WEDGETAIL
PROJECT CONSULTING

Biodiversity Management Plan (BMP)
Lakes Ridge

285 – 335 Pacific Highway, Lake Munmorah, NSW 2259

Report prepared for:
Rose Living Pty Ltd c/- Barker Ryan Stewart

Version 1.0
04 August 2022

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Lakes Ridge

285 – 335 Pacific Highway, Lake Munmorah, NSW 2259

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		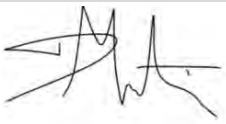
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1. INTRODUCTION

1.1 BACKGROUND

Wedgetail Project Consulting Pty Ltd (Wedgetail) was engaged by Barker Ryan Stewart (BRS), on behalf of the Rose Group Pty Ltd Group, to complete a Biodiversity Management Plan (BMP) to support the proposed Biocertification of land at 285, 295, 305, 315, 325 and 335 Pacific Highway Lake Munmorah, New South Wales (NSW) 2259 (inclusive of Lot 1 DP 626787, Lot 437 DP 755266, Lot 438 DP 755266, Lot 27 DP 755266, Lot 12 DP 771284, Lot 83 DP 650114) (hereafter referred to as the 'Subject Site') (see **Figure 1**).

The following terms are used throughout this report to describe particular geographical areas:

- **Subject Site** – 285 – 335 Pacific Highway, Lake Munmorah, NSW (inclusive of Lot 1 and 2 DP 626787, Lot 438 and 437 DP 755266, Lot 27 DP 755266, Lot 83 DP650114 and Lot 12 DP 771284) (**Figure 1**).
- **Development Site** - The area within the Subject Site to be subject to the proposed residential subdivision (rezoning to *R2 Low Density Residential*) (**Figure 2**).
- **Conservation Area** – The area within the Subject Site to be rezoned and maintained as a *C2 Environmental Conservation*, inclusive of areas of temporary impact and restoration associated with detention basins (constructed wetlands) (**Figure 2**).
- **Locality** - Land within a 5 kilometre (km) radius of the Subject Site (**Figure 1**).

1.2 SITE DESCRIPTION

The Subject Site is located within the suburb of Lake Munmorah within the Central Coast Council Local Government Area (LGA). The majority of the site is zoned *RU6 – Transition* under the Wyong Local Environmental Plan (LEP) 2013. The proposed road corridor to the west lies within an area that is currently Zoned *RE1 – Public Recreation*.

The Subject Site is currently comprised of semi-rural properties, characterised by a mix of residence, sheds, and existing infrastructure, including two large telecommunication towers. The vegetation throughout the site is characterised by a mix of remnant low woodland vegetation, scattered mature eucalypts, managed grassland, and windbreaks comprised of planted Radiata Pine (*Pinus radiata*). Groundcover within the Subject Site is comprised of native and exotic species (mainly introduced perennial grasses). The lack of plant diversity in the groundcover is likely to be the result of land management practises including grazing and slashing by the current landowners.

Low-lying areas within the eastern portion of the Subject Site are predominantly cleared. A small wetland dominated by rush species occurs near in the north-east corner of the Subject Site. Four constructed dams also occur in the south. A drainage channel intersects the location of the proposed road reserve adjacent to Chisholm Avenue to the west. A poorly defined drainage channel also flows in a northern direction through the eastern portion of the Subject Site.

1.3 PROPOSED DEVELOPMENT

The Planning Proposal involves the biocertification of lands within the Subject Site including the rezoning of the Development Site from *RU6 Transition* to *R2 Low Density Residential* to support the proposed residential subdivision, local roads, detention basins and other associated infrastructure. The biocertificaiton proposal will also involve the provision of Conservation Areas within the Subject Site to be rezoned to *C2 Environmental Conservation* in accordance requirements of the Gateway Determination issued in September 2020 and the framework for strategic biodiversity certification (**Figure 2**).

As part of the Planning Proposal, two conservation areas are proposed which include area of remnant native woodland to be retained, Important Habitat for the Critically Endangered Swift Parrot in the north-west corner of the Subject Site, and low-lying managed wetland areas within the eastern portion of the Subject Site, traversing across the entire extent of the mapped watercourse from the northern boundary to existing constructed dams in the south. These two Conservations Areas are known hereafter as “North-western Conservation Area” and the “Eastern Conservation Area”. Construction of roads and pedestrian pathways will flank the southern extent of the North-western Conservation Area and Eastern Conservation Area. Parts of the Conservation Areas will be subject to rehabilitation following completion of construction, thereby increasing vegetation condition, habitat values, and connectivity, alongside strategic use of street tree plantings. Furthermore, a five (5) metre vegetation buffer will be implemented along the southern boundary of the Subject Site, protecting a number of threatened species (*Angophora inopina*), and be subject to management under this Biodiversity Management Plan (BMP).

The proposed development includes the provision of a collector road joining Chisholm Road (to the west of the Subject Site) and Wallaby Rd (to the east). The proposed collector road is a requirement of Central Coast Council, with the need of internal roads within the area (proposed “New Road 2”) proposed as part of the GHD Traffic Study for Lake Munmorah informing The Greater Lake Munmorah Structure Plan: Road Development Strategy. The proposed road will bisect the Eastern Conservation Area, however design of the road avoids key habitat features including hollow-bearing trees, and sensitive road design will ensure impacts to the watercourse are minimal.

1.4 MANAGEMENT PLAN OBJECTIVES

1.4.1 Objectives

This BMP is to accompany the submission of a development application (DA) for the proposed development. The BMP has been prepared by a suitably qualified and experienced ecologist (see **Appendix 3**) and in accordance with *Chapter 3.6 – Tree and Vegetation Management* of the Wyong Development Control Plan (DCP) 2013 (the "Wyong DCP"), and relevant guidelines including:

- Appendix 8.2 – Guidelines for Vegetation Management Plans – Version 1 of the Wyong Shire Council Flora and Fauna Survey Guidelines Version 2.4 (Wyong Shire Council 2016),
- Central Coast Council Flora and Fauna Guidelines (CCC 2019),
- National Recovery Plan for the Swift Parrot (*Lathamus discolor*) (DAWE 2019)

The key objectives of the BMP are:

1. To minimise impacts to flora and fauna, and their habitats, during the construction phase of the residential subdivision project.
2. To improve the condition of the existing remnant woodland within the 'North-western Conservation Area' to ensure that it is maintained in a healthy condition.
3. To improve the condition of the existing low-lying managed wetland areas 'Eastern Conservation Area' to ensure that it is rehabilitated and maintained in a healthy condition.
4. To ensure that landscaping and any additional plantings within the proposed development are consistent with the objectives of Swift Parrot (*Lathamus discolor*) conservation.
5. To maintain and improve fauna habitat values within the conservation areas as part of the proposed development, and to ensure the maintenance of these features and functionality throughout the implementation period.

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Legend

- Subject Site
- Development Site
- Development Site (to be rehabilitated)
- Conservation Area
- NPWSReserve
- Cadastre
- Named creek
- Minor creek
- PrimaryRoad
- ArterialRoad
- LocalRoad

Locality

Figure: **1**

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Lakes Ridge, 285 - 335 Pacific Highway,
Lake Munmorah NSW 2259

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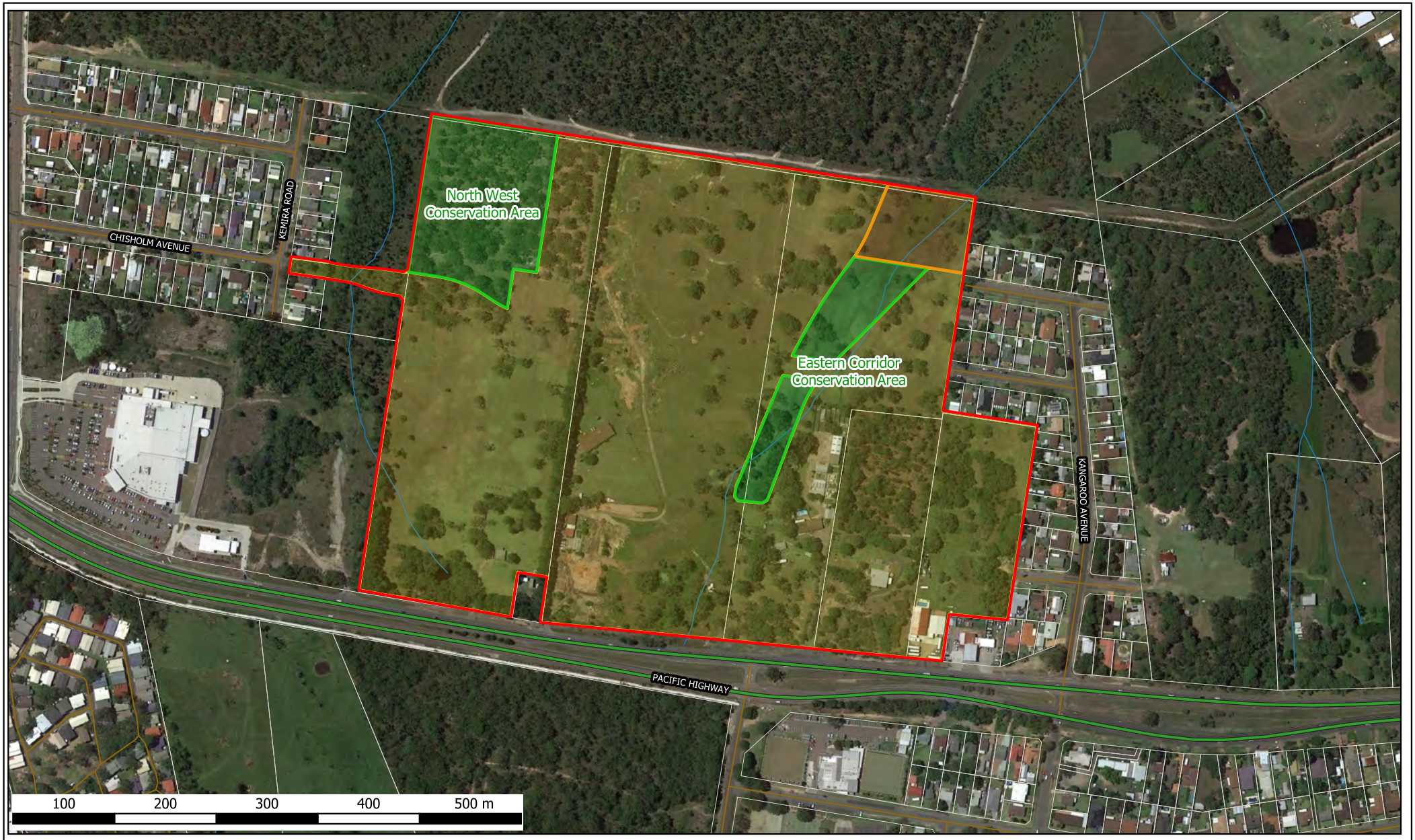

