW7	SW8
Bioregion		GipP	GipP	GipP	GipP	GipP	GipP
EVC / Tree		SW	SW	SW	SW	SW	SW
EVC Number		18	937	937	937	937	937
Patch Condition	Large Old Trees /10	0	0	0	3	3	7
	Canopy Cover /5	0	5	5	3	3	3
	Under storey /25	10	5	0	15	10	10
	Lack of Weeds /15	9	4	2	4	4	4
	Recruitment /10	0	1	5	0	0	0
	Organic Matter /5	3	4	4	4	4	4
	Logs /5	0	2	0	0	2	2
	Treeless EVC Multiplier	1.00	1.00	1.00	1.00	1.00	1.00
	Subtotal =	22.00	21.00	16.00	29.00	26.00	30.00
Landscape Value /25		4	2	2	2	2	2
Habitat Points /100		25	24	23	18	31	28
Habitat Score		**0.24**	**0.23**	**0.18**	**0.31**	**0.28**	**0.32**
Total Area (ha)		0.247	0.159	0.100	0.022	0.386	0.219
Total habitat hectares		**0.038**	**0.023**	**0.004**	**0.120**	**0.061**	**0.449**

Vegetation Zone		SW12	SW14	SW15	SW16	SW17	SW18
Bioregion		GipP	GipP	GipP	GipP	GipP	GipP
EVC / Tree		SW	SW	SW	SW	SW	SW
EVC Number		18	937	937	937	937	937
Patch Condition	Large Old Trees /10	0	10	0	9	0	10
	Canopy Cover /5	3	5	5	5	0	3
	Under storey /25	5	5	5	5	5	5
	Lack of Weeds /15	0	0	2	0	0	0
	Recruitment /10	1	3	1	1	5	3
	Organic Matter /5	4	0	3	4	2	4
	Logs /5	0	0	0	0	0	0
	Treeless EVC Multiplier	1.00	1.00	1.00	1.00	1.00	1.00
	Subtotal =	13.00	23.00	16.00	24.00	12.00	25.00
Landscape Value /25		4	4	0	0	4	2
Habitat Points /100		25	17	23	16	28	14
Habitat Score		**0.17**	**0.23**	**0.16**	**0.28**	**0.14**	**0.27**
Total Area (ha)		0.247	0.025	0.015	0.026	0.034	0.019
Total habitat hectares		**0.004**	**0.003**	**0.004**	**0.010**	**0.003**	**0.015**

Vegetation Zone		SW19	SW20	SW21	SW22	SW23	SW24
Bioregion		GipP	GipP	GipP	GipP	GipP	GipP
EVC / Tree		SW	SW	SW	SW	SW	SW
EVC Number		18	937	937	937	937	937
Patch Condition	Large Old Trees /10	0	0	0	10	10	0
	Canopy Cover /5	0	0	4	3	3	4
	Under storey /25	5	5	10	5	5	5
	Lack of Weeds /15	0	0	2	0	2	2
	Recruitment /10	1	3	3	3	3	3
	Organic Matter /5	4	4	2	4	4	4
	Logs /5	0	0	0	0	0	0
	Treeless EVC Multiplier	1.00	1.00	1.00	1.00	1.00	1.00
	Subtotal =	10.00	12.00	21.00	25.00	27.00	18.00
Landscape Value /25		4	2	2	4	4	4
Habitat Points /100		25	12	14	25	29	31
Habitat Score		**0.12**	**0.14**	**0.25**	**0.29**	**0.31**	**0.22**
Total Area (ha)		0.247	0.012	0.322	0.132	0.123	0.039
Total habitat hectares		**0.001**	**0.045**	**0.033**	**0.036**	**0.012**	**0.032**

Vegetation Zone		SW25	SW26	SW27	SW28	SW29	SW30
Bioregion		GipP	GipP	GipP	GipP	GipP	GipP
EVC / Tree		SW	SW	SW	SW	SW	SW
EVC Number		18	937	937	937	937	937
Patch Condition	Large Old Trees /10	0	0	6	0	0	0
	Canopy Cover /5	2	4	3	0	0	4
	Under storey /25	15	10	5	5	5	0
	Lack of Weeds /15	0	0	2	0	0	0
	Recruitment /10	3	3	3	1	3	1
	Organic Matter /5	4	4	4	4	4	4
	Logs /5	2	0	0	0	0	0
	Treeless EVC Multiplier	1.00	1.00	1.00	1.00	1.00	1.00
	Subtotal =	26.00	21.00	23.00	10.00	12.00	9.00
Landscape Value /25		4	4	4	4	4	4
Habitat Points /100		25	30	25	27	14	16
Habitat Score		**0.30**	**0.25**	**0.27**	**0.14**	**0.16**	**0.13**
Total Area (ha)		0.247	0.108	0.076	0.143	0.013	0.026
Total habitat hectares		**0.032**	**0.019**	**0.039**	**0.002**	**0.004**	**0.001**

Vegetation Zone		GF8	GF9	GF10	GF11	GF12	GF13
Bioregion		HSF	HSF	HSF	HSF	HSF	HSF
EVC / Tree		GF	GF	GF	GF	GF	GF
EVC Number		18	128	128	128	128	128
Patch Condition	Large Old Trees /10	9	9	0	5	7	7
	Canopy Cover /5	4	4	0	2	4	4
	Under storey /25	5	5	15	15	15	15
	Lack of Weeds /15	0	0	0	0	0	0
	Recruitment /10	5	1	10	10	5	10
	Organic Matter /5	4	4	2	5	3	2
	Logs /5	0	2	0	0	0	0
	Treeless EVC Multiplier	1.00	1.00	1.00	1.00	1.00	1.00
	Subtotal =	27.00	25.00	27.00	37.00	34.00	38.00
Landscape Value /25		4	2	2	2	2	2
Habitat Points /100		25	29	27	29	39	36
Habitat Score		**0.29**	**0.27**	**0.29**	**0.39**	**0.36**	**0.40**
Total Area (ha)		0.247	0.039	0.054	0.036	0.098	0.070
Total habitat hectares		**0.011**	**0.015**	**0.010**	**0.038**	**0.025**	**0.042**

Vegetation Zone		GF14	GF15	GF16	GW8	GW9	GW10
Bioregion		HSF	HSF	HSF	HSF	HSF	HSF
EVC / Tree		GF	GF	GF	GW	GW	GW
EVC Number		18	128	128	128	175	175
Patch Condition	Large Old Trees /10	9	2	9	0	0	0
	Canopy Cover /5	4	2	4	4	4	2
	Under storey /25	15	15	5	15	15	5
	Lack of Weeds /15	0	0	9	6	6	2
	Recruitment /10	10	10	0	3	3	3
	Organic Matter /5	2	5	2	4	4	3
	Logs /5	0	4	0	0	0	0
	Treeless EVC Multiplier	1.00	1.00	1.00	1.00	1.00	1.00
	Subtotal =	40.00	38.00	29.00	32.00	32.00	15.00
Landscape Value /25		4	4	4	2	6	4
Habitat Points /100		25	44	42	31	38	36
Habitat Score		**0.44**	**0.42**	**0.31**	**0.38**	**0.36**	**0.21**
Total Area (ha)		0.247	0.122	0.502	0.067	0.630	0.177
Total habitat hectares		**0.054**	**0.211**	**0.021**	**0.239**	**0.064**	**0.013**

Vegetation Zone		GW11	GW12	GW13	DHW7	DHW8	DHW9
Bioregion		HSF	HSF	HSF	HSF	HSF	HSF
EVC / Tree		GW	GW	GW	DHW	DHW	DHW
EVC Number		18	175	175	175	793	793
Patch Condition	Large Old Trees /10	0	10	10	9	0	1
	Canopy Cover /5	5	5	5	4	4	1
	Under storey /25	5	5	5	15	15	15
	Lack of Weeds /15	2	2	2	0	0	0
	Recruitment /10	0	1	1	5	3	10
	Organic Matter /5	2	2	4	4	5	4
	Logs /5	0	0	0	0	0	4
	Treeless EVC Multiplier	1.00	1.00	1.00	1.00	1.00	1.00
	Subtotal =	14.00	25.00	27.00	37.00	27.00	35.00
Landscape Value /25		4	4	6	6	2	2
Habitat Points /100		25	18	31	33	39	29
Habitat Score		**0.18**	**0.31**	**0.33**	**0.39**	**0.29**	**0.39**
Total Area (ha)		0.247	0.009	0.014	0.014	0.047	0.040
Total habitat hectares		**0.002**	**0.004**	**0.005**	**0.018**	**0.012**	**0.314**

Vegetation Zone		DHW10	DHW11	SW31
Bioregion		HSF	HSF	HSF
EVC / Tree		DHW	DHW	SW
EVC Number		18	793	793
Patch Condition	Large Old Trees /10	6	9	1
	Canopy Cover /5	5	4	0
	Under storey /25	15	15	5
	Lack of Weeds /15	4	6	6
	Recruitment /10	6	3	0
	Organic Matter /5	4	4	2
	Logs /5	2	2	2
	Treeless EVC Multiplier	1.00	1.00	1.00
	Subtotal =	42.00	43.00	16.00
Landscape Value /25		4	6	6
Habitat Points /100		25	48	49
Habitat Score		**0.48**	**0.49**	**0.18**
Total Area (ha)		0.247	0.357	0.185
Total habitat hectares		**0.171**	**0.091**	**0.171**

Appendix 2.4 – Scattered Remnant Trees within the Study Area

Table A2.4. Scattered remnant trees within the study area.

Tree ID	Species	Common Name	DBH (cm)	Other Attributes
1	*Eucalyptus* spp. *1*	Eucalyptus spp. 1	22	N/A
2	*Eucalyptus ovata*	Swamp Gum	35	N/A
3	*Eucalyptus ovata*	Swamp Gum	35	N/A
4	*Eucalyptus ovata*	Swamp Gum	48	N/A
5	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	49	N/A
6	*Eucalyptus goniocalyx*	Bundy	59	N/A
7	*Eucalyptus goniocalyx*	Bundy	55	N/A
8	*Eucalyptus goniocalyx*	Bundy	30	N/A
9	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	58	N/A
10	*Eucalyptus ovata*	Swamp Gum	74	N/A
11	*Eucalyptus ovata*	Swamp Gum	80	N/A
12	*Eucalyptus fulgens*	Green Scentbark	30	DEPI 2014 (Rare)
13	*Eucalyptus ovata*	Swamp Gum	85	N/A
14	*Eucalyptus radiata*	Peppermint Gum	40	N/A
15	*Eucalyptus cephalocarpa*	Silver-leaved Stringybark	17	N/A
16	*Eucalyptus ovata*	Swamp Gum	84	N/A
17	*Eucalyptus ovata*	Swamp Gum	82	N/A
18	*Eucalyptus ovata*	Swamp Gum	20	N/A
19	*Eucalyptus ovata*	Swamp Gum	60	N/A
20	*Eucalyptus ovata*	Swamp Gum	10	N/A
21	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	8	N/A
22	*Eucalyptus ovata*	Swamp Gum	75	N/A
23	*Eucalyptus ovata*	Swamp Gum	28	N/A
24	*Eucalyptus ovata*	Swamp Gum	68	N/A
25	*Eucalyptus radiata*	Peppermint Gum	18	N/A
26	*Eucalyptus ovata*	Swamp Gum	80	N/A
27	*Eucalyptus ovata*	Swamp Gum	75	N/A
28	*Eucalyptus ovata*	Swamp Gum	70	N/A
29	Dead Stag	Dead Stag	50	N/A