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WEDGETAIL PROJECT CONSULTING
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Legend

- Subject Site
- Development Site
- Development Site (to be rehabilitated)
- Conservation Area
- Cadastre
- Minor creek
- PrimaryRoad
- LocalRoad

Subject Areas

Figure: **2**

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Lakes Ridge, 285 - 335 Pacific Highway,
Lake Munmorah NSW 2259

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2. BIODIVERSITY VALUES

2.1 KEY BIODIVERSITY VALUES

A Biodiversity Certification Assessment Report (BCAR) was prepared for the project by Kleinfelder to support the proposed biocertification of the Subject Site (Kleinfelder 2022a). The key results of the BCAR are detailed below.

2.1.1 Flora Species

A total of 149 flora species were identified during field surveys, 44 of these were exotic species, of which eleven (11) are considered 'High Threat Exotics" and four (4) are listed Priority Weeds for the Greater Sydney Local Land Services Region under the *Biosecurity Act 2015* (NSW). Priority Weed species, Weeds of National Significance, High Threat Weed Species identified within the Subject Site are listed in **Table 1**.

Table 1 Priority Weed Species within the Subject Site.

Scientific Name	Common Name	Weeds of National Significance (WONS)	Priority weeds of the Greater Sydney LLS (Biosecurity Act)	High hreat Weeds (BAM)
Andropogon virginicus	Whiskey Grass			✓
Asparagus aethiopicus	Ground Asparagus		✓	✓
Axonopus fissifolius	Narrow-leaved Carpet Grass			✓
Cenchrus clandestinum	Kikuyu			✓
Cinnamomum camphora	Camphor Laurel			✓
Ehrharta erecta	Panic Veldt Grass			✓
Hyparrhenia hirta	Coolatai Grass			✓
Lantana camara	Lantana	✓	✓	✓
Paspalum dilatatum	Paspalum			✓
Rubus anglocandicans	Blackberry	✓	✓	✓
Senecio madagascariensis	Fire Weed	✓	✓	✓

One (1) threatened flora species was identified within the Subject Site during field surveys, *Angophora inopina* (Charmhaven Apple), listed as vulnerable under the Biodiversity Conservation Act (BC Act) 2016. The species was recorded mainly within woodland areas (Vegetation Zones 4 and 5). A list of the flora species identified within the Subject Site is provided in **Appendix 1**. Further discussion on exotic species within the Subject Site is provided in **Section 2.2.2** of this BMP.

2.1.2 Vegetation Communities

Three (3) native vegetation communities occur within the Subject Site *PCT 1649 - Smooth-barked Apple - Red Mahogany - Swamp Mahogany - Melaleuca sieberi heathy swamp woodland of coastal lowlands* (EEC), *PCT 1638 - Smooth-barked Apple - Red Bloodwood - Scribbly Gum grass - shrub woodland on lowlands of the Central Coast* and *PCT 1737 - Typha rushland* (EEC).

The above PCTs were further assigned to eight (8) vegetation zones based on floristics and vegetation condition as shown in **Table 2**. The table provides a summary of areas of each vegetation zone to be retained with no direct impacts (Conservation Areas [C2]), development impacts, and impacts resulting from the establishment of two constructed wetlands (which will ultimately be rehabilitated). Note that the Constructed Wetlands form part of both the Disturbance Footprint and the Conservation Area.

2.1.3 Fauna and Habitat Values

The Subject Site is characterised by mix of fragmented open woodlands (managed and unmanaged) with a grassy groundcover, grasslands, small areas of shrub regrowth, and scattered mature eucalypts (various species).

Shallow drainage channels intersect the Subject Site where surface flows are concentrated. Low-lying wet areas occur in the north-east in an Subject Site of Typha Rushland. Five constructed dams occur in the southern portion of the Subject Site .

As stated previously, the coverage of native vegetation within the Subject Site has been reduced due to historical vegetation clearing and land management practises such as slashing, mowing and grazing by livestock. The coverage of native shrubs and groundcover species is particularly low throughout most areas of the site, hence, habitat for fauna species that require dense vegetation for cover (refugia) is limited. Additionally, the low lack of native plant diversity also reduces the availability of foraging resources.

Despite historical disturbance within the Subject Site, an abundance of hollow-bearing trees (HBTs) occurs. Site inspections revealed that several hollows are occupied by fauna species, mostly locally occurring bird and possum species.

A summary of the key fauna habitat features identified within the Subject Site is as follows:

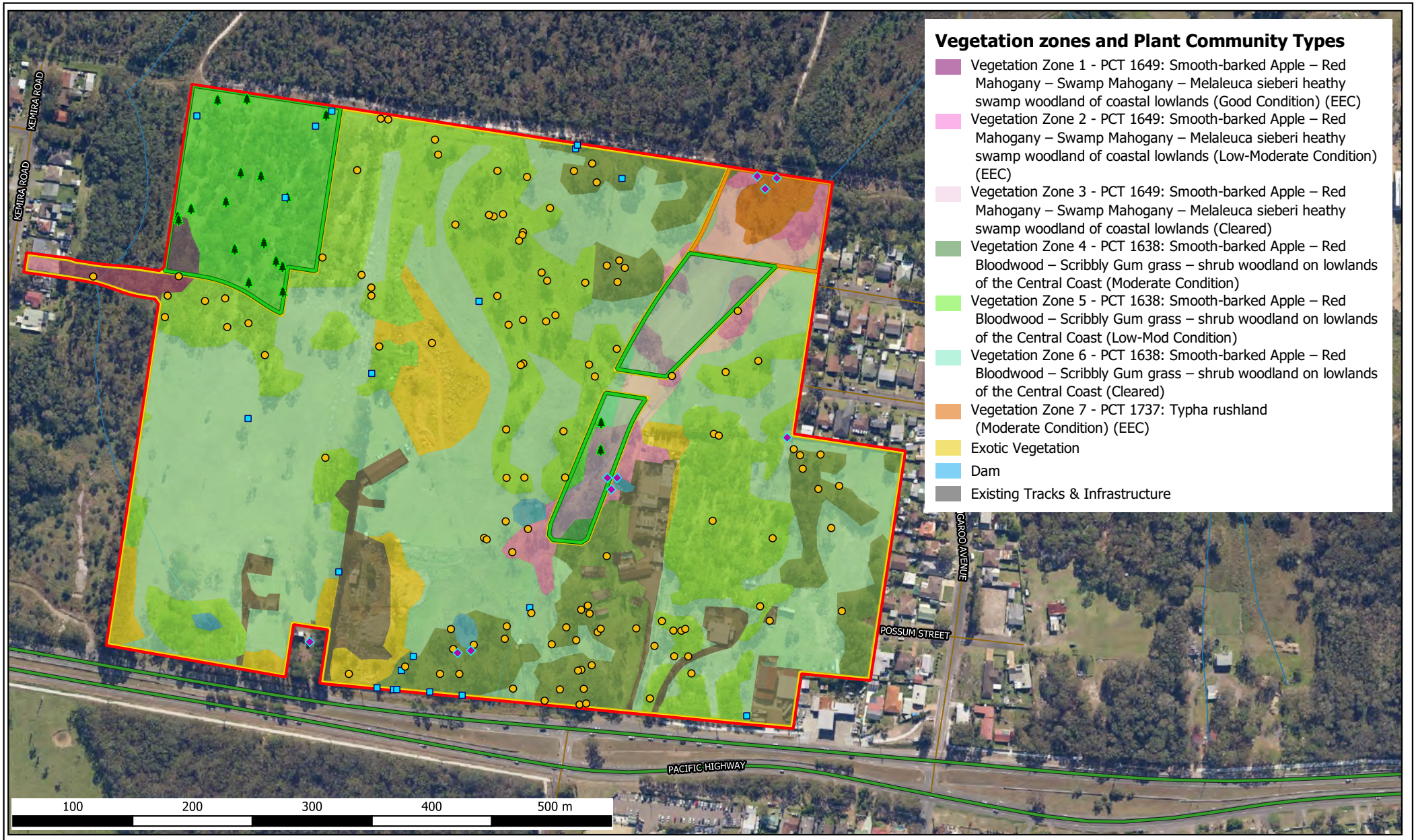
- A total of 131 Hollow-bearing Trees (HBTs) were recorded (including four dead stags with hollows). Of these trees 33 were recorded as having large hollows (>30cm diameter), 28 trees had a maximum size hollow being “medium” (20-29cm diameter) and 70 trees only had small hollows (10-19cm).
- Fallen logs and timber (limited to unmanaged areas).
- Mature eucalypts that may provide foraging and nesting habitat for native bird species.
- Two shallow ephemeral drainage channels that contain pools of water for short periods following high rainfall.
- A small Typha Rushland (0.25 ha) in the north-east corner of the Subject Site, though limited open water is present.
- Five constructed dams that contain water on a permanent/semi-permanent basis.