Tree ID	Species	Common Name	DBH (cm)	Other Attributes
30	*Eucalyptus ovata*	Swamp Gum	70	N/A
31	*Eucalyptus ovata*	Swamp Gum	10	N/A
32	*Eucalyptus ovata*	Swamp Gum	120	N/A
33	*Eucalyptus ovata*	Swamp Gum	15	N/A
34	*Eucalyptus ovata*	Swamp Gum	78	N/A
35	*Eucalyptus ovata*	Swamp Gum	84	N/A
36	*Eucalyptus ovata*	Swamp Gum	118	N/A
38	*Eucalyptus ovata*	Swamp Gum	105	N/A
39	*Eucalyptus ovata*	Swamp Gum	40	N/A
40	*Eucalyptus ovata*	Swamp Gum	35	N/A
41	*Eucalyptus ovata*	Swamp Gum	35	N/A
42	*Eucalyptus ovata*	Swamp Gum	6	N/A
43	*Eucalyptus ovata*	Swamp Gum	28	N/A
44	*Eucalyptus ovata*	Swamp Gum	105	N/A
45	*Eucalyptus fulgens*	Green Scentbark	55	DEPI 2014 (Rare)
47	*Eucalyptus fulgens*	Green Scentbark	51	DEPI 2014 (Rare)
48	*Eucalyptus fulgens*	Green Scentbark	51	DEPI 2014 (Rare)
62	*Eucalyptus cephalocarpa*	Silver-leaved Stringybark	72	N/A
63	Dead Stag	Dead Stag	60	N/A
64	*Eucalyptus* spp. *1*	Eucalyptus spp. 1	70	N/A
65	*Allocasurina littoralis*	Black Sheoak	35	N/A
66	*Eucalyptus cephalocarpa*	Silver-leaved Stringybark	67	N/A
67	*Allocasurina littoralis*	Black Sheoak	28	N/A
68	*Eucalyptus cephalocarpa*	Silver-leaved Stringybark	17	N/A
69	*Eucalyptus cephalocarpa*	Silver-leaved Stringybark	19	N/A
70	*Eucalyptus cephalocarpa*	Silver-leaved Stringybark	103	N/A
71	*Eucalyptus cephalocarpa*	Silver-leaved Stringybark	33	N/A
72	*Eucalyptus cephalocarpa*	Silver-leaved Stringybark	43	N/A
73	*Eucalyptus cephalocarpa*	Silver-leaved Stringybark	64	N/A
74	*Eucalyptus obliqua*	Messmate	70	N/A
75	*Eucalyptus obliqua*	Messmate	44	N/A
76	*Eucalyptus obliqua*	Messmate	22	N/A
77	*Eucalyptus obliqua*	Messmate	24	N/A

Tree ID	Species	Common Name	DBH (cm)	Other Attributes
78	*Eucalyptus obliqua*	Messmate	25	N/A
79	*Eucalyptus obliqua*	Messmate	36	N/A
80	*Eucalyptus obliqua*	Messmate	52	N/A
81	*Eucalyptus obliqua*	Messmate	19	N/A
82	*Allocasurina littoralis*	Black Sheoak	47	N/A
83	*Allocasurina littoralis*	Black Sheoak	40	N/A
84	*Allocasurina littoralis*	Black Sheoak	34	N/A
86	*Allocasurina littoralis*	Black Sheoak	40	N/A
87	*Allocasurina littoralis*	Black Sheoak	50	N/A
88	*Allocasurina littoralis*	Black Sheoak	31	N/A
89	*Eucalyptus cephalocarpa*	Silver-leaved Stringybark	43	N/A
90	*Eucalyptus cephalocarpa*	Silver-leaved Stringybark	27	N/A
91	*Allocasurina littoralis*	Black Sheoak	35	N/A
92	*Eucalyptus cephalocarpa*	Silver-leaved Stringybark	37	N/A
93	*Eucalyptus cephalocarpa*	Silver-leaved Stringybark	67	N/A
94	*Eucalyptus cephalocarpa*	Silver-leaved Stringybark	28	N/A
95	*Eucalyptus radiata*	Peppermint Gum	54	N/A
96	*Eucalyptus ovata*	Swamp Gum	20	N/A
97	*Eucalyptus ovata*	Swamp Gum	60	N/A
98	*Allocasuarina verticillata*	Drooping Sheoak	42	N/A
99	Dead Stag	Dead Stag	18	N/A
100	*Eucalyptus ovata*	Swamp Gum	30	N/A
101	Dead Stag	Dead Stag	10	N/A
102	Dead Stag	Dead Stag	30	N/A
103	*Eucalyptus ovata*	Swamp Gum	15	N/A
104	*Eucalyptus fulgens*	Green Scentbark	89	DEPI 2014 (Rare)
105	*Eucalyptus ovata*	Swamp Gum	18	N/A
106	*Eucalyptus ovata*	Swamp Gum	48	N/A
107	*Eucalyptus ovata*	Swamp Gum	8	N/A
108	*Eucalyptus ovata*	Swamp Gum	7	N/A
109	Dead Stag	Dead Stag	15	N/A
110	*Eucalyptus ovata*	Swamp Gum	5	N/A
111	*Eucalyptus goniocalyx*	Bundy	80	N/A

Tree ID	Species	Common Name	DBH (cm)	Other Attributes
112	Dead Stag	Dead Stag	40	N/A
113	Dead Stag	Dead Stag	45	N/A
114	Dead Stag	Dead Stag	60	N/A
115	*Eucalyptus ovata*	Swamp Gum	43	N/A
116	*Eucalyptus ovata*	Swamp Gum	43	N/A
117	Dead Stag	Dead Stag	30	N/A
118	*Eucalyptus goniocalyx*	Bundy	55	N/A
122	*Eucalyptus goniocalyx*	Bundy	40	N/A
123	*Eucalyptus radiata*	Peppermint Gum	80	N/A
124	*Eucalyptus radiata*	Peppermint Gum	70	N/A
125	Dead Stag	Dead Stag	45	N/A
126	Dead Stag	Dead Stag	60	N/A
127	*Eucalyptus goniocalyx*	Bundy	57	N/A
128	*Eucalyptus goniocalyx*	Bundy	36	N/A
129	*Eucalyptus ovata*	Swamp Gum	33	N/A
130	*Eucalyptus goniocalyx*	Bundy	27	N/A
131	*Eucalyptus ovata*	Swamp Gum	160	N/A
132	*Eucalyptus ovata*	Swamp Gum	35	N/A
133	*Eucalyptus goniocalyx*	Bundy	92	N/A
134	*Eucalyptus goniocalyx*	Bundy	25	N/A
135	*Eucalyptus goniocalyx*	Bundy	25	N/A
136	*Eucalyptus goniocalyx*	Bundy	85	N/A
137	*Eucalyptus goniocalyx*	Bundy	30	N/A
138	*Eucalyptus goniocalyx*	Bundy	25	N/A
140	Dead Stag	Dead Stag	40	N/A
141	Dead Stag	Dead Stag	73	N/A
142	Dead Stag	Dead Stag	67	N/A
143	*Eucalyptus ovata*	Swamp Gum	88	N/A
144	*Eucalyptus ovata*	Swamp Gum	43	N/A
145	*Eucalyptus ovata*	Swamp Gum	64	N/A
146	*Eucalyptus ovata*	Swamp Gum	28	N/A
147	*Eucalyptus ovata*	Swamp Gum	23	N/A
148	Dead Stag	Dead Stag	86	N/A

Tree ID	Species	Common Name	DBH (cm)	Other Attributes
149	Dead Stag	Dead Stag	96	N/A
150	Dead Stag	Dead Stag	77	N/A
152	Dead Stag	Dead Stag	86	N/A
155	Dead Stag	Dead Stag	60	N/A
156	*Eucalyptus obliqua*	Messmate	30	N/A
157	Dead Stag	Dead Stag	55	N/A
158	*Eucalyptus obliqua*	Messmate	96	N/A
159	Dead Stag	Dead Stag	53	N/A
160	*Eucalyptus ovata*	Swamp Gum	52	N/A
161	*Eucalyptus ovata*	Swamp Gum	80	N/A
162	*Eucalyptus viminalis subsp pryoriana*	Gippsland Manna Gum	120	N/A
163	*Eucalyptus viminalis subsp pryoriana*	Gippsland Manna Gum	135	N/A
164	Dead Stag	Dead Stag	56	N/A
165	*Eucalyptus ovata*	Swamp Gum	84	N/A
167	Dead Stag	Dead Stag	105	N/A
168	Dead Stag	Dead Stag	136	N/A
169	*Eucalyptus ovata*	Swamp Gum	125	N/A
171	Dead Stag	Dead Stag	110	N/A
172	Dead Stag	Dead Stag	102	N/A
175	Dead Stag	Dead Stag	80	N/A
176	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	86	N/A
177	Dead Stag	Dead Stag	85	N/A
178	Dead Stag	Dead Stag	85	N/A
179	*Eucalyptus* spp. *1*	Eucalyptus spp. 1	92	N/A
180	Dead Stag	Dead Stag	80	N/A
181	Dead Stag	Dead Stag	101	N/A
182	Dead Stag	Dead Stag	39	N/A
184	*Eucalyptus obliqua*	Messmate	83	N/A
185	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	147	N/A
186	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	125	N/A
188	*Eucalyptus ovata*	Swamp Gum	127	N/A
189	*Eucalyptus ovata*	Swamp Gum	106	N/A
190	*Eucalyptus ovata*	Swamp Gum	171	N/A

Tree ID	Species	Common Name	DBH (cm)	Other Attributes
191	*Eucalyptus ovata*	Swamp Gum	152	N/A
192	*Eucalyptus ovata*	Swamp Gum	137	N/A
193	*Eucalyptus ovata*	Swamp Gum	92	N/A
194	*Eucalyptus ovata*	Swamp Gum	106	N/A
195	*Eucalyptus ovata*	Swamp Gum	98	N/A
196	*Eucalyptus ovata*	Swamp Gum	110	N/A
197	Dead Stag	Dead Stag	70	N/A
199	Dead Stag	Dead Stag	90	N/A
200	Dead Stag	Dead Stag	80	N/A
201	Dead Stag	Dead Stag	30	N/A
203	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	84	N/A
204	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	57	N/A
205	Dead Stag	Dead Stag	61	N/A
206	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	100	N/A
207	Dead Stag	Dead Stag	82	N/A
211	*Eucalyptus ovata*	Swamp Gum	98	N/A
212	*Eucalyptus ovata*	Swamp Gum	77	N/A
213	*Eucalyptus ovata*	Swamp Gum	127	N/A
214	*Eucalyptus ovata*	Swamp Gum	89	N/A
216	*Eucalyptus ovata*	Swamp Gum	134	N/A
217	Dead Stag	Dead Stag	71	N/A
218	Dead Stag	Dead Stag	66	N/A
219	*Eucalyptus ovata*	Swamp Gum	92	N/A
220	Dead Stag	Dead Stag	92	N/A
221	Dead Stag	Dead Stag	106	N/A
224	*Eucalyptus ovata*	Swamp Gum	60	N/A
225	*Eucalyptus ovata*	Swamp Gum	60	N/A
226	*Eucalyptus ovata*	Swamp Gum	131	N/A
227	Dead Stag	Dead Stag	80	N/A
228	*Eucalyptus obliqua*	Messmate	116	N/A
229	*Eucalyptus obliqua*	Messmate	25	N/A
230	Dead Stag	Dead Stag	110	N/A
231	Dead Stag	Dead Stag	80	N/A

Tree ID	Species	Common Name	DBH (cm)	Other Attributes
234	*Eucalyptus radiata*	Peppermint Gum	25	N/A
235	Dead Stag	Dead Stag	76	N/A
236	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	195	N/A
237	Dead Stag	Dead Stag	210	N/A
239	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	161	N/A
241	*Eucalyptus fulgens*	Green Scentbark	105	DEPI 2014 (Rare)
242	*Eucalyptus ovata*	Swamp Gum	40	N/A
243	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	90	N/A
244	Dead Stag	Dead Stag	80	N/A
245	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	83	N/A
246	*Eucalyptus fulgens*	Green Scentbark	80	DEPI 2014 (Rare)
247	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	80	N/A
248	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	85	N/A
249	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	85	N/A
250	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	75	N/A
251	Dead Stag	Dead Stag	40	N/A
252	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	75	N/A
253	*Eucalyptus fulgens*	Green Scentbark	98	DEPI 2014 (Rare)
254	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	43	N/A
256	*Eucalyptus radiata*	Peppermint Gum	69	N/A
257	*Eucalyptus radiata*	Peppermint Gum	70	N/A
258	*Eucalyptus radiata*	Peppermint Gum	60	N/A
259	*Eucalyptus radiata*	Peppermint Gum	60	N/A
260	*Eucalyptus radiata*	Peppermint Gum	43	N/A
261	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	103	N/A
262	*Eucalyptus radiata*	Peppermint Gum	56	N/A
263	*Eucalyptus goniocalyx*	Bundy	40	N/A
264	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	75	N/A
265	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	80	N/A
266	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	82	N/A
267	*Eucalyptus obliqua*	Messmate	84	N/A
268	Dead Stag	Dead Stag	78	N/A
269	*Eucalyptus radiata*	Peppermint Gum	80	N/A