A total of 66 species of fauna (six amphibians, 43 birds, 17 mammals) were detected within the Subject Site during field surveys. A total of six (6) species detected within the Subject Site are listed as vulnerable under the BC Act, including the following:

- Southern Myotis (*Myotis macropus*) [Vulnerable BC Act],
- Greater Broad-nosed Bat (*Scoteanax rueppellii*) [Vulnerable BC Act],
- Little Bent-winged Bat (*Miniopterus australis*) [Vulnerable BC Act],
- Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*) [Vulnerable BC Act],
- Glossy Black Cockatoo *(Calyptorhynchus lathami*) [Vulnerable BC Act],
- Eastern Osprey (*Pandion cristatus)* [Vulnerable BC Act]

Table 2 Vegetation Zones within the Subject Site

PCT	Vegetation Zone	Condition Class	Development Site	Conservation Area		Total Disturbance Footprint	Total Conservation Area	Subject Site (ha)
				Constructed Wetland (Temporary Impacts)	Conservation Areas (C2) (No Direct Impacts)			
PCT 1649 – *Smooth-barked Apple – Red Mahogany – Swamp Mahogany – Melaleuca sieberi heathy swamp woodland of coastal lowlands(EEC)*	*Zone 1*	Good (EEC)	0.20	0	0.11	**0.20**	**0.11**	**0.32**
	Zone 2	Low- Moderate (EEC)	0.43	0.09	0.47	**0.52**	**0.56**	**0.99**
	Zone 3	Cleared	0.21	0.04	0.74	**0.25**	**0.78**	**0.99**
PCT 1638 – Smooth-barked Apple – Red Bloodwood – Scribbly Gum grass – shrub woodland on lowlands of the Central Coast	*Zone 4*	Moderate	2.87	0.00	0.05	**2.81**	**0.05**	**2.92**
	Zone 5	Low-Moderate	6.66	0	1.93	**6.66**	**1.93**	**8.59**
	Zone 6	Cleared	10.26	0.01	0.09	**10.27**	**0.10**	**10.36**
PCT 1737 – Typha rushland (EEC)	*Zone 7*	Moderate (EEC)	0	0.14	0.12	**0.14**	**0.26**	**0.26**
Exotic Vegetation	*Zone 8*	N/A	1.43	0	0	**1.43**	**0**	**1.43**
Existing Tracks & Infrastructure			1.53	0	0	**1.53**	**0**	**1.53**
Dams and Watercourse			0.14	0	0	**0.14**	**0**	**0.14**
Total			**23.46**	**0.28**	**3.51**	**24.01**	**3.79**	**27.52**



Vegetation zones and Plant Community Types

- Vegetation Zone 1 - PCT 1649: Smooth-barked Apple – Red Mahogany – Swamp Mahogany – Melaleuca sieberi heathy swamp woodland of coastal lowlands (Good Condition) (EEC)
- Vegetation Zone 2 - PCT 1649: Smooth-barked Apple – Red Mahogany – Swamp Mahogany – Melaleuca sieberi heathy swamp woodland of coastal lowlands (Low-Moderate Condition) (EEC)
- Vegetation Zone 3 - PCT 1649: Smooth-barked Apple – Red Mahogany – Swamp Mahogany – Melaleuca sieberi heathy swamp woodland of coastal lowlands (Cleared)
- Vegetation Zone 4 - PCT 1638: Smooth-barked Apple – Red Bloodwood – Scribbly Gum grass – shrub woodland on lowlands of the Central Coast (Moderate Condition)
- Vegetation Zone 5 - PCT 1638: Smooth-barked Apple – Red Bloodwood – Scribbly Gum grass – shrub woodland on lowlands of the Central Coast (Low-Mod Condition)
- Vegetation Zone 6 - PCT 1638: Smooth-barked Apple – Red Bloodwood – Scribbly Gum grass – shrub woodland on lowlands of the Central Coast (Cleared)
- Vegetation Zone 7 - PCT 1737: Typha rushland (Moderate Condition) (EEC)
- Exotic Vegetation
- Dam
- Existing Tracks & Infrastructure

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Legend

- Study Area
- Development Area
- Conservation Areas retained
- Conservation Areas impacted
- Hollow Bearing Trees to be retained
- Hollow Bearing Trees to be removed
- Threatened flora location
- Threatened fauna location
- PrimaryRoad
- LocalRoad
- Minor creek

Vegetation and Biodiversity Values

Figure: 3

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2.2 KEY THREATS

2.2.1 Inappropriate Grazing and Management of Groundcover

Inappropriate livestock grazing can have a detrimental impact on areas of native vegetation by altering the species composition and structure of the community through selective grazing of more palatable species and regenerating species (i.e. canopy species), soil compaction and facilitating weed incursion (DECCW 2010). The Subject Site is currently subject to a medium to high level of grazing (horses and sheep) which is likely to be influencing the diversity and cover of native flora, along with reduced tree and shrub recruitment. These impacts are compounded by regular management of the groundcover through mowing.

Grazing will be excluded from areas of retained vegetation under this BMP during the **Construction** and **Operational** phases of the proposed development.

2.2.2 Weed Incursions

Weeds are recognised as a key threat to the retained vegetation within the Subject Site, with the fertile and productive nature of low-lying wet areas leading to an increased vulnerability to weed species invasion and spread (DAWE 2020). Weed establishment and dominance can lead to changes in nutrient cycling, species composition, structure and fauna habitat values (DAWE 2020).

A total of five (4) Priority Weed species for the Greater Sydney Local Land Services Region (DPI, 2022) were identified within the Subject Site. Weed mapping will occur during the first monitoring event.

Weed incursions will continue to be a threat to biodiversity values during:

- ***Construction Phase:*** Construction activities occurring on site as part of the proposed development, namely vehicle movements and transport of materials (i.e. soil and mulch) have the potential to facilitate the spread of exotic flora species within the Subject Site.
- ***Operational Phase:*** The proposed development, if unmanaged, may further exacerbate local weed incursions or facilitate the introduction of novel weed species through the movement of weed seeds/propagules and changes to nutrient inputs from increase runoff.

2.2.3 Invasive Fauna Species

Invasive fauna species are potentially a key threat to native vegetation retained within the Subject Site, particularly to areas of Conservation Areas. Species relevant to the Subject Site include introduced herbivores (i.e. Horses, Sheep and Goats) – discussed in **Section 2.2.1**), introduced predators (i.e. Mosquito fish [*Gambusia holbrooki*]) and invasive native species (Noisy Miner [*Manorina melanocephala*]). Introduced predators such as the Mosquito fish pose a key threat to

native fauna through predation, especially locally occurring frog species, limiting the ability for locally occurring frog populations to persist within the Subject Site. A range of threatened woodland and forest bird species listed under the Threatened Species Conservation Act 1995 are adversely affected by aggressive exclusion by abundant Noisy Miners including the Swift Parrot (*Lathamus discolor).*

Invasive fauna species are likely to be a key threat to biodiversity values during:

- ***Operational Phase:*** The proposed development may further exacerbate the threat of invasive species through the reduction of suitable refuge habitats for frogs and tadpoles (protection from Mosquito fish).

2.2.4 Vegetation Clearing and Habitat Loss

The proposed development will require the clearing of native vegetation, including 24.01 ha of native forest/woodland (PCT 1649 – *Smooth-barked Apple – Red Mahogany – Swamp Mahogany – Melaleuca sieberi heathy swamp woodland of coastal lowlands, PCT 1638 – Smooth-barked Apple – Red Bloodwood – Scribbly Gum grass – shrub woodland on lowlands of the Central Coast and PCT 1737 – Typha rushland* (EEC)). Vegetation clearing will involve the removal of 115 hollow-bearing trees (containing 58 small hollows 102 medium sized hollows and 49 large hollows), representing potential nesting habitat for various native bird and arboreal mammal species. Incursions into areas of native forest may exacerbate existing weed management threats and adversely impact threatened species and ecological communities proposed to be retained within the Subject Site.

Vegetation clearing and habitat loss represents a threat to biodiversity values during:

- ***Construction Phase:*** Other than the direct impacts to native vegetation and fauna habitat detailed above, construction activities within the Subject Site have the potential to impact retained vegetation through accidental incursions, and the introduction and facilitation of weed incursions.
- ***Operational Phase:*** The proposed residential subdivision may further exacerbate habitat loss and degradation of vegetation through inappropriate management of retained vegetation.

2.2.5 Erosion and Sedimentation

Erosion resulting from earthworks such as the operation of machinery during the construction phase may facilitate the movement of water-borne sediments that have the potential to adversely impact important biodiversity values on site. This may include impacts on the condition of native vegetation

including wetlands, threatened ecological communities (*Typha Rushland* EEC) and threatened species habitat.