Tree ID	Species	Common Name	DBH (cm)	Other Attributes
270	Dead Stag	Dead Stag	98	N/A
271	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	84	N/A
272	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	80	N/A
273	*Eucalyptus radiata*	Peppermint Gum	50	N/A
274	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	105	N/A
275	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	80	N/A
276	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	106	N/A
277	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	93	N/A
278	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	85	N/A
279	*Eucalyptus obliqua*	Messmate	70	N/A
280	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	55	N/A
281	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	70	N/A
282	Dead Stag	Dead Stag	105	N/A
283	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	98	N/A
284	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	107	N/A
285	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	80	N/A
286	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	90	N/A
287	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	20	N/A
288	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	75	N/A
289	*Eucalyptus radiata*	Peppermint Gum	80	N/A
290	*Eucalyptus goniocalyx*	Bundy	140	N/A
291	*Eucalyptus goniocalyx*	Bundy	86	N/A
292	*Eucalyptus goniocalyx*	Bundy	86	N/A
293	*Eucalyptus goniocalyx*	Bundy	102	N/A
294	*Eucalyptus goniocalyx*	Bundy	33	N/A
295	*Eucalyptus goniocalyx*	Bundy	18	N/A
296	*Eucalyptus goniocalyx*	Bundy	156	N/A
297	*Eucalyptus goniocalyx*	Bundy	105	N/A
298	*Eucalyptus goniocalyx*	Bundy	50	N/A
302	*Eucalyptus ovata*	Swamp Gum	49	N/A
305	Dead Stag	Dead Stag	81	N/A
306	Dead Stag	Dead Stag	61	N/A
310	Dead Stag	Dead Stag	50	N/A

Tree ID	Species	Common Name	DBH (cm)	Other Attributes
311	*Eucalyptus cinerea*	Mealy Stringybark	48	N/A
312	*Eucalyptus ovata*	Swamp Gum	55	N/A
313	*Eucalyptus ovata*	Swamp Gum	53	N/A
314	*Eucalyptus ovata*	Swamp Gum	40	N/A
315	*Eucalyptus fulgens*	Green Scentbark	60	DEPI 2014 (Rare)
316	Dead Stag	Dead Stag	110	N/A
317	Dead Stag	Dead Stag	63	N/A
318	*Eucalyptus radiata*	Peppermint Gum	62	N/A
319	*Eucalyptus radiata*	Peppermint Gum	33	N/A
320	Dead Stag	Dead Stag	43	N/A
321	*Eucalyptus ovata*	Swamp Gum	15	N/A
322	*Eucalyptus radiata*	Peppermint Gum	44	N/A
323	Dead Stag	Dead Stag	42	N/A
324	Dead Stag	Dead Stag	40	N/A
325	*Eucalyptus radiata*	Peppermint Gum	18	N/A
326	*Eucalyptus ovata*	Swamp Gum	25	N/A
327	*Eucalyptus ovata*	Swamp Gum	15	N/A
328	Dead Stag	Dead Stag	35	N/A
329	*Eucalyptus ovata*	Swamp Gum	46	N/A
330	Dead Stag	Dead Stag	53	N/A
331	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	38	N/A
332	*Eucalyptus radiata*	Peppermint Gum	60	N/A
333	*Eucalyptus ovata*	Swamp Gum	35	N/A
334	*Eucalyptus radiata*	Peppermint Gum	57	N/A
335	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	40	N/A
336	Dead Stag	Dead Stag	62	N/A
337	*Eucalyptus ovata*	Swamp Gum	50	N/A
338	Dead Stag	Dead Stag	41	N/A
339	Dead Stag	Dead Stag	73	N/A
340	*Eucalyptus ovata*	Swamp Gum	58	N/A
341	*Eucalyptus ovata*	Swamp Gum	72	N/A
342	*Eucalyptus ovata*	Swamp Gum	35	N/A
343	*Eucalyptus ovata*	Swamp Gum	33	N/A

Tree ID	Species	Common Name	DBH (cm)	Other Attributes
344	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	142	N/A
345	*Eucalyptus ovata*	Swamp Gum	60	N/A
346	*Eucalyptus ovata*	Swamp Gum	109	N/A
348	Dead Stag	Dead Stag	63	N/A
349	Dead Stag	Dead Stag	68	N/A
350	*Eucalyptus ovata*	Swamp Gum	113	N/A
351	Dead Stag	Dead Stag	47	N/A
353	Dead Stag	Dead Stag	47	N/A
354	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	108	N/A
355	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	110	N/A
356	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	28	N/A
357	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	33	N/A
358	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	24	N/A
359	*Eucalyptus radiata*	Peppermint Gum	82	N/A
360	*Eucalyptus radiata*	Peppermint Gum	23	N/A
361	*Eucalyptus ovata*	Swamp Gum	45	N/A
362	*Eucalyptus ovata*	Swamp Gum	10	N/A
363	*Eucalyptus ovata*	Swamp Gum	8	N/A
364	*Eucalyptus ovata*	Swamp Gum	44	N/A
365	*Eucalyptus ovata*	Swamp Gum	25	N/A
366	*Eucalyptus ovata*	Swamp Gum	33	N/A
367	*Eucalyptus ovata*	Swamp Gum	35	N/A
368	*Eucalyptus ovata*	Swamp Gum	10	N/A
369	*Eucalyptus ovata*	Swamp Gum	40	N/A
370	*Eucalyptus ovata*	Swamp Gum	32	N/A
371	*Eucalyptus ovata*	Swamp Gum	84	N/A
372	*Eucalyptus goniocalyx*	Bundy	76	N/A
373	Dead Stag	Dead Stag	33	N/A
374	*Eucalyptus cinerea*	Mealy Stringybark	40	N/A
375	*Eucalyptus goniocalyx*	Bundy	125	N/A
376	*Eucalyptus fulgens*	Green Scentbark	46	DEPI 2014 (Rare)
377	*Eucalyptus ovata*	Swamp Gum	75	N/A
378	*Eucalyptus fulgens*	Green Scentbark	55	DEPI 2014 (Rare)

Tree ID	Species	Common Name	DBH (cm)	Other Attributes
379	*Eucalyptus fulgens*	Green Scentbark	108	DEPI 2014 (Rare)
380	Dead Stag	Dead Stag	40	N/A
381	Dead Stag	Dead Stag	30	N/A
382	Dead Stag	Dead Stag	40	N/A
384	*Eucalyptus ovata*	Swamp Gum	35	N/A
385	*Eucalyptus ovata*	Swamp Gum	48	N/A
388	Dead Stag	Dead Stag	35	N/A
390	*Eucalyptus radiata*	Peppermint Gum	30	N/A
401	*Eucalyptus radiata*	Peppermint Gum	35	N/A
409	*Eucalyptus radiata*	Peppermint Gum	30	N/A
410	*Eucalyptus radiata*	Peppermint Gum	40	N/A
411	*Eucalyptus ovata*	Swamp Gum	75	N/A
413	*Eucalyptus radiata*	Peppermint Gum	45	N/A
418	*Eucalyptus radiata*	Peppermint Gum	55	N/A
423	*Eucalyptus radiata*	Peppermint Gum	30	N/A
424	*Eucalyptus radiata*	Peppermint Gum	25	N/A
428	*Eucalyptus radiata*	Peppermint Gum	30	N/A
429	Dead Stag	Dead Stag	30	N/A
430	*Eucalyptus radiata*	Peppermint Gum	35	N/A
431	*Eucalyptus radiata*	Peppermint Gum	45	N/A
432	*Eucalyptus radiata*	Peppermint Gum	15	N/A
434	Dead Stag	Dead Stag	90	N/A
435	*Eucalyptus radiata*	Peppermint Gum	30	N/A
436	*Eucalyptus radiata*	Peppermint Gum	30	N/A
441	Dead Stag	Dead Stag	40	N/A
442	Dead Stag	Dead Stag	30	N/A
443	Dead Stag	Dead Stag	15	N/A
444	Dead Stag	Dead Stag	20	N/A
445	Dead Stag	Dead Stag	53	N/A
446	Dead Stag	Dead Stag	30	N/A
447	*Eucalyptus radiata*	Peppermint Gum	40	N/A
448	Dead Stag	Dead Stag	45	N/A
449	Dead Stag	Dead Stag	25	N/A

Tree ID	Species	Common Name	DBH (cm)	Other Attributes
450	Dead Stag	Dead Stag	20	N/A
451	Dead Stag	Dead Stag	45	N/A
452	Dead Stag	Dead Stag	35	N/A
453	Dead Stag	Dead Stag	45	N/A
454	Dead Stag	Dead Stag	30	N/A
455	Dead Stag	Dead Stag	30	N/A
456	*Eucalyptus radiata*	Peppermint Gum	30	N/A
457	*Eucalyptus radiata*	Peppermint Gum	35	N/A
458	Dead Stag	Dead Stag	25	N/A
459	*Eucalyptus radiata*	Peppermint Gum	40	N/A
460	Dead Stag	Dead Stag	30	N/A
461	Dead Stag	Dead Stag	30	N/A
462	Dead Stag	Dead Stag	30	N/A
463	*Eucalyptus radiata*	Peppermint Gum	25	N/A
464	*Eucalyptus ovata*	Swamp Gum	55	N/A
465	*Eucalyptus ovata*	Swamp Gum	68	N/A
466	Dead Stag	Dead Stag	40	N/A
467	Dead Stag	Dead Stag	15	N/A
468	Dead Stag	Dead Stag	10	N/A
469	Dead Stag	Dead Stag	25	N/A
470	Dead Stag	Dead Stag	25	N/A
471	*Eucalyptus radiata*	Peppermint Gum	30	N/A
472	Dead Stag	Dead Stag	35	N/A
473	Dead Stag	Dead Stag	25	N/A
474	Dead Stag	Dead Stag	30	N/A
475	Dead Stag	Dead Stag	15	N/A
476	Dead Stag	Dead Stag	30	N/A
477	Dead Stag	Dead Stag	20	N/A
478	Dead Stag	Dead Stag	30	N/A
479	*Eucalyptus radiata*	Peppermint Gum	20	N/A
480	*Eucalyptus radiata*	Peppermint Gum	20	N/A
481	*Eucalyptus radiata*	Peppermint Gum	20	N/A
482	Dead Stag	Dead Stag	25	N/A

Tree ID	Species	Common Name	DBH (cm)	Other Attributes
483	Dead Stag	Dead Stag	40	N/A
484	Dead Stag	Dead Stag	20	N/A
485	Dead Stag	Dead Stag	30	N/A
486	*Eucalyptus radiata*	Peppermint Gum	35	N/A
487	Dead Stag	Dead Stag	30	N/A
488	Dead Stag	Dead Stag	55	N/A
489	Dead Stag	Dead Stag	30	N/A
490	Dead Stag	Dead Stag	25	N/A
491	Dead Stag	Dead Stag	30	N/A
492	Dead Stag	Dead Stag	25	N/A
493	Dead Stag	Dead Stag	25	N/A
494	Dead Stag	Dead Stag	30	N/A
495	Dead Stag	Dead Stag	25	N/A
496	Dead Stag	Dead Stag	30	N/A
497	Dead Stag	Dead Stag	15	N/A
498	Dead Stag	Dead Stag	25	N/A
499	Dead Stag	Dead Stag	30	N/A
500	Dead Stag	Dead Stag	25	N/A
501	Dead Stag	Dead Stag	30	N/A
502	Dead Stag	Dead Stag	30	N/A
503	Dead Stag	Dead Stag	25	N/A
504	Dead Stag	Dead Stag	30	N/A
505	Dead Stag	Dead Stag	30	N/A
506	Dead Stag	Dead Stag	30	N/A
507	Dead Stag	Dead Stag	25	N/A
508	Dead Stag	Dead Stag	35	N/A
509	Dead Stag	Dead Stag	30	N/A
510	Dead Stag	Dead Stag	30	N/A
511	Dead Stag	Dead Stag	25	N/A
512	Dead Stag	Dead Stag	25	N/A
513	Dead Stag	Dead Stag	30	N/A
514	Dead Stag	Dead Stag	30	N/A
515	Dead Stag	Dead Stag	55	N/A