2.2.6 Lighting, Noise and Water Pollution

Urban developments can result in a number of indirect impacts native vegetation communities and the habitat they provide, including increased lighting (light pollution) and noise (noise pollution), and changes to surface water runoff and quality. Threats to local biodiversity values pertaining to the proposed development include the following:

- ***Construction Phase:*** Increased noise from construction activities and changes to surface water runoff patterns and quality into adjacent wetland.
- ***Operational Phase:*** The proposed development may result in changes to soil nutrient status from increased runoff, and increased/inappropriate lighting and noise from traffic during operation.

Stormwater Quality

A total of two (2) stormwater retention basins are proposed within the Subject Site, located within along the western boundary and within the north-eastern corner of the Subject Site. The location and layout of the western basin was selected so as to minimise impacts to native vegetation, especially mature trees known to provide foraging habitat for the threatened Swift Parrot (*Lathamus discolor*). Both basins are to be designed as constructed wetlands, involving the rehabilitation of wetland vegetation occurring within the Subject Site and representative of *PCT 1737 – Typha Rushland* (Vegetation Zone 7). The water flow and pollutants into the coastal wetland have avoided direct and indirect impacts to the sensitive ecosystem. The design ensures that the water flow and pollutants to the coastal wetland will now be equal to or less than that modelled for the pre-development state.

The establishment of the two constructed wetlands is further detailed in **Section 3.4.2**.

3. MANAGEMENT PLAN

3.1 MANAGEMENT ZONES

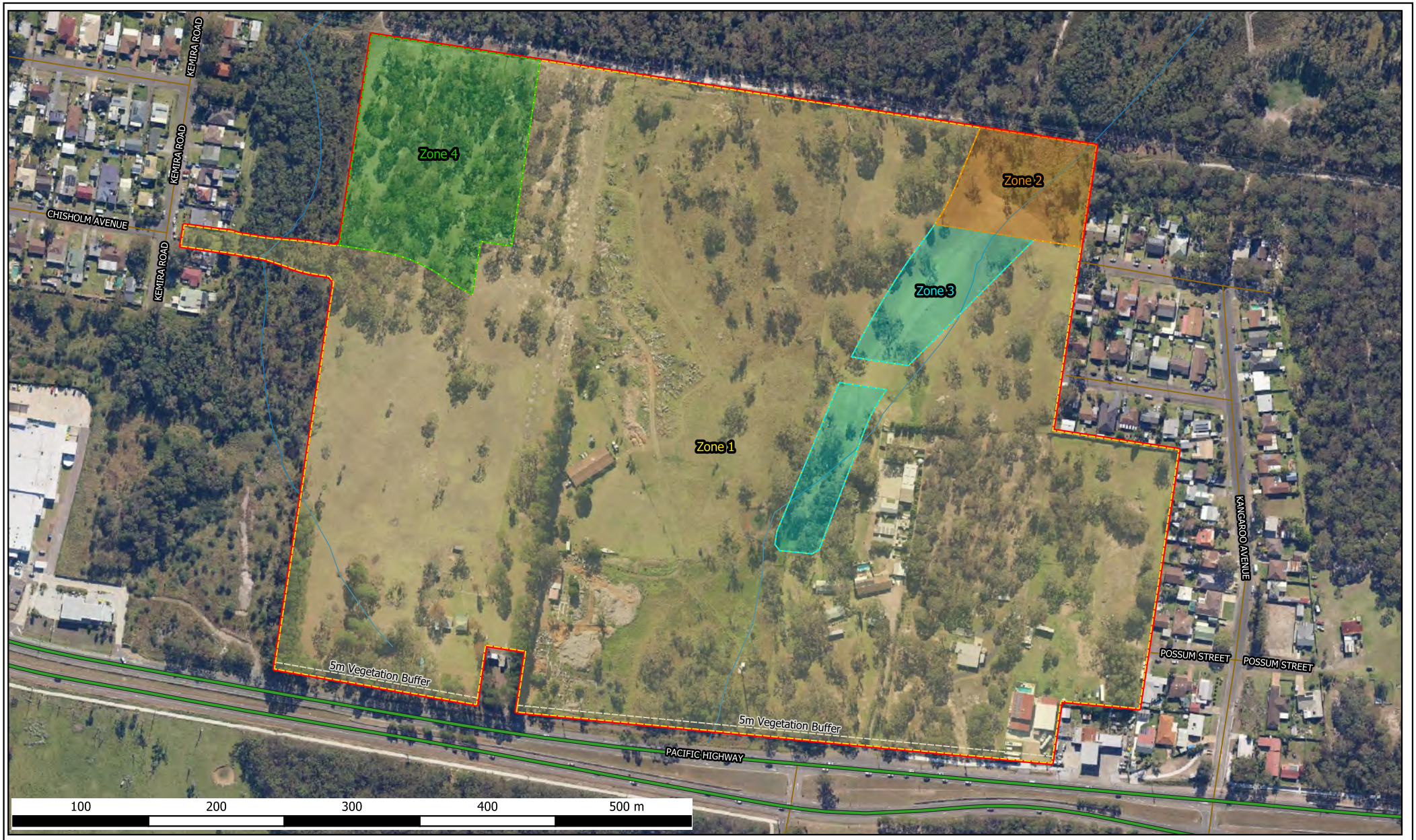
A total of four (4) Management Zones within the Subject Site have been delineated based on current condition/status, management requirements, and proposed future land use. The management zones are shown in Figure 4, and detailed in **Table 3**.

- **Management Zone 1:** Development Site
- **Management Zone 2:** Eastern Conservation Area (Detention Basin – Constructed Wetland)
- **Management Zone 3:** Eastern Conservation Area
- **Management Zone 4**: North-western Conservation Area

Table 3: Management Zones within the Subject Site

Management Zone	Description
Management Zone 1: Development Site	**Total area within Subject Site:** 23.73 ha **Community:** PCT 1649 – *Smooth-barked Apple – Red Mahogany – Swamp Mahogany – Melaleuca sieberi heathy swamp woodland of coastal lowlands, PCT 1638 – Smooth-barked Apple – Red Bloodwood – Scribbly Gum grass – shrub woodland on lowlands of the Central Coast* and Exotic Vegetation. Also including existing infrastructure and dams. **Description:** The vegetation throughout the site is characterised by a mix of remnant low woodland vegetation, scattered mature eucalypts, managed grassland, and windbreaks comprised of planted Radiata Pine (*Pinus radiata*). Groundcover within the Subject Site is comprised of native and exotic species (mainly introduced perennial grasses). The lack of plant diversity in the groundcover is likely to be the result of land management practices including grazing and slashing by the current landowners. **Management Goals:** Goals associated with this vegetation zone include the appropriate management of impacts such as vegetation clearing, weed establishment, erosion and nutrient movement. This area will be subject to ongoing operational impacts with landscaping. Landscaping is to be consistent with the adjacent retained native vegetation communities, with street trees to be selected so as to provide foraging habitat for the Swift Parrot.
Management Zone 2: Eastern Conservation Area (Detention Basin – Constructed Wetland)	**Total area within Subject Site:** 0.73 ha **Community:** *PCT 1737 – Typha rushland (Moderate Condition - EEC)* **Form:** Moderate Condition Freshwater Wetlands **Description:** The vegetation within Management Zone 3 is dominated by *Typha orientalis* (Broad-leaved Cumbungi) with a mix *Gahnia clarkei* (Tall Saw-sedge), of herbs including *Ranunculus inundatus* (River Buttercup), *Baumea rubiginosa*, *Cyperus polystachyos*, and *Schoenus apogon* (Fluke Bog-rush). The canopy and midstorey is absent, with the exception of occasional emergent of *Melaleuca quinquenervia* (Broad-leaved Paperbark) and *Eucalyptus robusta* (Swamp Mahogany). The vegetation Zone 7 is characterised by a predominantly low cover of exotic species, however *Andropogon virginicus* (Whiskey Grass) is invading the edges of the community. **Disturbances:** This zone has a low cover of exotic species, however *Andropogon virginicus* (Whiskey Grass) is invading the edges of the community.