Tree ID	Species	Common Name	DBH (cm)	Other Attributes
516	Dead Stag	Dead Stag	45	N/A
517	*Eucalyptus radiata*	Peppermint Gum	55	N/A
518	*Eucalyptus radiata*	Peppermint Gum	40	N/A
519	Dead Stag	Dead Stag	35	N/A
520	Dead Stag	Dead Stag	30	N/A
521	Dead Stag	Dead Stag	25	N/A
522	Dead Stag	Dead Stag	30	N/A
523	Dead Stag	Dead Stag	25	N/A
524	Dead Stag	Dead Stag	45	N/A
525	*Eucalyptus ovata*	Swamp Gum	55	N/A
526	*Eucalyptus radiata*	Peppermint Gum	30	N/A
527	*Eucalyptus radiata*	Peppermint Gum	15	N/A
528	*Eucalyptus radiata*	Peppermint Gum	15	N/A
529	*Eucalyptus radiata*	Peppermint Gum	15	N/A
530	*Eucalyptus radiata*	Peppermint Gum	15	N/A
531	Dead Stag	Dead Stag	55	N/A
532	*Eucalyptus radiata*	Peppermint Gum	15	N/A
533	*Eucalyptus radiata*	Peppermint Gum	15	N/A
534	*Eucalyptus radiata*	Peppermint Gum	15	N/A
535	*Eucalyptus radiata*	Peppermint Gum	15	N/A
536	*Eucalyptus radiata*	Peppermint Gum	25	N/A
537	*Eucalyptus radiata*	Peppermint Gum	30	N/A
538	*Eucalyptus radiata*	Peppermint Gum	20	N/A
539	*Eucalyptus radiata*	Peppermint Gum	20	N/A
540	*Eucalyptus radiata*	Peppermint Gum	20	N/A
541	Dead Stag	Dead Stag	53	N/A
542	Dead Stag	Dead Stag	65	N/A
543	Dead Stag	Dead Stag	35	N/A
544	Dead Stag	Dead Stag	30	N/A
545	Dead Stag	Dead Stag	30	N/A
546	Dead Stag	Dead Stag	55	N/A
547	Dead Stag	Dead Stag	45	N/A
548	Dead Stag	Dead Stag	50	N/A

Tree ID	Species	Common Name	DBH (cm)	Other Attributes
549	Dead Stag	Dead Stag	40	N/A
550	Dead Stag	Dead Stag	35	N/A
551	Dead Stag	Dead Stag	45	N/A
552	Dead Stag	Dead Stag	30	N/A
553	Dead Stag	Dead Stag	25	N/A
554	Dead Stag	Dead Stag	30	N/A
555	Dead Stag	Dead Stag	15	N/A
556	Dead Stag	Dead Stag	20	N/A
557	Dead Stag	Dead Stag	45	N/A
569	Dead Stag	Dead Stag	40	N/A
570	*Eucalyptus ovata*	Swamp Gum	55	N/A
571	*Eucalyptus ovata*	Swamp Gum	45	N/A
572	*Eucalyptus ovata*	Swamp Gum	53	N/A
574	*Eucalyptus ovata*	Swamp Gum	73	N/A
577	*Eucalyptus ovata*	Swamp Gum	172	N/A
578	*Eucalyptus ovata*	Swamp Gum	80	N/A
579	*Eucalyptus radiata*	Peppermint Gum	20	N/A
580	*Eucalyptus radiata*	Peppermint Gum	25	N/A
581	*Eucalyptus radiata*	Peppermint Gum	48	N/A
582	*Eucalyptus radiata*	Peppermint Gum	48	N/A
583	*Eucalyptus radiata*	Peppermint Gum	53	N/A
585	*Eucalyptus radiata*	Peppermint Gum	55	N/A
586	*Eucalyptus goniocalyx*	Bundy	50	N/A
588	*Eucalyptus goniocalyx*	Bundy	40	N/A
589	*Eucalyptus goniocalyx*	Bundy	45	N/A
590	*Eucalyptus radiata*	Peppermint Gum	40	N/A
591	*Eucalyptus radiata*	Peppermint Gum	42	N/A
593	*Eucalyptus radiata*	Peppermint Gum	40	N/A
594	*Eucalyptus radiata*	Peppermint Gum	44	N/A
595	*Eucalyptus goniocalyx*	Bundy	120	N/A
596	*Eucalyptus fulgens*	Green Scentbark	42	DEPI 2014 (Rare)
602	*Eucalyptus goniocalyx*	Bundy	58	N/A
603	*Eucalyptus fulgens*	Green Scentbark	84	DEPI 2014 (Rare)

Tree ID	Species	Common Name	DBH (cm)	Other Attributes
604	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	67	N/A
605	*Eucalyptus fulgens*	Green Scentbark	89	DEPI 2014 (Rare)
606	*Eucalyptus fulgens*	Green Scentbark	74	DEPI 2014 (Rare)
607	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	64	N/A
608	*Eucalyptus radiata*	Peppermint Gum	108	N/A
609	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	165	N/A
610	*Eucalyptus ovata*	Swamp Gum	65	N/A
611	*Eucalyptus ovata*	Swamp Gum	53	N/A
612	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	115	N/A
613	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	105	N/A
614	*Eucalyptus ovata*	Swamp Gum	99	N/A
615	*Eucalyptus ovata*	Swamp Gum	109	N/A
616	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	110	N/A
617	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	85	N/A
618	*Eucalyptus ovata*	Swamp Gum	71	N/A
620	*Eucalyptus ovata*	Swamp Gum	72	N/A
621	*Eucalyptus ovata*	Swamp Gum	72	N/A
622	*Eucalyptus ovata*	Swamp Gum	78	N/A
623	*Eucalyptus ovata*	Swamp Gum	70	N/A
624	*Eucalyptus ovata*	Swamp Gum	80	N/A
625	Dead Stag	Dead Stag	85	N/A
626	*Eucalyptus ovata*	Swamp Gum	104	N/A
627	*Eucalyptus ovata*	Swamp Gum	70	N/A
628	*Eucalyptus ovata*	Swamp Gum	60	N/A
630	*Eucalyptus obliqua*	Messmate	30	N/A
668	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	109	N/A
669	Dead Stag	Dead Stag	75	N/A
670	*Eucalyptus fulgens*	Green Scentbark	15	DEPI 2014 (Rare)
671	*Eucalyptus fulgens*	Green Scentbark	54	DEPI 2014 (Rare)
672	*Eucalyptus fulgens*	Green Scentbark	55	DEPI 2014 (Rare)
673	*Eucalyptus camaldulensis*	River Red-gum	90	N/A
674	*Eucalyptus fulgens*	Green Scentbark	20	DEPI 2014 (Rare)
675	*Eucalyptus camaldulensis*	River Red-gum	45	N/A

Tree ID	Species	Common Name	DBH (cm)	Other Attributes
676	*Eucalyptus fulgens*	Green Scentbark	72	DEPI 2014 (Rare)
677	*Eucalyptus fulgens*	Green Scentbark	85	DEPI 2014 (Rare)
678	*Eucalyptus fulgens*	Green Scentbark	89	DEPI 2014 (Rare)
681	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	80	N/A
684	*Eucalyptus viminalis* subsp. *viminalis*	Manna Gum	93	N/A
685	Dead Stag	Dead Stag	-	N/A

Notes: DBH = Diametre at Breast Height, Dead Stag = Dead Standing Tree.

APPENDIX 3

Appendix 3.1 – Fauna Results

Table A3.1. Fauna recorded during the present survey (December 2012 to March 2013), and previously recorded within 10 kilometres of the study area.

Notes:

H - Heard
S - Seen
I - Incidental (feathers, bones, scats etc)
T - Trapped / handheld
Ht - Hair tube
C - Camera
A - Anabat detection

Mi - Migratory
Ma - Marine
* - Introduced species

Common name	Scientific name	Last documented record	Total # of documented records	Hollow use	Mi/ Ma	Present survey
MAMMALS						
Short-beaked Echidna	*Tachyglossus aculeatus*	2003	11	-	-	-
Agile antechinus	*Antechinus agilis*	2004	47	Partial	-	-
Dusky Antechinus	*Antechinus swainsonii*	2004	12	-	-	-
Brush-tailed Phascogale	*Phascogale tapoatafa tapoatafa*	1960	1	Total	-	-
Southern Brown Bandicoot	*Isoodon obesulus obesulus*	2008	15	-	-	-
Common Wombat	*Vombatus ursinus*	2004	22	-	-	S, C
Koala	*Phascolarctos cinereus*	2004	12	-	-	-
Long-nosed Bandicoot	*Perameles nasuta*	1981	1	-	-	-
Mountain Brushtail Possum	*Trichosurus cunninghami*	1996	3	Total	-	-

Common name	Scientific name	Last documented record	Total # of documented records	Hollow use	Mi/ Ma	Present survey
Common Brushtail Possum	*Trichosurus vulpecula*	2008	31	Total	-	S, C, Ht
Eastern Pygmy-possum	*Cercartetus nanus*	1996	10	Partial	-	-
Leadbeater's Possum	*Gymnobelideus leadbeateri*	1915	2	Total	-	-
Yellow-bellied Glider	*Petaurus australis*	2004	7	Total	-	-
Sugar Glider	*Petaurus breviceps*	2004	23	Total	-	S
Common Ringtail Possum	*Pseudocheirus peregrinus*	2008	44	Partial	-	S, C
Greater Glider	*Petauroides volans*	2004	10	Total	-	-
Feathertail Glider	*Acrobates pygmaeus*	1997	21	Total	-	-
Eastern Grey Kangaroo	*Macropus giganteus*	2006	20	-	-	S
Black Wallaby	*Wallabia bicolor*	2004	33	-	-	-
Grey-headed Flying-fox	*Pteropus poliocephalus*	2003	3	-	-	-
White-striped Freetail Bat	*Tadarida australis*	2007	15	Total	-	H, A
Gould's Wattled Bat	*Chalinolobus gouldii*	1991	1	Total	-	A
Chocolate Wattled Bat	*Chalinolobus morio*	1988	3	Total	-	A
Lesser Long-eared Bat	*Nyctophilus geoffroyi*	1993	11	Total	-	-
Unidentified Long-eared Bat	*Nyctophilus* sp.					A
Large Forest Bat	*Vespadelus darlingtoni*	1991	2	Total	-	A
Little Forest Bat	*Vespadelus vulturnus*	1991	5	Total	-	A
Water Rat	*Hydromys chrysogaster*	1996	1	-	-	-
House Mouse*	*Mus musculus*	2006	4	-	-	C, Ht
Bush Rat	*Rattus fuscipes*	2004	83	-	-	Ht
Swamp Rat	*Rattus lutreolus*	2004	6	-	-	Ht

Common name	Scientific name	Last documented record	Total # of documented records	Hollow use	Mi/ Ma	Present survey
Brown Rat*	*Rattus norvegicus*	2006	3	-	-	-
Black Rat*	*Rattus rattus*	2003	4	-	-	C, Ht
Dingo & Dog (feral)*	*Canis lupus*	1993	5	-	-	-
Red Fox*	*fam. Canidae gen. Vulpes*	2008	26	-	-	S, C
Cat*	*Felis catus*	2003	4	-	-	S, C
Sambar*	*Cervus unicolor*	1955	4	-	-	-
European Rabbit*	*Oryctolagus cuniculus*	2008	15	-	-	S, C
European Hare*	*Lepus europeaus*	2002	2	-	-	S
BIRDS						
Stubble Quail	*Coturnix pectoralis*	2000	7	-	Ma	-
Brown Quail	*Coturnix ypsilophora australis*	1951	1	-	-	-
Musk Duck	*Biziura lobata*	2006	6	-	Ma	-
Freckled Duck	*Stictonetta naevosa*	1980	2	-	-	-
Cape Barren Goose	*Cereopsis novaehollandiae*	1998	1	-	Ma	-
Black Swan	*Cygnus atratus*	2006	19	-	-	S
Australian Shelduck	*Tadorna tadornoides*	2006	19	Total	-	-
Australian Wood Duck	*Chenonetta jubata*	2006	90	Total	-	S
Pink-eared Duck	*Malacorhynchus membranaceus*	2006	8	Partial	-	-
Australasian Shoveler	*Anas rhynchotis*	1998	8	-	-	S
Grey Teal	*Anas gracilis*	2008	16	Total	-	-
Chestnut Teal	*Anas castanea*	2008	13	Total	-	S
Northern Mallard*	*Anas platyrhynchos*	1988	3	-	-	-