Management Zone	Description
	Management Goals: Goals will include the restoration and maintenance of a native constructed wetland, with the restored vegetation being commensurate with *PCT 1737 – Typha rushland*.
Management Zone 3: Eastern Conservation Area	**Total area within Subject Site:** 1.06 ha **Community:** *PCT 1649 – Smooth-barked Apple – Red Mahogany – Swamp Mahogany – Melaleuca sieberi heathy swamp woodland of coastal lowlands (Low – Moderate Condition – EEC)* and *PCT 1649 – Smooth-barked Apple – Red Mahogany – Swamp Mahogany – Melaleuca sieberi heathy swamp woodland of coastal lowlands (Cleared)* **Form:** Low – Moderate Condition **Description:** The vegetation within this Management Zone 2 was characterized by largely cleared land with areas including an open canopy of *Angophora floribunda* (Rough-barked Apple), *Eucalyptus resinifera* (Red Mahogany), *Eucalyptus robusta* (Swamp Mahogany), *Melaleuca quinquenervia* (Broad-leaved Paperbark), and *Eucalyptus haemastoma* (Broad-leaved Scribbly Gum). The midstorey is variable, with areas around waterbodies (constructed dams) and wetlands (Vegetation Zone 7) being characterised by *Melaleuca quinquenervia* juveniles, and *Melaleuca sieberi*. The shrub layer and groundcover is predominantly managed throughout the vegetation zone with occasional *Pittosporum undulatum* (Sweet Pittosporum) and *Livistona australis* (Cabbage Tree Palm). The groundcover is dominated by a mix of native and exotic grasses including *Andropogon virginicus* (Whisky Grass), *Themeda triandra* (Kangaroo Grass), *Sporobolus virginicus* (Sand Couch), and *Eragrostis leptostachya* (Paddock Lovegrass). Low lying areas had a greater abundance of species such as *Baumea rubiginosa*, *Cyperus polystachyos*, *Schoenus apogon* (Common Bog-rush), and *Juncus holoschoenus*. **Disturbances:** Historic vegetation clearing, grazing, and moderate weed invasion. *The vegetation zone generally has a low cover of exotic species, however Andropogon virginicus (Whiskey Grass) occurs throughout the vegetation zone.* **Management Goals:** This zone will be retained and subject to active restoration of a native vegetation closely to PCT 1649. Goals within this zone include the planting of native canopy species, improve fauna habitat values, and a reduction of weed impacts. Active restoration of the riparian zone within this Management Zone aims to provide a stable watercourse and riparian corridor which will emulate local native vegetation communities.
Management Zone 4: North-western Conservation Area	**Total area within Subject Site:** 1.99 ha **Community:** *PCT 1638 – Smooth-barked Apple – Red Bloodwood – Scribbly Gum grass – shrub woodland on lowlands of the Central Coast (Low-Moderate Condition)* **Form:** Low to Moderate Condition **Description:** The vegetation within this Management Zone is characterised by a canopy dominated by *Angophora costata* (Smooth-barked Apple), *Eucalyptus haemastoma* (Broad-leaved Scribbly Gum), with *Corymbia gummifera* (Red Bloodwood) and *Eucalyptus capitellata* (Brown Stringybark). The midstory is sparse and comprised of species including *Allocasuarina littoralis* (She-oak). The ground layer is variable across the Subject Site based on management regime (grazing, mowing, or left idle) but can be generally characterized by a mix of native and exotic grasses including *Themeda triandra*, *Andropogon virginicus* (Whiskey Grass), *Aristida vagans*, *Entolasia stricta* (Wiry Panic), *Microlaena stipoides* (Weeping Grass) and *Eragrostis brownii* (Brown's Lovegrass) **Disturbances:** Exotic species cover is variable, with Whiskey Grass being widespread and patches of *Rubus anglocandicans* (Blackberry) within the south of the Subject Site. Historic grazing and slashing practices have occurred intensively over the area. **Management Goals:** This zone will be retained and subject to active management to maintain and restore native vegetation condition, improve fauna habitat values and reduce weed impacts.



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Legend

- Study Area
- Management Zone 1
- Management Zone 2
- Management Zone 3
- Management Zone 4
- 5m Vegetation buffer
- Primary Road
- Local Road
- Minor creek

Management Zones

Figure: **4**

Rose Living Pty Ltd, C-/ Barker Ryan Stewart
Lakes Ridge, 285 - 335 Pacific Highway,
Lake Munmorah NSW 2259

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3.1.1 Management Stages

The BMP will be implemented over a 5-year period. The timing of management tasks and performance criteria are based on Management Stages defined by the progress of the proposed development. The stages are defined as the following:

- **Pre-Construction Phase:** Between development approval and the initiation of construction works on site.
- **Construction Phase:** Between the initiation and completion of construction within the site.
- **Post Construction Phase:** Between the completion of construction and the first monitoring event.
- **Adaptive Management/Operational Phase:** Between the first monitoring event and the end of the implementation period, 5 years after the completion of construction.

3.1.2 Performance Criteria

The overall performance criterion of this BMP are as follows:

- **Vegetation Condition (Management Zones 3 and 4):** The condition of native vegetation within Management Zones 1, and 2 will be maintained or improved, based on baseline plot data recorded during initial impact assessments (Kleinfelder 2022) by the end of the implementation period (5 years). Condition benchmarks including species composition, structure and function attributes are to be monitored in accordance with the Biodiversity Assessment Method (BAM) 2020 and associated guidelines (i.e. the BAM Ecological Monitoring Module). These benchmarks are detailed in **Table 4.**
    - Condition of threatened flora species within the 5m vegetated buffer will be monitored, with no loss in threatened trees throughout the BMP implementation period
- **Vegetation Extent:** The area of native vegetation within Management Zone 2 (Retention Basin) is to be rehabilitated with active restoration and planting of flora species commensurate with *PCT 1737 – Typha rushland* after its construction (**Appendix 2**). Condition benchmarks including species composition, structure and function attributes are to be monitored in accordance with the Biodiversity Assessment Method (BAM) 2020 and associated guidelines (i.e. the BAM Ecological Monitoring Module) after the rehabilitation of the Retention Basins. These benchmarks are detailed in **Table 4.**
- **Fauna Management (Management Zone 1):** Management of impacts such as vegetation clearing, weed establishment, erosion and nutrient movement. This area will be subject to ongoing operational impacts with landscaping. Landscaping is to be consistent with the adjacent retained native vegetation communities.

- Other:
  - The maintenance of boundary fencing and signage around the Conservation Areas where practical.
  - The establishment and maintenance of habitat features (i.e. nest boxes and/or repurposed hollows).
  - Reduction of Priority Weeds, Weeds of National Significance (WoNS), and High Threat Weeds (HTWs).
  - No signs of firewood collection, dumping of waste (inc. garden waste)

Table 4 Vegetation Condition Performance Targets

Variable #	Condition Variable	Current Status	5-year Target	Responsibility
Management Zone 2				
Rehabilitated *PCT 1737 – Typha rushland*				
1.	Species Composition (BAM Condition Score)	87.0	90	Landowner
2.	Vegetation Structure (BAM Condition Score)	48.3	70	Landowner
3.	Vegetation Function (BAM Condition Score)	N/A	N/A	Landowner
4.	Exotics Species (BAM Plot Data)	42%	5%	Landowner
Management Zone 3				
Rehabilitated *PCT 1649 – Smooth-barked Apple – Red Mahogany – Swamp Mahogany – Melaleuca sieberi heathy swamp woodland of coastal lowlands*				
1.	Species Composition (BAM Condition Score)	39.4	70	Landowner
2.	Vegetation Structure (BAM Condition Score)	50.1	70	Landowner
3.	Vegetation Function (BAM Condition Score)	15.0	50	Landowner

Variable #	Condition Variable	Current Status	5-year Target	Responsibility
4.	Exotics Species (BAM Plot Data)	66%	5%	Landowner
Management Zone 4				
Maintained *PCT 1638 – Smooth-barked Apple – Red Bloodwood – Scribbly Gum grass – shrub woodland on lowlands of the Central Coast*				
1.	Species Composition (BAM Condition Score)	24.1	50	Landowner
2.	Vegetation Structure (BAM Condition Score)	34.6	50	Landowner
3.	Vegetation Function (BAM Condition Score)	56.1	70	Landowner
4.	Exotics Species (BAM Plot Data)	7%	5%	Landowner

3.1.3 Responsibilities

Implementation and funding of this BMP is the responsibility of the proponent who will be the proprietor of the Conservation Areas throughout the implementation period and into perpetuity. This BMP will be implemented over a five (5) year period. Management of the reserve will adopt an adaptive management process and may be subject to review of monitoring results and recommendations. A review of management requirement will be completed at the end of the 5 year implementation period, with recommendations for management into perpetuity to be provided in consultation with Central Coast Council.

Strategies outlined in the BMP will be undertaken by suitably experienced and qualified persons or companies engaged by the proprietor of the site and reserve. Any vegetation restoration works (including weed management, plantings and landscaping) will be undertaken by a suitably qualified and experienced professional bush regeneration contractor. The minimum qualifications and experience required for the bush regeneration contractor are a TAFE Certificate IV in Conservation and Land Management (or equivalent) and three years demonstrated experience (for site supervisor) and a TAFE Certificate 2 in Conservation and Land Management and one year demonstrated

experience (for other personnel). Monitoring and reporting will be undertaken by suitably qualified Ecologists

3.2 PRE-CONSTRUCTION PHASE

3.2.1 Construction Environmental Management Plan (CEMP)

A Construction Environmental Management Plan (CEMP) will be established prior to the commencement of construction. The CEMP must include:

- The environmental site management measures must remain in place and be maintained throughout the period of the development.
- The CEMP must address all environmental aspects of the development's construction phases, and include where relevant, but not be limited to, the following:
  - Project Contact Information
  - Site Security Details
  - Timing and Sequencing Information
  - Site Soil and Water Management Plan
  - Noise and Vibration Control Plan
  - Air Quality monitoring and management
  - Health and Safety Plan
  - Incident Management Contingency
  - Implementation of mitigation measures specified in Section 5 (subsections 5.3) of the Biodiversity Certification Assessment Report (BCAR) (Kleinfelder 2022).
  - Unexpected Finds Protocol

3.2.2 Establishment of Monitoring Program

Floristic monitoring plots and photo monitoring points are to be established within the Conservation Areas in accordance with monitoring program detailed in **Section 3.5.1.** Baseline monitoring is to be completed within one (1) month of the commencement of construction works within the Subject Site.

3.3 CONSTRUCTION PHASE

The following measures will be adhered to within the construction phase of the project, that being immediately prior to, during and immediately after completion of clearing, earthworks and construction. All contractors, sub-contractors, and personnel must be notified of these measures.