Common name	Scientific name	Last documented record	Total # of documented records	Hollow use	Mi/ Ma	Present survey
Pacific Black Duck	*Anas superciliosa*	2008	75	-	-	S
Hardhead	*Aythya australis*	2006	7	-	-	S
Blue-billed Duck	*Oxyura australis*	2006	3	-	-	-
Australasian Grebe	*Tachybaptus novaehollandiae*	2006	50	-	-	S
Hoary-headed Grebe	*Poliocephalus poliocephalus*	2006	19	-	-	S
Rock Dove*	*Columba livia*	1981	16	-	-	S
Spotted Turtle-Dove*	*Streptopelia chinensis*	2006	111	-	-	S
Common Bronzewing	*Phaps chalcoptera*	2008	60	-	-	S
Brush Bronzewing	*Phaps elegans*	2000	15	-	-	-
Peaceful Dove	*Geopelia striata*	2003	1	-	-	-
Wonga Pigeon	*Leucosarcia melanoleuca*	2006	5	-	-	-
Tawny Frogmouth	*Podargus strigoides*	2004	22	-	-	H
White-throated Nightjar	*Eurostopodus mystacalis*	2004	5	-	-	-
Australian Owlet-nightjar	*Aegotheles cristatus*	2004	20	Total	-	H
White-throated Needletail	*Hirundapus caudacutus*	2001	25	-	Mi/Ma	-
Fork-tailed Swift	*Apus pacificus*	1976	6	-	Mi/Ma	-
Gang-gang Cockatoo	*Callocephalon fimbriatum*	2004	83	-	-	-
Darter	*Anhinga novaehollandiae*	1994	2	-	-	-
Little Pied Cormorant	*Microcarbo melanoleucos*	2006	21	-	-	-
Great Cormorant	*Phalacrocorax carbo*	2002	12	-	-	-
Little Black Cormorant	*Phalacrocorax sulcirostris*	2005	5	-	-	-
Australian Pelican	*Pelecanus conspicillatus*	1980	4	-	Ma	-

Common name	Scientific name	Last documented record	Total # of documented records	Hollow use	Mi/ Ma	Present survey
Little Bittern	*Ixobrychus minutus dubius*	2006	4	-	-	-
Black Bittern	*Ixobrychus flavicollis australis*	2008	1	-	-	-
White-necked Heron	*Ardea pacifica*	2002	26	-	-	S
Eastern Great Egret	*Ardea modesta*	1981	13	-	Mi/Ma	-
Cattle Egret	*Ardea ibis*	1981	7	-	Mi/Ma	-
White-faced Heron	*Egretta novaehollandiae*	2008	70	-	-	S
Little Egret	*Egretta garzetta nigripes*	1998	1	-	Ma	-
Nankeen Night Heron	*Nycticorax caledonicus hillii*	2008	3	-	Ma	-
Australian White Ibis	*Threskiornis molucca*	2000	42	-	Ma	S
Straw-necked Ibis	*Threskiornis spinicollis*	2006	22	-	Ma	-
Royal Spoonbill	*Platalea regia*	1980	2	-	-	-
Yellow-billed Spoonbill	*Platalea flavipes*	2005	9	-	-	-
Black-shouldered Kite	*Elanus axillaris*	1988	35	-	-	S
Letter-winged Kite	*Elanus scriptus*	1980	1	-	-	-
Whistling Kite	*Haliastur sphenurus*	1979	3	-	Ma	S
Brown Goshawk	*Accipiter fasciatus*	2004	20	-	Ma	-
Collared Sparrowhawk	*Accipiter cirrhocephalus*	1982	6	-	-	-
Grey Goshawk	*Accipiter novaehollandiae novaehollandiae*	1978	1	-	-	-
Swamp Harrier	*Circus approximans*	2002	4	-	Ma	-
Wedge-tailed Eagle	*Aquila audax*	2005	65	-	-	S
Little Eagle	*Hieraaetus morphnoides*	1981	2	-	-	-
Nankeen Kestrel	*Falco cenchroides*	2005	26	Partial	Ma	-

Common name	Scientific name	Last documented record	Total # of documented records	Hollow use	Mi/ Ma	Present survey
Brown Falcon	*Falco berigora*	2001	14	-	-	S
Australian Hobby	*Falco longipennis*	2001	6	-	-	S
Black Falcon	*Falco subniger*	1975	1	-	-	-
Peregrine Falcon	*Falco peregrinus*	2008	8	Partial	-	-
Purple Swamphen	*Porphyrio porphyrio*	2005	26	-	-	S
Buff-banded Rail	*Gallirallus philippensis*	1995	2	-	-	S
Baillon's Crake	*Porzana pusilla palustris*	2003	3	-	Ma	-
Australian Spotted Crake	*Porzana fluminea*					S
Black-tailed Native-hen	*Gallinula ventralis*					S
Dusky Moorhen	*Gallinula tenebrosa*	2006	39	-	-	S
Eurasian Coot	*Fulica atra*	2006	26	-	-	S
Double-banded Plover	*Charadrius bicinctus*	1998	1	-	Mi/Ma	-
Black-fronted Dotterel	*Elseyornis melanops*	2006	29	-	-	-
Masked Lapwing	*Vanellus miles*	2006	45	-	-	S
Latham's Snipe	*Gallinago hardwickii*	2006	17	-	Mi/Ma	S
Common Sandpiper	*Actitis hypoleucos*	1998	1	-	Mi/Ma	-
Pectoral Sandpiper	*Calidris melanotos*	1998	1	-	Mi/Ma	-
Sharp-tailed Sandpiper	*Calidris acuminata*	2006	4	-	Mi/Ma	-
Stilt Sandpiper	*Calidris himantopus*	2006	5	-	-	-
Painted Button-quail	*Turnix varia*	2000	9	-	-	-
Welcome Swallow	*Petrochelidon neoxena*	2008	110	Partial	-	S
Caspian Tern	*Hydroprogne caspia*	1997	1	-	Mi/Ma	-

Common name	Scientific name	Last documented record	Total # of documented records	Hollow use	Mi/ Ma	Present survey
Whiskered Tern	*Chlidonias hybridus javanicus*	1997	1	-	Ma	-
Silver Gull	*Chroicocephalus novaehollandiae*	2006	6	-	Ma	-
Yellow-tailed Black-Cockatoo	*Calyptorhynchus funereus*	2002	118	Total	-	S
Galah	*Eolophus roseicapilla*	2001	57	Total	-	S
Long-billed Corella	*Cacatua tenuirostris*	2002	4	Total	-	S
Little Corella	*Cacatua sanguinea*	1981	1	Total	-	-
Sulphur-crested Cockatoo	*Cacatua galerita*	2008	94	Total	-	S
Cockatiel	*Nymphicus hollandicus*	1978	2	Total	-	-
Rainbow Lorikeet	*Trichoglossus haematodus*	2006	2	Total	-	S
Musk Lorikeet	*Glossopsitta concinna*	1978	2	-	-	S
Little Lorikeet	*Glossopsitta pusilla*	1976	1	-	-	-
Purple-crowned Lorikeet	*Glossopsitta porphyrocephala*	1976	1	Total	-	-
Australian King-Parrot	*Alisterus scapularis*	2005	49	Total	-	S
Crimson Rosella	*Platycercus elegans*	2008	294	Total	-	S
Eastern Rosella	*Platycercus eximius*	2008	122	Total	-	S
Budgerigar	*Melopsittacus undulatus*	1951	1	Partial	-	-
Blue-winged Parrot	*Neophema chrysostoma*	2008	7	Partial	-	-
Horsfield's Bronze-Cuckoo	*Chrysococcyx basalis*	2008	17	-	Ma	-
Shining Bronze-Cuckoo	*Chrysococcyx lucidus*	2004	42	-	Ma	-
Pallid Cuckoo	*Cuculus pallidus*	2004	40	-	Ma	-
Fan-tailed Cuckoo	*Cacomantis flabelliformis*	2004	77	-	-	-
Brush Cuckoo	*Cacomantis variolosus*	1999	6	-	-	-

Common name	Scientific name	Last documented record	Total # of documented records	Hollow use	Mi/ Ma	Present survey
Powerful Owl	*Ninox strenua*	2007	35	Total	-	-
Barking Owl	*Ninox connivens connivens*	1999	3	Total	-	-
Southern Boobook	*Ninox novaeseelandiae*	2004	80	Total	Ma	S
Sooty Owl	*Tyto tenebricosa tenebricosa*	2004	10	Total	-	-
Masked Owl	*Tyto novaehollandiae novaehollandiae*	1993	2	Total	-	-
Pacific Barn Owl	*Tyto javanica*	2005	9	Partial	-	H
Azure Kingfisher	*Alcedo azurea*	1981	1	-	-	-
Laughing Kookaburra	*Dacelo novaeguineae*	2006	196	Total	-	S
Sacred Kingfisher	*Todiramphus sanctus*	2000	26	Partial	Ma	-
Superb Lyrebird	*Menura novaehollandiae*	2001	62	-	-	-
White-throated Treecreeper	*Cormobates leucophaeus*	2005	338	Total	-	H
Red-browed Treecreeper	*Climacteris erythrops*	2002	63	Total	-	-
Brown Treecreeper (south-eastern ssp.)	*Climacteris picumnus victoriae*	2000	1	Total	-	-
Satin Bowerbird	*Ptilonorhynchus violaceus*	2008	11	-	-	-
Superb Fairy-wren	*Malurus cyaneus*	2008	282	-	-	S
Southern Emu-wren	*Stipiturus malachurus*	2001	23	-	-	-
Pilotbird	*Pycnoptilus floccosus*	1993	23	-	-	-
White-browed Scrubwren	*Sericornis frontalis*	2008	251	-	-	S
Large-billed Scrubwren	*Sericornis magnirostris*	2000	5	-	-	-
Chestnut-rumped Heathwren	*Calamanthus pyrrhopygius*	1971	1	-	-	-
Speckled Warbler	*Chthonicola sagittatus*	1914	1	-	-	-
Weebill	*Smicrornis brevirostris*	1999	5	-	-	-

Common name	Scientific name	Last documented record	Total # of documented records	Hollow use	Mi/ Ma	Present survey
White-throated Gerygone	*Gerygone olivacea*	1978	2	-	-	-
Striated Thornbill	*Acanthiza lineata*	2005	325	-	-	S
Yellow Thornbill	*Acanthiza nana*	1981	14	-	-	-
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	2008	61	-	-	S
Buff-rumped Thornbill	*Acanthiza reguloides*	1993	19	-	-	-
Brown Thornbill	*Acanthiza pusilla*	2008	387	-	-	S
Spotted Pardalote	*Pardalotus punctatus*	2005	258	-	-	S
Striated Pardalote	*Pardalotus striatus*	2008	69	Partial	-	S
Eastern Spinebill	*Acanthorhynchus tenuirostris*	2005	207	-	-	-
Lewin's Honeyeater	*Meliphaga lewinii*	2001	28	-	-	-
Yellow-faced Honeyeater	*Lichenostomus chrysops*	2002	148	-	-	-
Singing Honeyeater	*Lichenostomus virescens*	1975	1	-	-	-
White-eared Honeyeater	*Lichenostomus leucotis*	2002	226	-	-	-
Yellow-tufted Honeyeater	*Lichenostomus melanops*	1993	15	-	-	-
Helmeted Honeyeater	*Lichenostomus melanops cassidix*	1982	2	-	Mi	-
White-plumed Honeyeater	*Lichenostomus penicillatus*	2005	47	-	-	S
Bell Miner	*Manorina melanophrys*	2005	102	-	-	-
Noisy Miner	*Manorina melanocephala*	2008	53	-	-	S
Little Wattlebird	*Anthochaera chrysoptera*	1999	6	-	-	-
Red Wattlebird	*Anthochaera carunculata*	2008	132	-	-	S
White-fronted Chat	*Epthianura albifrons*	1993	2	-	-	-
Crescent Honeyeater	*Phylidonyris pyrrhoptera*	2002	79	-	-	-

Common name	Scientific name	Last documented record	Total # of documented records	Hollow use	Mi/ Ma	Present survey
New Holland Honeyeater	*Phylidonyris novaehollandiae*	2005	99	-	-	-
Brown-headed Honeyeater	*Melithreptus brevirostris*	2002	71	-	-	-
White-naped Honeyeater	*Melithreptus lunatus*	2005	236	-	-	-
Noisy Friarbird	*Philemon corniculatus*	1983	2	-	-	-
Spotted Quail-thrush	*Cinclosoma punctatum*	1993	6	-	-	-
Eastern Whipbird	*Psophodes olivaceus*	2005	96	-	-	-
Varied Sittella	*Daphoenositta chrysoptera*	2002	70	-	-	-
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	2008	89	-	Ma	S
Common Cicadabird	*Coracina tenuirostris*	1982	4	-	Ma	-
White-winged Triller	*Lalage sueurii*	1971	1	-	-	-
Crested Shrike-tit	*Falcunculus frontatus*	2001	63	-	-	-
Olive Whistler	*Pachycephala olivacea*	2001	20	-	-	-
Golden Whistler	*Pachycephala pectoralis*	2002	226	-	-	S
Rufous Whistler	*Pachycephala rufiventris*	2002	93	-	-	-
Grey Shrike-thrush	*Colluricincla harmonica*	2006	282	Partial	-	S
Crested Pigeon	*Ocyphaps lophotes*					S
Olive-backed Oriole	*Oriolus sagittatus*	2001	10	-	-	-
Dusky Woodswallow	*Artamus cyanopterus*	2000	33	Partial	-	-
Grey Butcherbird	*Cracticus torquatus*	2008	130	-	-	S
Australian Magpie	*Gymnorhina tibicen*	2008	185	-	-	S
Pied Currawong	*Strepera graculina*	2002	65	-	-	-
Grey Currawong	*Strepera versicolor*	2003	47	-	-	-

Common name	Scientific name	Last documented record	Total # of documented records	Hollow use	Mi/ Ma	Present survey
Rufous Fantail	*Rhipidura rufifrons*	2005	69	-	Mi/Ma	-
Grey Fantail	*Rhipidura albiscarpa*	2008	381	-	-	S
Willie Wagtail	*Rhipidura leucophrys*	2008	105	-	-	S
Australian Raven	*Corvus coronoides*	2008	62	-	-	S
Little Raven	*Corvus mellori*	2008	77	-	Ma	S
Leaden Flycatcher	*Myiagra rubecula*	2000	15	-	-	-
Satin Flycatcher	*Myiagra cyanoleuca*	2001	25	-	Mi/Ma	-
Restless Flycatcher	*Myiagra inquieta*	2005	7	-	-	-
Magpie-lark	*Grallina cyanoleuca*	2008	139	-	-	S
White-winged Chough	*Corcorax melanorhamphos*	1979	1	-	-	S
Jacky Winter	*Microeca fascinans*	2000	22	-	-	-
Scarlet Robin	*Petroica boodang*	2001	95	-	-	-
Red-capped Robin	*Petroica goodenovii*	1991	2	-	-	-
Flame Robin	*Petroica phoenicea*	2001	21	-	-	-
Rose Robin	*Petroica rosea*	2002	35	-	-	-
Pink Robin	*Petroica rodinogaster*	2000	9	-	-	-
Hooded Robin	*Melanodryas cucullata cucullata*	1980	3	-	-	-
Eastern Yellow Robin	*Eopsaltria australis*	2005	299	-	-	-
European Skylark*	*Alauda arvensis*	2008	14	-	-	-
Golden-headed Cisticola	*Cisticola exilis*	1981	8	-	-	S
Clamorous Reed Warbler	*Acrocephalus stentoreus*	2007	8	-	Mi/Ma	-
Little Grassbird	*Megalurus gramineus*	2007	1	-	-	S

Common name	Scientific name	Last documented record	Total # of documented records	Hollow use	Mi/ Ma	Present survey
Rufous Songlark	*Cincloramphus mathewsi*	2008	4	-	-	-
Brown Songlark	*Cincloramphus cruralis*	1959	2	-	-	-
Silvereye	*Zosterops lateralis*	2005	116	-	Ma	S
Fairy Martin	*Petrochelidon ariel*	1981	5	Partial	-	-
Tree Martin	*Petrochelidon nigricans*	1981	7	Total	Ma	S
Bassian Thrush	*Zoothera lunulata*	2001	56	-	-	S
Common Blackbird*	*Turdus merula*	2008	191	-	-	S
Song Thrush*	*Turdus philomelos*	2000	16	-	-	-
Common Starling*	*Sturnus vulgaris*	2008	122	Partial	-	S
Common Myna*	*Acridotheres tristis*	2008	114	-	-	S
Mistletoebird	*Dicaeum hirundinaceum*	2001	78	-	-	-
Red-browed Finch	*Neochmia temporalis*	2008	95	-	-	S
Beautiful Firetail	*Stagonopleura bella*	2000	9	-	-	-
House Sparrow*	*Passer domesticus*	2002	66	-	-	S
Eurasian Tree Sparrow*	*Passer montanus*	1976	2	-	-	-
Australasian Pipit	*Anthus novaeseelandiae*	2008	14	-	Ma	S
European Greenfinch*	*Carduelis chloris*	1982	37	-	-	S
European Goldfinch*	*fam. Fringillidae gen. Carduelis*	2008	71	-	-	S
Domestic Goose*	*fam. Anatidae gen. Anser*	1990	1	-	-	-
REPTILES						
Long neck tortoise	*Chelodina longicollis*	2005	6	-	-	S
Tree Dragon	*Amphibolurus muricatus*	1981	3	Partial	-	-

Common name	Scientific name	Last documented record	Total # of documented records	Hollow use	Mi/ Ma	Present survey
Lace Goanna	*Varanus varius*	2003	3	Partial	-	-
Black Rock Skink	*Egernia saxatilis intermedia*	1981	2	Partial	-	-
Southern Water Skink	*Eulamprus tympanum tympanum*	1981	1	-	-	-
Delicate Skink	*Lampropholis delicata*	2008	12	-	-	S
Garden Skink	*Lampropholis guichenoti*	1999	19	-	-	S
McCoy's Skink	*Nannoscincus maccoyi*	1981	24	-	-	-
Spencer's Skink	*Pseudemoia spenceri*	1993	1	Total	-	-
Weasel Skink	*Saproscincus mustelinus*	1981	8	-	-	S
Eastern Three-lined Skink	*Bassiana duperreyi*	1964	1	-	-	-
Coventry's Skink	*Niveoscincus coventryi*	1981	2	-	-	-
Metallic Skink	*Niveoscincus metallicus*	1979	3	-	-	-
Blotched Blue-tongued Lizard	*Tiliqua nigrolutea*	2000	2	-	-	-
Lowland Copperhead	*Austrelaps superbus*	1996	23	-	-	-
White-lipped Snake	*Drysdalia coronoides*	1964	1	-	-	-
Tiger Snake	*Notechis scutatus*	1996	3	-	-	-
Eastern Small-eyed Snake	*Rhinoplocephalus nigrescens*	1981	2	-	-	-
AMPHIBIANS						
Common Froglet	*Crinia signifera*	2008	114	-	-	H
Plains Froglet	*Crinia parinsignifera*	-	-	-	-	H
Victorian Smooth Froglet	*Geocrinia victoriana*	2007	31	-	-	-
Pobblebonk Frog	*Limnodynastes dumerilii dumerilii*	2008	1	-	-	H
Striped Marsh Frog	*Limnodynastes peronii*	2008	89	-	-	S, H

Common name	Scientific name	Last documented record	Total # of documented records	Hollow use	Mi/ Ma	Present survey
Spotted Marsh Frog SCR	*Limnodynastes tasmaniensis SCR*	2007	125	-	-	S, H
Southern Toadlet	*Pseudophryne semimarmorata*	2006	37	-	-	-
Southern Brown Tree Frog	*Litoria ewingii*	2008	75	-	-	S, H
Peron's Tree Frog	*Litoria peronii*	2003	1	Partial	-	-
Growling Grass Frog	*Litoria raniformis*	2008	221	-	-	S
Whistling Tree Frog	*Litoria verreauxii verreauxii*	2008	172	-	-	S, H
FISH						
Short-headed Lamprey	*Mordacia mordax*	1998	8	-	-	-
Short-finned Eel	*Anguilla australis*	2009	63	-	-	S
Longfinned Eel	*Anguilla reinhardtii*	2005	3	-	-	-
Serpent Eel	*Ophisurus serpens*	2004	1	-	-	-
Common Galaxias	*Galaxias maculatus*	2009	47	-	-	S
Mountain Galaxias	*Galaxias olidus*	2002	3	-	-	-
Spotted Galaxias	*Galaxias truttaceus*	2008	5	-	-	S
Dwarf Galaxias	*Galaxiella pusilla*	2005	7	-	-	-
Australian Grayling	*Prototroctes maraena*	1997	1	-	-	-
Brown Trout*	*Salmo trutta*	2002	9	-	-	-
Goldfish*	*Carassius auratus*	2008	13	-	-	-
Gambusia*	*Gambusia holbrooki*	2009	58	-	-	S
Carp*	*Cyprinus carpio*	2008	2	-	-	-
Tamar River Goby	*Afurcagobius tamarensis*	2008	1	-	-	-
River Blackfish	*Gadopsis marmoratus*	2002	11	-	-	-

Common name	Scientific name	Last documented record	Total # of documented records	Hollow use	Mi/ Ma	Present survey
Southern Pygmy Perch	*Nannoperca australis*	2008	40	-	-	S
Redfin*	*Perca fluviatilis*	2008	9	-	-	S
Tupong	*Pseudaphritis urvillii*	2009	10	-	-	S
MUSSELS & CRUSTACEANS						
Common Yabby	*Cherax destructor*	-	-	-	-	S
Central Victorian Spiny Crayfish	*Euastacus woiwuru*	2001	3	-	-	-
Common Freshwater Shrimp	*Paratya australiensis*	2009	43	-	-	S
Foothill Burrowing Crayfish	*Engaeus victoriensis*	1911	1	-	-	-
Freshwater Crayfish	*fam. Parastacidae gen. Euastacus*	2009	1	-	-	-
Gippsland Spiny Crayfish	*Euastacus kershawi*	2002	2	-	-	-
Southern Victorian Spiny Crayfish	*Euastacus yarraensis*	2009	2	-	-	-

Source used to determine number of records and year: Victorian Biodiversity Atlas (DELWP 2017)**; Source used to determine hollow use**: Victorian Fauna Database (Viridans 2011b); **Source used to determine migratory and marine:** EPBC Act**; Taxonomic order:** Mammals (Strahan 1995 in Menkhorst & Knight 2004); Birds (Christidis & Boles, 2008); Reptiles and Amphibians (Cogger et al. 1983 in Cogger 1996); Fish (Nelson 1994); Mussels & Crustaceans (Alphabetical); Invertebrates (Alphabetical).

Appendix 3.2 – Significant Fauna Species

Table A3.2. Significant fauna within 10 kilometres of the study area.

Habitat characteristics of significant fauna species previously recorded within 10 kilometres of the study area, or that may potentially occur within the study area were assessed to determine their likelihood of occurrence. The likelihood of occurrence rankings for each of the threatened species are:

1	High Likelihood	• Known resident in the study area based on site observations, database records, or expert advice; and/or, • Recent records (i.e. within five years) of the species in the local area (VBA 2011); and/or, • The study area contains the species' preferred habitat.
2	Moderate Likelihood	• The species is likely to visit the study area regularly (i.e. at least seasonally); and/or, • Previous records of the species in the local area (DELWP 2017); and/or, • The study area contains some characteristics of the species' preferred habitat.
3	Low Likelihood	• The species is likely to visit the study area occasionally or opportunistically whilst en route to more suitable sites; and/or, • There are only limited or historical records of the species in the local area (i.e. more than 20 years old); and/or, • The study area contains few or no characteristics of the species' preferred habitat.
4	Unlikely	• No previous records of the species in the local area; and/or, • The species may fly over the study area when moving between areas of more suitable habitat; and/or, • Out of the species' range; and/or, • No suitable habitat present.