3.3.1 Construction Impact Mitigation

The procedures and mitigation measures detailed below are to be followed/implemented to minimize direct and indirect impacts to biodiversity values within the Subject Site:

- Vegetation may only be removed from the approved development footprint
- Exclusion fencing will be installed around the boundaries of vegetation to be retained (including Management Zone 3, 4 and the 5m Vegetation Buffer). The exclusion fencing will extend out to at least 5 m from trees and native vegetation.
- Trees to be retained within the Development footprint will have bunting installed around their drip line, to prevent any disturbance that may impact on their health; this must remain around the tree until all construction activities have been completed.
- The areas of retained vegetation within the exclusion fencing shall be marked as **'No-Go' zones**. All vehicles, construction materials and refuse will be prohibited from these areas. Compaction and the placement of fill within 5 metres of trees and native vegetation will be prohibited.

3.3.2 Vegetation Clearing Supervision

The following procedures in relation to vegetation clearing are to be followed to minimise impacts to biodiversity values within the Subject Site and to maximise the salvage of habitat features to be used in restoration works within the Conservation Areas.

- Vegetation clearing should be avoided during the months of spring, to avoid the peak breeding period of hollow-dependent fauna.
- Preclearing surveys will be conducted by the project ecologist and will include the following procedures:
  - The project ecologist will inspect vegetation within the clearing footprint and advise the site manager and tree clearing staff of any habitat potential and precautions necessary during vegetation removal.
  - Any significant, salvageable habitat features (such as large ground logs and bush rocks) will be clearly marked with flagging tape or spray paint and are to be salvaged and redistributed in the Conservation Areas, under the supervision of the project ecologist.
  - All hollow-bearing trees in the clearing footprint will be clearly marked with flagging tape and/or spray paint.
- Removal of hollow-bearing trees will be done under the supervision of the project ecologist and will include the following tree felling procedures:

- Immediately prior to felling, hollow-bearing trees are to be knocked (with an excavator bucket or other machinery) to encourage fauna to evacuate the tree. The hollow-bearing tree will then be “soft-felled”. Sectional dismantling will be undertaken where hollows are to be reused (on instruction from the project ecologist).
- Felled trees will be inspected by the project ecologist or licensed wildlife carer immediately following tree felling. Any displaced fauna will be relocated into adjacent habitat, as close to the development area as possible. Any injured fauna will be placed into the care of a local veterinary hospital or wildlife rescue group. In circumstances where native fauna species are detected, clearing will cease until the ecologist or wildlife carer has relocated the animal.
- Before being stock-piled, felled trees must be left for at least 24 hours on the ground to allow fauna to escape.
- Any salvaged hollows will then be stockpiled, to be used as ground habitat in the retained Conservation Areas. These hollows are to be placed in such a way as to look natural, not add to bushfire risks, and to provide benefit to native fauna (on instruction from the project ecologist).
- Note that nest box installation, maintenance and monitoring will be undertaken to offset the loss of the hollows in the development footprint. Nest boxes/repurposed hollows must be installed in trees that do not currently have natural hollows present. However, as almost all trees within the Conservation Areas already contain multiple hollows, nest boxes may need to be installed at an alternative site approved by Council.
- Cleared vegetation (that is not salvageable as ground habitat, see above) will be mulched and re-used throughout the site, where necessary, as part of any vegetation regeneration or landscaping activities. Non-salvageable material shall be disposed of in an approved manner.
- If any injured or displaced fauna are encountered onsite in the absence of an ecologist or licensed wildlife carer, the advice of the ecologist and/or a local wildlife rescue group will be sought immediately.
- During site inductions, all contractors, sub-contractors, and personnel must be notified of these vegetation protection requirements.

3.3.3 Nest Box Installation

Potential roosting and denning habitat occurs within the Development Site for a range of locally occurring fauna species. A total of 115 habitat trees containing 209 hollows will be removed during construction. A total of 105 (50%) nest boxes will be installed prior to construction, providing compensatory nesting habitat for any displaced fauna. It is recommended that nest boxes be sought

from commercial suppliers that produce a range of nest boxes that have been designed to suit specific species/groups of wildlife. The requirement for further nest boxes will be determined following the clearing of the 115 habitat trees within the Development site, allowing for a more accurate estimate of total hollow removal within the Subject Site. Further locations will need to be determined to the North of the site with areas within the Conservation area not being large enough to install the entirety of the nest boxes due to already having hollow bearing trees and the small areas.

Important characteristics when constructing or commissioning nest boxes include the following:

- The front and base should be made from hardwood (> 25 mm thick).
- The box should include a hinged lid to allow easy inspection during monitoring/maintenance checks (the hinge should be stainless steel or aluminium).
- Only non-toxic paint should be used on the outside and the inside and the entrance hole should be left un-painted.
- Grooves should be cut on the inside face to allow ease of access/exit.
- Drainage holes should be included in the base.
- Wood shavings or sawdust should be placed in the bottom of the box prior to installation.
- Rear entrances should be included in the design where appropriate.

Hollows removed will be replaced with nest-boxes on a ratio of 1:1. A total of 105 Nest Boxes must be installed at least two weeks prior to vegetation clearing. The following nest box types are to be installed:

- Microbat boxes: 15.
- Small Parrot (Lorikeet) boxes: 15
- Medium Parrot (Galah) boxes: 20
- Small Arboreal Mammal boxes: 20
- Medium Arboreal Mammal boxes: 20
- Possum boxes: 15

Nest boxes are to be installed in the retained portion of the Subject Site and adjacent areas. The exact location of nest box placement within these areas should be determined by a qualified Ecologist during installation and should consider the following factors:

- Target species home range and likely territory to be defended.
- Fauna access (e.g. flight path for birds).

- Aspect (i.e. overheating can increase mortality of young).
- Distance to feeding resources.
- Camouflage from potential predators.
- Access for monitoring.

Nest boxes should be mounted in healthy living trees without existing hollows. Aspect of the nest box should aim to provide shelter from the sun and rain (Freegard and Richter 2009), with the exception that bat boxes may be positioned to receive late afternoon sun providing warmth prior to nocturnal exit (Goldingay and Stevens 2009). Bat boxes should be installed on a tree clear of branches above or below the box (de Souza-Daw 2003) and where possible nest boxes should be installed on opposite sides of a single tree to provide two approaches and exit options. Labelled nest boxes should be placed within Management Zone 3 and 4 and in adjacent areas to the north in consultation with council. Each nest box will be marked using GPS to aid in the next years monitoring event. Monitoring of installed nest boxes is detailed in **Section 3.5.1.**

3.3.4 Management of Erosion and Sedimentation

Hydrological and erosion / sediment controls must be implemented to maintain the quality and quantity of pre-development water flows into downstream wetland areas.

Measures to reduce soil erosion and pollutant run-off during construction activities include:

- Installation of erosion and sediment control measures (including silt fencing) around the boundary of the Conservation Areas prior to any works.
- Regular inspection of erosion and sediment control measures, particularly following rainfall events, to ensure their ongoing functionality.
- Management of excavated materials to reduce the movement of sediments during high wind or rainfall events.
- Avoiding stockpiling of materials within or adjacent to the Conservation Areas, stockpiling should be undertaken in areas that are already cleared/ disturbed.
- Undertake maintenance of silt fences and other mitigation measures to isolate runoff.

Erosion and sediment control measures should be designed and installed following the Guidelines for Erosion and Sediment Control on Building Sites (DLWC 2001). Useful information can also be found within the Blue Book (Landcom 2004).

3.3.5 Weed Management During Construction

Appropriate weed control measures must be implemented during the construction phase, including the following:

- All weeds removed from the site must be transported in a sealed container or bag and disposed at a waste management facility licensed to accept green waste.
- Vehicles, machinery and equipment must be free from weed material (including seeds) before entering the construction corridor.

3.4 POST CONSTRUCTION PHASE

3.4.1 Establishment of Conservation Areas

Permanent boundary fencing must be erected around the boundaries of the Conservation Areas. Fencing must be of a type that is durable, restricts vehicle access and allows movement of native fauna. Suitable fencing could include open post and rail or post and wire (no barbed wire on the top or bottom strand), or a low fence largely restricting vehicle access and delineating the boundary of the Conservation Areas.

Permanent educational conservation signs must be installed at multiple points around the boundary of the Conservation Areas, so they are clearly visible to the residents of the new residential development. Information must include a summary of restrictions associated with the Conservation Areas (e.g. no firewood collection, vehicle access or livestock grazing). Signage must also include suggestions on how to minimize impacts on the native vegetation, by undertaking activities such as planting local species in gardens, minimising clearing, erecting nest boxes, limiting use of fertilisers, controlling pets and managing weeds.

3.4.2 Restoration of Conservation Areas

Active restoration of Conservation Areas will occur in Management Zones 2 and 3, with the adaptive management being the preferred method for Management Zone 4 (i.e. natural regeneration, monitoring and intervention only where required). Consequently, each zone has specific restoration requirements based on current state, future use, and condition. Detailed goals for each management zone are detailed in **Table 3**, performance criterion for the Conservation Areas are summarised in **Table 4.**

The restoration of the Conservation Areas within Subject Site will adopt a strategy of adaptive management, informed by annual monitoring results and recommendations.

Restoration techniques used within the Conservation Areas include removal of livestock (horses, sheep and goats), weed management, tubestock planting/direct seeding, habitat augmentation, and fire management. These are detailed below.