EPBC	*Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
FFG	*Flora and Fauna Guarantee Act 1988* (FFG Act)
DSE	Advisory List of Threatened Vertebrate Fauna in Victoria (DSE 2013); Advisory List of Threatened Invertebrate Fauna in Victoria (DSE 2009)
NAP	National Action Plan (Cogger et al 1993; Duncan et al. 1999; Garnet et al 2011; Woinarski et al 2014; Sands and New 2002; Tyler 1997)

EX	Extinct	DD	Data deficient (insufficiently or poorly known
RX	Regionally extinct	L	Listed as threatened under FFG Act
CR	Critically endangered	EN	Endangered
#	Listed on the Protected Matters Search Tool	NT	Near threatened
VU	Vulnerable	CD	Conservation dependent
LC	least concern	RA	Rare

Common name	Scientific name	Last documented record	Total # of documented records	EPBC Act	FFG Act	DSE (2013)	National Action Plan	Likely use of study area
NATIONAL SIGNIFICANCE								
#Swamp Antechinus	*Antechinus minimus maritimus*	-	-	VU	L	NT	VU	4
# Spot-tailed Quoll	*Dasyurus maculatus*	-	-	EN	L	EN	VU	4
#Southern Brown Bandicoot	*Isoodon obesulus obesulus*	2012	26	EN	L	NT	NT	3
# Smoky Mouse	*Pseudomys fumeus*	-	-	EN	L	EN	RA	4
# New Holland Mouse	*Pseudomys novaehollandiae*	-	-	VU	L	VU	--	4
Leadbeater's Possum	*Gymnobelideus leadbeateri*	1915	2	EN	L	EN	EN	4
Greater Glider	*Gymnobelideus leadbeateri*	2009	11	VU	-	VU	VU	4
#Grey-headed Flying-fox	*Pteropus poliocephalus*	2003	3	VU	L	VU	VU	2
#Broad-toothed Rat	*Mastacomys fuscus mordicus*	-	-	VU	L	EN	VU	3
# Australasian Bittern	*Botaurus poiciloptilus*	-	-	EN	L	EN	VU	3
# Australian Painted Snipe	*Rostratula australis*	-	-	VU	L	CR	VU	3
# Fairy Tern	*Sternula nereis*	-	-	VU	L	EN	-	4
#Eastern Curlew	*Numenius madagascariensis*	-	-	CR	-	VU	-	4
#Curlew Sandpiper	*Calidris ferruginea*	-	-	CR	-	EN	-	4
# Swift Parrot	*Lathamus discolor*	-	-	EN	L	EN	EN	3
Helmeted Honeyeater	*Lichenostomus melanops cassidix*	1982	2	EN	L	CR	CR	3
# Regent Honeyeater	*Anthochaera phrygia*	-	-	EN	L	CR	EN	4
#Painted Honeyeater	*Grantiella picta*	-	-	VU	L	VU	NT	4
#Growling Grass Frog	*Litoria raniformis*	2008	221	VU	L	EN	VU	2
#Dwarf Galaxias	*Galaxiella pusilla*	2005	7	VU	L	VU	VU	3
#Australian Grayling	*Prototroctes maraena*	1997	1	VU	L	VU	VU	4

Common name	Scientific name	Last documented record	Total # of documented records	EPBC Act	FFG Act	DSE (2013)	National Action Plan	Likely use of study area
Murray Cod	*Maccullochella peelii*	1970	2	VU	L	VU	-	4
Macquarie Perch	*Macquaria australasica*	1976	2	EN	L	EN	DD	4
# Golden Sun Moth	*Synemon plana*	-	-	CR	L	EN	-	4
STATE SIGNIFICANCE								
Grey Goshawk	*Accipiter novaehollandiae novaehollandiae*	1978	1	-	L	VU	-	4
Brush-tailed Phascogale	*Phascogale tapoatafa tapoatafa*	1960	1	-	L	VU	NT	3
Musk Duck	*Biziura lobata*	2006	6	-	-	VU	-	3
Freckled Duck	*Stictonetta naevosa*	1980	2	-	L	EN	-	3
Australasian Shoveler	*Anas rhynchotis*	1998	8	-	-	VU	-	1
Hardhead	*Aythya australis*	2006	7	-	-	VU	-	1
Blue-billed Duck	*Oxyura australis*	2006	3	-	L	EN	-	3
White-throated Needletail	*Hirundapus caudacutus*	2001	28	-	-	VU	-	3
Little Bittern	*Ixobrychus minutus dubius*	2006	4	-	L	EN	-	3
Black Bittern	*Ixobrychus flavicollis australis*	2008	1	-	L	VU	-	3
Eastern Great Egret	*Ardea modesta*	1981	13	-	L	VU	-	2
Little Egret	*Egretta garzetta nigripes*	1998	1	-	L	EN	-	3
Black Falcon	*Falco subniger*	1975	1	-	-	VU	-	3
Baillon's Crake	*Porzana pusilla palustris*	2003	3	-	L	VU	-	2
Common Sandpiper	*Actitis hypoleucos*	1998	1	-	-	VU	-	4
Caspian Tern	*Hydroprogne caspia*	1997	1	-	L	NT	-	4
Powerful Owl	*Ninox strenua*	2012	44	-	L	VU	-	3
Barking Owl	*Ninox connivens connivens*	1999	3	-	L	EN	NT	4

Common name	Scientific name	Last documented record	Total # of documented records	EPBC Act	FFG Act	DSE (2013)	National Action Plan	Likely use of study area
Sooty Owl	*Tyto tenebricosa tenebricosa*	2004	10	-	L	VU	-	4
Masked Owl	*Tyto novaehollandiae novaehollandiae*	1993	2	-	L	EN	NT	3
Brown Treecreeper (south-eastern ssp.)	*Climacteris picumnus victoriae*	2000	1	-	-	NT	NT	3
Chestnut-rumped Heathwren	*Calamanthus pyrrhopygius*	1971	1	-	L	VU	-	3
Speckled Warbler	*Chthonicola sagittatus*	1914	1	-	L	VU	NT	4
Hooded Robin	*Melanodryas cucullata cucullata*	1980	3	-	L	NT	NT	3
Lace Goanna	*Varanus varius*	2003	3	-	-	VU	-	4
Glossy Grass Skink	*Pseudemoia rawlinsoni*	2010	1	-	-	VU	-	3
Southern Toadlet	*Pseudophryne semimarmorata*	2006	37	-	-	VU	-	3
Foothill Burrowing Crayfish	*Engaeus victoriensis*	1911	1	-	-	EN	-	3
REGIONAL SIGNIFICANCE								
Eastern Pygmy-possum	*Cercartetus nanus*	1996	10	-	I	NT	-	4
Brown Quail	*Coturnix ypsilophora australis*	1951	1	-	-	NT	-	3
Cape Barren Goose	*Cereopsis novaehollandiae*	1998	1	-	-	NT	-	4
Royal Spoonbill	*Platalea regia*	1980	2	-	-	VU	-	2
Nankeen Night Heron	*Nycticorax caledonicus hillii*	2008	3	-	-	NT	-	2
Latham's Snipe	*Gallinago hardwickii*	2006	17	-	-	NT	-	1
Pectoral Sandpiper	*Calidris melanotos*	1998	1	-	-	NT	-	4
Whiskered Tern	*Chlidonias hybridus javanicus*	1997	1	-	-	NT	-	4
Azure Kingfisher	*Alcedo azurea*	1981	1	-	-	NT	-	3
Spotted Quail-thrush	*Cinclosoma punctatum*	1993	6	-	-	NT	-	4

Common name	Scientific name	Last documented record	Total # of documented records	EPBC Act	FFG Act	DSE (2013)	National Action Plan	Likely use of study area
River Blackfish	*Gadopsis marmoratus*	2002	11	-	-	DD	-	4

Data source: Victorian Biodiversity Atlas (DELWP 2017); Victorian Fauna Database (Viridans 2011b); Protected Matters Search Tool (DoEE 2017).

Taxonomic order: Mammals (Strahan 1995 in Menkhorst & Knight 2004); Birds (Christidis & Boles, 2008); Reptiles and Amphibians (Cogger et al. 1983 in Cogger 1996); Fish (Nelson 1994); Mussels & Crustaceans (Alphabetical); Invertebrates (Alphabetical).

Appendix 3.3 – Targeted Growling Grass Frog Survey Results

Table A3.3. Targeted Growling Grass Frog survey results (December 2012 to January 2013).

Property No	Survey point	Growling Grass Frog *Litoria raniformis*	Common Froglet *Crinia signifera*	Plains Froglet *Crinia parainsignifera*	Southern Bullfrog *Limnodynastes dumerilii*	Striped Marsh Frog *Limnodynastes peronii*	Spotted Marsh Frog *Limnodynastes tasmaniensis*	Southern Brown Tree Frog *Litoria ewingii*	Whistling Tree Frog *Litoria verreauxii verreauxii*	Tadpoles present	Metamorphs (M) and/or juveniles (J) present
N/A	Deep Creek North	-	-	-	-	-	-	-	-	-	-
15	Deep Creek South	-	-	✓	-	✓	-	-	✓	-	-
9	1	-	-	-	-	✓	-	✓	✓	-	-
7	2	-	-	-	-	-	✓	✓	-	-	-
7	3	-	-	-	-	-	-	-	-	-	-
7	4	-	-	-	-	✓	-	-	✓	Whisting and/or Southern Brown Tree Frog	-
8	5	-	✓	-	-	-	✓	-	✓	-	-
2	6	-	-	-	-	-	✓	-	✓	-	Spotted Marsh Frog (M,J)
3	7	-	-	-	-	✓	-	-	✓	-	-
6	8	-	-	-	-	-	-	-	-	-	-
6	9	-	✓	-	-	-	-	-	✓	-	-
34	10	-	✓	-	-	-	✓ ✓	✓	✓ ✓	-	Whisting and/or Southern Brown Tree Frog (J)
32	11	-	✓	-	✓	✓	✓	-	✓	Whisting and/or Southern Brown	Spotted Marsh Frog (J), Whisting

Property No	Survey point	Growling Grass Frog *Litoria raniformis*	Common Froglet *Crinia signifera*	Plains Froglet *Crinia parainsignifera*	Southern Bullfrog *Limnodynastes dumerilii*	Striped Marsh Frog *Limnodynastes peronii*	Spotted Marsh Frog *Limnodynastes tasmaniensis*	Southern Brown Tree Frog *Litoria ewingii*	Whistling Tree Frog *Litoria verreauxii verreauxii*	Tadpoles present	Metamorphs (M) and/or juveniles (J) present
						✓			✓	Tree Frog. Southern Bullfrog	and/or Southern Brown Tree Frog (J)
1	12	-	-	-	-	-	✓	-	✓	-	-
1	13	-	-	-	-	-	✓	-	✓	-	-
14	14	-	-	-	-	-	-	-	-	-	-
14	15	-	-	-	-	✓	-	-	✓	-	-
14	16	-	-	-	-	-	-	-	✓	-	-
36	17	-	-	-	-	-	✓	✓	✓ ✓	-	Whisting and/or Southern Brown Tree Frog (J)
37	18	-	✓	-	-	✓ ✓	-	✓ ✓	✓ ✓	-	-
47	19	-	-	-	-	-	-	-	-	-	-
47	20	-	-	-	-	-	✓	-	✓	-	-
52	21	-	✓	-	-	-	✓	✓	✓ ✓	-	-
46	22	-	✓	-	-	-	-	✓	✓ ✓	-	Whisting and/or Southern Brown Tree Frog (J)
44	23	✓ (one		-	-	-	-	-	-	-	-