Removal of Livestock Grazing

The site has a long history of use for horse, sheep and goat grazing and has been exposed to various agricultural management regimes including slashing of grasslands. These practices have likely impacting native floristic diversity and structure, canopy regeneration, weed abundance, and resulted in elevated nutrient loads. As such, grazing fauna will be excluded from the Conservation Areas within the **Pre-Construction Phase**. Monitoring will inform the adaptive management of the Conservation Areas to reverse the impacts of previous land use (i.e. soil nutrient management) (see Rawlings, *et al*. 2010).

Weed Management

Weed management will be undertaken within Management Zones 2, 3 and 4 in accordance with **Section 3.4.4**.

Revegetation and Supplementary Planting

The Conservation Areas are characterized by sparse mature woodland, minimal scattered native shrubs, and a high cover and diversity non-native grasses. Fauna grazing is likely to have limited the natural regeneration of native canopy within the Subject Site. The exclusion of livestock from the Conservation Areas during the **Pre-Construction Phase** is expected to result in increased native species recruitment and survival, negating the need for extensive supplementary planting within Management Zone 4 and much of Management Zone 3. Natural regeneration is expected to be further assisted through the control and suppression of weeds throughout the BMP implementation period.

The following planting is recommended:

- **Management Zone 1**: Planting of tree species characteristic of the local vegetation community onsite (see **Appendix 2**) will be utlised within the road reserve along the Eastern boundary of the Subject Site.
- **Management Zone 2:** Planting of wetland species characteristic of the local vegetation community (PCT 1737) (see **Appendix 2**) will be required after the sediment basin has been completed within the Management Zone.
- **Management Zone 3:** Supplementary planting of shrub species characteristic of the local vegetation community (PCT 1649) (see **Appendix 2**). No planting of canopy or groundcover species initially. The requirement for supplementary planting of canopy and groundcover species will be addressed within recommendations of annual monitoring reports.

- **Management Zone 4:** Supplementary planting of shrub species characteristic of the local vegetation community (PCT 1638) (see **Appendix 2**). No planting of canopy or groundcover species initially. The requirement for supplementary planting of canopy and groundcover species will be addressed within recommendations of annual monitoring reports.

All planting should utilize the species listed within **Appendix 2**, with preference for local provenance stock. Where these species cannot be sourced, only local species commensurate with the PCT's that occur onsite can be utilized.

Habitat Augmentation

Fallen and standing timber (coarse woody debris and dead branches, snags, stumps etc) provides essential or important breeding, foraging or shelter habitat for many threatened species. All tree trunks and larger branches (over 10 cm diameter) are to be removed from the development area during vegetation clearing. Suitable logs and branches are then to be cut up into long pieces (i.e. over 4 m where possible) and carefully placed into woodland and grassland areas within the Conservation Areas. Placement of logs and branches are to be in such a way as to look natural, not add to bushfire risks, and to provide benefit to native fauna (on instruction from the project ecologist).

3.4.3 Landscaping of Parks and Open Spaces

Landscape planting in parks and open spaces within the Subject Site will include plant species consistent with local vegetation. Species recommended for planting are detailed within **Appendix 2**. The following measures are to be implemented in the landscaping of parks and open space areas:

- Any native trees to be retained within proposed parks and open space areas will be protected during construction and appropriately maintained throughout the implementation period.
- Stockpiled topsoil and mulched vegetation from the development site will be utilised in site landscaping and revegetation works for any areas that require rehabilitation.
- Where any plantings are required, locally indigenous flora will be used. Plants must be sourced from nurseries that grow seed sourced from local areas, to avoid planting of human created cultivars.
- Street trees within the Development Site will include locally occurring Swift Parrot Feed Tree species including *Eucalyptus robusta* (Swamp Mahogany) and *Corymbia gummifera* (Red Bloodwood).
- For any park areas that require turfing or direct seeding, only non-invasive (and preferably locally native) grasses/groundcovers will be used.

- Fertiliser use will be strictly limited to a specifically designed Australian native plant fertiliser or an organic based fertiliser with low levels of phosphorus (P). Artificial and chemical fertilisers are strictly prohibited.

3.4.4 Weed Management

Weed management within the Conservation Areas will prioritise the management of the four (4) listed Priority Weed species detected within the Subject Site, including:

- *Asparagus aethiopicus* (Ground Asparagus) [Priority Weed]
- *Lantana camara* (Lantana) [WoNS and Priority Weed]
- *Senecio madagascariensis* (Fireweed) [WoNS and Priority Weed]
- *Rubus anglocandicans* (Blackberry) [WoNS and Priority Weed]

Weed mapping should be conducted during the first monitoring event of the Subject Site to determine areas of weed incursions and methods of control.

Management will adopt the 'Bradley method', which involves the progressive removal of weeds from less disturbed areas (outside of mapped weed infestations), followed by removal from more weed infested areas (i.e. mapped weed infestation areas). This method also aims to remove weeds with minimal disturbance and allow native species to re-establish naturally from the existing seed bank and rootstock.

The following steps are to be followed when controlling weeds on the site:

1. The weed removal team will require a site-specific induction, to understand what weeds are to be removed, the process of removal, identification of the native species, and the procedures to be followed.
2. Manual weed removal. Due to the high cover of native species within the groundcover and seedbank in the Conservation Areas the manual removal of weeds will be prioritised where possible.
3. Weed propagules collected during weed control activities are to be taken offsite. This will stop weed material smothering native plants and prevent re-establishment. This material is to be taken to an appropriate waste disposal center to prevent further weed spread in the region.
4. Chemical weed control. Chemical should be applied only where application to larger weeds can be isolated (i.e. no broad application).

For concentrations and dosage rates on targeted chemical control, refer to the Department of Primary Industries New South Wales 'WeedWise' webpage (DPI, 2021a). Any weed spraying should be conducted by an authorised person, having a Chemical Application Certificate or similar qualification. This would ensure that best practice is adhered to in consideration of the sensitive nature of the surrounding ecosystems.

The removal of general exotic species (of which 44 were recorded – see **Appendix 1** for full list of exotic plant species recorded within the Subject Site [Kleinfelder 2022]) will be based on the recommendations provided in annual monitoring reports. It is expected that other restoration tasks including the removal of livestock grazing, slashing and additional plantings will assist in the natural reduction of general exotic species cover over the duration of the BMP implementation period (5 years).

3.5 ADAPTIVE MANAGEMENT/OPERATIONAL PHASE

Adaptive management will be undertaken within the Conservation Areas throughout the implementation period, with monitoring and report recommendations used to continually inform management strategies. Monitoring and reporting requirements under this BMP are detailed below.

3.5.1 Monitoring Program

A monitoring program will be implemented to ensure that the measures detailed within this BMP are implemented and successful. The program will be completed throughout the implementation period, a summary of key monitoring events and deliverables are shown in **Table 5**. Monitoring program methods are detailed below. Reporting requirements are detailed in **Section 3.5.2**.

Table 5: Monitoring and Reporting Summary

Monitoring Event	Timing	Scope	Deliverable
Baseline Monitoring Survey	Completed within one (1) month prior to the beginning of construction	Establishment of permanent monitoring plots and completion of the Monitoring Programme	Baseline Monitoring Report
Pre-clearance Survey	Prior to vegetation clearing	Assessment of habitat features to be removed.as per **Section 3.3.2**	Pre-Clearance Letter Report
Clearance Supervision	During vegetation clearing	Supervision of vegetation clearing of habitat features to be removed.as per **Section 3.3.2**	Clearance Supervision Letter Report
Nest box Installation	After nest box installation	Nest boxes that have been installed to cover hollow losses.	Nest box Installation Letter Report

Monitoring Event	Timing	Scope	Deliverable
Nest box Monitoring	Completed after 6 months of installation and at 6 month intervals thereafter for 5 year period	Monitoring of nest boxes to determine species use and the need for any repairs.	Nest box Monitoring Letter Report
Annual Monitoring Survey	Completed one (1) month following the completion of construction. Completed annually thereafter for entire implementation period (5 Years)	Completion of the Monitoring Programme	Annual Monitoring Survey Report
Final Summary Report	Completed at the end of the 5-year implementation period.	Summary of the Monitoring Programme throughout implementation period.	Final Summary Report

Monitoring Program Methods

Monitoring will be completed within the Conservation Reserves and the Sediment Basin (Once it has been planted) throughout the implementation period as per the schedule detailed in **Table 5**. Monitoring methods address key performance criterion listed in **Section 3.1.2**, and are informed by the following resources:

- The Biodiversity Assessment Method 2020 (known hereafter as "BAM 2020") (DPIE 2020),

The Monitoring Program is comprised of three (3) key components: *Vegetation Extent*, *Vegetation Condition*, and *Reserve Maintenance* detailed below.

Vegetation Extent

The mapped extent of native woodland (comprising native canopy species) and weed infestation are to be updated during every monitoring event using a hand-held GPS.

Vegetation Condition

A total of three (3) 20 m x 50m permanent quadrats will be established within the Conservation Reserves during baseline monitoring, with one (1) quadrat in the each of the Management Zones. The quadrats are to be sampled as per Section 5.3.4 of the NSW Biodiversity Assessment Method (BAM) (DPIE, 2020), with a 20 m x20 m nested quadrat and a central 50 m north-south bearing transect. Quadrats are to be marked at the start and end of the 50 m transect with permanent markers. Location and bearing of transects are to be recorded to ensure accuracy of repeat monitoring.