Property No	Survey point	Growling Grass Frog *Litoria raniformis*	Common Froglet *Crinia signifera*	Plains Froglet *Crinia parainsignifera*	Southern Bullfrog *Limnodynastes dumerilii*	Striped Marsh Frog *Limnodynastes peronii*	Spotted Marsh Frog *Limnodynastes tasmaniensis*	Southern Brown Tree Frog *Litoria ewingii*	Whistling Tree Frog *Litoria verreauxii verreauxii*	Tadpoles present	Metamorphs (M) and/or juveniles (J) present
		adult female on two occasions)	✓								
52	24	-	✓	-	-	-	✓	-	✓ ✓	-	-
15	25	-	-	-	✓	-	✓	-	✓	Unidentified Limnodynastes sp.	-
15	26	-	-	-	-	✓	-	-	✓	Hundreds of Striped Marsh Frog	-
53	27	-	-	-	-	-	-	-		-	-
53	28	-	-	-	-	-	-	-		-	-
43	29	-	✓	-	-	-	-	✓	✓ ✓	-	-
1	30	-	-	-	-	-	✓		✓	-	-
2	31	-	-	-	-	✓	✓	✓		-	Spotted Marsh Frog (M,J)
Bypass	U24	-	✓	-	-	✓		✓		-	-
Bypass	U25	-	✓	-	-	✓	✓	✓	✓	-	-
Bypass	U26	-	✓	-	-	✓	✓	✓	✓	-	-
Bypass	U27	-	-	-	-	-	✓	✓	✓	Whistling Tree Frog, Unidentified	Common Froglet (M)

Property No	Survey point	Growling Grass Frog *Litoria raniformis*	Common Froglet *Crinia signifera*	Plains Froglet *Crinia parainsignifera*	Southern Bullfrog *Limnodynastes dumerilii*	Striped Marsh Frog *Limnodynastes peronii*	Spotted Marsh Frog *Limnodynastes tasmaniensis*	Southern Brown Tree Frog *Litoria ewingii*	Whistling Tree Frog *Litoria verreauxii verreauxii*	Tadpoles present	Metamorphs (M) and/or juveniles (J) present
										Limnodynastes sp.	Limnodynastes (M)
Bypass	U28	-	✓	-	-	✓	✓	✓	✓	-	-
Bypass	U29	-	✓	-	-	✓	✓	-	-	-	-
Bypass	U30	✓	✓	-	-	✓	-	-	-	-	-
Bypass	U31	-	✓	-	-	-	✓	✓	✓	-	-
Bypass	U32	✓	-	-	-	✓	-	-	-	-	-
Bypass	U33	✓	-	-	-	-	-	-	-	-	-
Bypass	U34	-	✓	-	-	-	-	✓	-	-	-

Table A3.3. Targeted Growling Grass Frog survey results (November 2016 to March 2017).

Date	Property No.	Survey Site	Growling Grass Frog *Litoria raniformis*	Whistling Tree Frog *Litoria verreauxii verreauxii*	Southern Brown Tree Frog *Litoria ewingii*	Common Froglet *Crinia signifera*	Southern Bullfrog *Limnodynastes dumerilii*	Striped Marsh Frog *Limnodynastes peronii*	Spotted Marsh Frog *Limnodynastes tasmaniensis*
17/11/2016	32	11	-	✓	-	✓	-	✓	-
17/11/2016	34	10	-	✓	-	-	-	-	-
17/11/2016	47	19	-	✓	-	-	-	-	-
17/11/2016	47	20	-	✓	-	✓	✓	-	✓
17/11/2016	52	21	-	-	-	-	-	-	✓
17/11/2016	Bypass	U24	-	-	-	✓	-	-	-
17/11/2016	44	23	-	-	-	-	-	-	-
17/11/2016	52	24	-	-	-	-	-	-	-
22/11/2016	14	14	-	✓	-	✓	-	✓	-
22/11/2016	14	15	-	✓	-	✓	-	✓	-
22/11/2016	Bypass	U24	-	-	-	✓	-	-	-
22/11/2016	Bypass	U27	-	-	-		-	✓	-
22/11/2016	Bypass	U29	-	-	-	✓	-	✓	-
22/11/2016	15	SBB Cam03	-	-	-	-	-	-	-
22/11/2016	15	SBB Cam05	-	-	-	-	-	-	-
22/11/2016	15	SBB Cam06	-	-	-	-	-	-	-

Date	Property No.	Survey Site	Growling Grass Frog *Litoria raniformis*	Whistling Tree Frog *Litoria verreauxii verreauxii*	Southern Brown Tree Frog *Litoria ewingii*	Common Froglet *Crinia signifera*	Southern Bullfrog *Limnodynastes dumerilii*	Striped Marsh Frog *Limnodynastes peronii*	Spotted Marsh Frog *Limnodynastes tasmaniensis*
1/12/2016	32	11 (Repeat)	-	✓	-	✓	-	-	-
1/12/2016	34	10 (Repeat)	-	✓	-	✓	-	✓	-
10/01/2017	14	16	-	-	-	-	-	-	-
10/01/2017	14	15 (repeat)	-	-	-	-	-	-	-
10/01/2017	14	14 (repeat)	-	-	-	-	-	-	-
10/01/2017	8	5	-	✓	-	-	-	✓	-
10/01/2017	9	1	-	✓	-	-	-	-	-
10/01/2017	7	4	-	-	-	-	-	-	-
10/01/2017	7	2	-	-	-	-	-	-	-
10/01/2017	7	3	-	-	-	-	-	-	✓
10/01/2017	3	7	-	✓	-	-	-	-	-
15/03/2017	34	10 (repeat)	-	✓	-	-	-	-	-
15/03/2017	32	11 (repeat)	-	✓	-	-	-	-	-
15/03/2017	15	25	-	-	-	-	-	✓	-
15/03/2017	15	26	-	-	-	-	-	-	-

Appendix 3.4 – Targeted Southern Brown Bandicoot Survey Results

Table A3.4a Fauna recorded on the infra-red cameras and in hair tubes (18 February – 6 March 2013).

Notes: H - hair tube definite, h - hair tube probable, C - camera.

Common name	Scientific name	Transect 1	Transect 2	Transect 3	Transect 4	Transect 5	Transect 6	Transect 7	Transect 8	Transect 9	Grid 10
Common Brushtail Possum	*Trichosurus vulpecula*	H	C	-	H, C	H, C	-	-	H	H	H
Common Ringtail Possum	*Pseudocheirus peregrinus*	-	-	-	-	-	-	C	-	-	C
Common Wombat	*Vombatus ursinus*	-	-	-	-	C	-	-	-	-	-
Bush Rat	*Rattus fuscipes*	-	-	-	H, C	-	-	-	-	-	-
Swamp Rat	*Rattus lutreolus*	H	h	h	H, C	-	H	-	-	-	H
Black Rat*	*Rattus rattus*	-	-	-	-	-	C	-	C	C	-
House Mouse*	*Mus musculus*	-	C	-	C	-	H	h	C	-	C
European Rabbit*	*Oryctolagus cuniculus*	-	-	-	C	C	-	-	-	-	C
Red Fox *	*Vulpes vulpes*	-	-	-	-	C	-	-	C	-	-
Domestic Dog*	*Canis lupus familiaris*	-	-	-	-	-	-	-	h	-	H
Striated Pardelote	*Pardalotus striatus*	-	-	-	-	-	-	-	-	-	C
Buff-Banded Rail	*Gallirallus philippensis*	-	-	-	C	-	-	-	-	-	-
Common Starling*	*Sturnus vulgaris*	-	-	-	-	-	-	-	-	-	C
Common Blackbird *	*Turdus merula*	-	C	C	-	C	-	-	-	-	C
Common Myna *	*Acridotheres tristis*	-	-	-	-	-	-	-	-	C	-

* Introduced species

Table A3.4b Fauna recorded on the infra-red cameras (7 November – 22 November 2016).

Site ID	Date Start / Finish		Native Mammals				Introduced Mammals				Native Birds					Introduced Birds				
			Brushtail Possum	Ringtail Possum	Echidna	Common Wombat	Red Fox	Cat	European Rabbit	Black Rat	Domestic Sheep	Magpie lark	Australian Magpie	Little Raven	Crested Pidgeon	Common Myna	Common Starling	Common Blackbird	Spotted Dove	Domestic Chicken
S01	7/11/2016	22/11/2016	-	-	-	-	1	-	5	-	-	1	-	-	-	1		1	-	-
S02	7/11/2016	22/11/2016	2	-	-	-	1	-	-	-	-	-	-	-	-	1		1	-	-
S03	7/11/2016	22/11/2016	-	-	-	-	5	-	1	-	-	-	-	-	-	-	1	1	-	-
S04	7/11/2016	22/11/2016	-	-	-	-	6	-	-	-	-	-	-	-	-	-		1	1	-
S05	7/11/2016	22/11/2016	-	1	-	-	-	-	-	1	-	-	-	-	-	-	1	1	1	-
S06	7/11/2016	22/11/2016	-	-	-	-	-	-	-	1	-	-	-	-	-	1	1	-	-	-
S07	7/11/2016	22/11/2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1		-
S08	7/11/2016	22/11/2016	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-
S09	8/11/2016	22/11/2016	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-
S10	8/11/2016	22/11/2016	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1	-	-	-
S11	8/11/2016	22/11/2016	-	-	1	1	1	-	-	1	-	-	-	-	-	1	-	1	-	-
S12	8/11/2016	22/11/2016	2	-	-	-	2	1	2	-	1	-	-	-	1	-	1	1	1	1
S13	8/11/2016	22/11/2016	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-
S14	8/11/2016	22/11/2016	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1	1	-	-
S15	8/11/2016	22/11/2016	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1	-	-	-
S16	8/11/2016	22/11/2016	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-	1	1	-
S17	8/11/2016	22/11/2016	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-

Site ID	Date Start / Finish		Native Mammals				Introduced Mammals				Native Birds					Introduced Birds				
			Brushtail Possum	Ringtail Possum	Echidna	Common Wombat	Red Fox	Cat	European Rabbit	Black Rat	Domestic Sheep	Magpie lark	Australian Magpie	Little Raven	Crested Pidgeon	Common Myna	Common Starling	Common Blackbird	Spotted Dove	Domestic Chicken
S18	8/11/2016	22/11/2016	-	-	-	-	3	-	-	1	-	1	-	-	-	1	1	1	-	-
S19	8/11/2016	22/11/2016	-	-	-	-	1	-	-	-	-	1	1	1	-	1	1	1	-	-
S20	8/11/2016	22/11/2016	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1	-	-	-

Appendix 3.5 – Aquatic Survey Results

Table A3.5. Aquatic Survey Results.

Site	Native Fish					Exotic fish		Decapod Crustaceans		Other Fauna
	Common Galaxias *Galaxias maculatus*	Short-finned Eel *Anguilla australis*	Spotted Galaxias *Galaxias truttaceas*	Southern Pygmy Perch *Nannoperca australis*	Tupong *Pseudophrites urvilli*	Eastern Gabusia *Gambusia hollbrooki*	Redfin Perch *Perca fluviatilis*	Freshwater Shrimp *Paratya australiensis*	Common Yabby *Cherax destructor*	Eastern Long-necked Turtle *Chelodina longicollis*
1	1	-	-	3	1	-	-	-	-	-
2	-	-	-	-	-	-	-	2	-	-
3	20	27	8	-	57	-	-	>1000	1	-
4	53	-	7	-	12	-	-	-	2	-
5	40	-	-	2	19	-	-	50	-	-
6	-	5	-	-	-	>1000	9	>1000	46	2
7	10	33	-	-	-	>1000	12	>1000	46	1
10	2	1	-	-	-	>1000	-	>1000	-	-

APPENDIX 4

Appendix 4.1 – EPBC Act Referral Decision

Notification of

REFERRAL DECISION – not controlled action
Pakenham East Precinct Structure Plan, Victoria (EPBC 2017/8069)

This decision is made under Section 75 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Proposed action

Person proposing to take the action	Cardinia Shire Council ABN – 32 210 906 807
proposed action	To rezone a 630 ha precinct for the purposes of residential and commercial development, located approximately 60 kilometres south east of Melbourne and which covers the suburbs of Pakenham, Nar Nar Goon and Nar Nar Goon North. [See EPBC Act referral 2017/8069].

Referral decision: Not a controlled action

status of proposed action	The proposed action is not a controlled action.

Person authorised to make decision

Name and position	James Barker Assistant Secretary Assessments and Governance Branch
signature	
date of decision	9 / 1 / 2018

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