Within each plot the following metrics are collected:

- Floristic diversity (number of native and exotic species within the nested 20 m x 20 m quadrat)
- Floristic cover and abundance for each species (within the nested 20 m x 20 m quadrat).
- Stem size classes and the presence of native canopy regeneration (as per BAM 2020) (within the 20 m x 50 m quadrat)
- Cover of litter and bare ground (as per BAM 2020) (within the 20 m x 50 m quadrat)
- Total length of fallen logs (dbh <10 cm) (as per BAM 2020) (within the 20 m x 50 m quadrat)
- Photo monitoring: a single photo is to be taken at the start and end of the 50 m transect looking into the quadrat.

Conservation Area Maintenance

The monitoring program will assess condition of the Conservation Area through a general meander of the site and notes on the following features:

- Condition of boundary fencing and signage around the Conservation Area
- Signs of firewood collection, dumping of waste (inc. garden waste)
- Condition of habitat features (i.e. nest boxes and/or repurposed hollows)
- Condition and composition of native vegetation within constructed stormwater retention basins
- Monitoring and maintenance of weeds within all three areas.

3.5.2 Reporting

Reporting requirements and timing of deliverables are summarised within **Table 5**, all monitoring and reporting will be completed by a suitably qualified person (i.e. Ecologist), content of reporting deliverables will are detailed below:

- **Baseline Monitoring Survey Report:** This report will provide details on location of monitoring points, baseline measurements of key extent and condition variables within the Conservation Reserves.
- **Pre-clearance Survey Report:** This report will detail the results of the pre-clearance survey, including identification of fauna habitat features to be removed and those that have potential for salvage and utilisation within the Conservation Areas.
- **Clearance Supervision:** This report will detail the results of the clearance supervision including identification of any fauna recorded during clearing works and the location of habitat features re-distributed within the Conservation Areas to provide for habitat.

- **Nest box Installation:** This report will detail the results of the nest box installation (number, type and location).
- **Nest box Monitoring:** This report will be conducted biannually and will detail the results of the monitoring of the nest boxes that have been installed including condition and usage from locally occurring fauna species.
- **Annual Monitoring Survey Report:** This report will detail the results of annual monitoring, with comparison to baseline results and preceding survey events. Reporting will provide recommendations for future monitoring and management within the reserve. These reports are to be submitted annually to Council
- **Final Summary Report:** Summary of the Monitoring Programme throughout the 5 year implementation period with recommendations provided for the management of the Subject Site into perpetuity.

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APPENDIX 1. FLORA SPECIES LIST

Table A1: Subject Site Flora Species List (Kleinfelder 2022a)

No.	Family	Scientific Name	Common Name	Form
1.	Amaryllidaceae	*Agapanthus praecox*	Africa Lilly	Exotic
2.	Poaceae	*Axonopus fissifolius*	Narrow-leafed Carpet Grass	Exotic
3.	Poaceae	*Briza maxima*	Quaking Grass	Exotic
4.	Asphodelaceae	*Bulbine bulbosa*	Bulbine Lily	Exotic
5.	Lauraceae	*Cinnamomum camphora*	Camphor Laurel	Exotic
6.	Asteraceae	*Conyza bonariensis*	Flaxleaf Fleabane	Exotic
7.	Crassulaceae	*Crassula multicalva*	Fairy Crassula	Exotic
8.	Apiaceae	*Cyclospermum leptophyllum*	Slender Celery	Exotic
9.	Poaceae	*Cynodon dactylon*	Common Couch	Exotic
10.	Poaceae	*Cynodon incompletus*	-	Exotic
11.	Cyperaceae	*Cyperus polystachyos*	-	Exotic
12.	Asteraceae	*Gamochaeta americana*	Cudweed	Exotic
13.	Apocynaceae	*Gomphocarpus fruticosus*	Narrow-leaved Cotton Bush	Exotic
14.	Apiaceae	*Hydrocotyle bonariensis*	-	Exotic
15.	Clusiaceae	*Hypericum perforatum*	St. Johns Wort	Exotic
16.	Asteraceae	*Hypochaeris radicata*	Catsear	Exotic
17.	Iridaceae	*Iris sp.*	-	Exotic
18.	Juncaceae	*Juncus cognatus*	-	Exotic
19.	Juncaceae	*Juncus sp.*	-	Exotic
20.	Primulaceae	*Lysimachia arvensis*	Scarlet Pimpernel	Exotic
21.	Fabaceae (Faboideae)	*Medicago lupulina*	Black Medic	Exotic
22.	Poaceae	*Megathyrsus maximus*	-	Exotic
23.	Pinaceae	*Pinus radiata*	Radiata Pine	Exotic
24.	Plantaginaceae	*Plantago lanceolata*	Lamb's Tongues	Exotic
25.	Poaceae	*Poa annua*	Winter Grass	Exotic
26.	Rubiaceae	*Richardia humistrata*	-	Exotic

No.	Family	Scientific Name	Common Name	Form
27.	Fabaceae	*Securigera varia*	Crownvetch	Exotic
28.	Poaceae	*Setaria pumila*	Pale Pigeon Grass	Exotic
29.	Malvaceae	*Sida rhombifolia*	Paddy's Lucerne	Exotic
30.	Poaceae	*Sporobolus africanus*	Parramatta Grass	Exotic
31.	Lamiaceae	*Stachys arvensis*	Stagger Weed	Exotic
32.	Asteraceae	*Tagetes minuta*	Stinking Roger	Exotic
33.	Asteraceae	*Taraxacum officinale*	Dandelion	Exotic
34.	Fabaceae (Faboideae)	*Trifolium repens*	White Clover	Exotic
35.	Verbenaceae	*Verbena bonariensis*	Purpletop	Exotic
36.	Gleicheniaceae	*Gleichenia dicarpa*	Pouched Coral Fern	Fern
37.	Lindsaeaceae	*Lindsaea linearis*	Screw Fern	Fern
38.	Selaginellaceae	*Sellaginella uliginosa*	Swamp Selaginella	Fern
39.	Orchidaceae	*Caladenia catenata*	White Caladenia	Forb
40.	Commelinaceae	*Commelina cyanea*	Native Wandering Jew	Forb
41.	Orchidaceae	*Cryptostylis subulata*	Large Tongue Orchid	Forb
42.	Alismataceae	*Damasonium minus*	Starfruit	Forb
43.	Goodeniaceae	*Dampiera stricta*	-	Forb
44.	Phormiaceae	*Dianella caerulea*	Blue Flax-lily	Forb
45.	Convolvulaceae	*Dichondra repens*	Kidney Weed	Forb
46.	Euphorbiaceae	*Euphorbia drummondii*	Caustic Weed	Forb
47.	Geraniaceae	*Geranium solanderi*	Native Geranium	Forb
48.	Haloragaceae	*Gonocarpus micranthus*	-	Forb
49.	Haloragaceae	*Gonocarpus teucrioides*	Germander Raspwort	Forb
50.	Goodeniaceae	*Goodenia bellidifolia*	-	Forb
51.	Haemodoraceae	*Haemodorum planifolium*	-	Forb
52.	Asteraceae	*Lagenifera stipitata*	Blue Bottle-daisy	Forb
53.	Campanulaceae	*Lobelia purpurascens*	whiteroot	Forb

No.	Family	Scientific Name	Common Name	Form
54.	#N/A	*Microtis sp.*	#N/A	Forb
55.	Rubiaceae	*Opercularia diphylla*	Stinkweed	Forb
56.	Rubiaceae	*Opercularia varia*	Variable Stinkweed	Forb
57.	Oxalidaceae	*Oxalis perennans*	-	Forb
58.	Iridaceae	*Patersonia sericea*	Silky Purple-Flag	Forb
59.	Philydraceae	*Philydrum lanuginosum*	Frogsmouth	Forb
60.	Portulacaceae	*Portulaca oleracea*	Pigweed	Forb
61.	Ranunculaceae	*Ranunculus inundatus*	River Buttercup	Forb
62.	Stylidiaceae	*Stylidium gramineum*	-	Forb
63.	Orchidaceae	*Thelymitra branwhitei*	-	Forb
64.	Orchidaceae	*Thelymitra pauciflora*	Slender Sun Orchid	Forb
65.	Apiaceae	*Trachymene incisa*	Trachymene	Forb
66.	Violaceae	*Viola hederacea*	Ivy-leaved Violet	Forb
67.	Xyridaceae	*Xyris gracilis*	-	Forb
68.	Poaceae	*Aristida vagans*	Threeawn Speargrass	Grass (Grass Like)
69.	Cyperaceae	*Baumea rubiginosa*	--	Grass (Grass Like)
70.	Cyperaceae	*Carex inversa*	Knob Sedge	Grass (Grass Like)
71.	Cyperaceae	*Cyathochaeta diandra*	-	Grass (Grass Like)
72.	Cyperaceae	*Cyperus sanguinolentus*	-	Grass (Grass Like)
73.	Poaceae	*Echinopogon caespitosus*	Bushy Hedgehog-grass	Grass (Grass Like)
74.	Poaceae	*Entolasia stricta*	Wiry Panic	Grass (Grass Like)
75.	Poaceae	*Eragrostis brownii*	Brown's Lovegrass	Grass (Grass Like)
76.	Poaceae	*Eragrostis leptostachya*	Paddock Lovegrass	Grass (Grass Like)
77.	Cyperaceae	*Fimbristylis dichotoma*	Common Fringe-sedge	Grass (Grass Like)

No.	Family	Scientific Name	Common Name	Form
78.	Cyperaceae	*Gahnia clarkei*	Tall Saw-sedge	Grass (Grass Like)
79.	Poaceae	*Imperata cylindrica*	Blady Grass	Grass (Grass Like)
80.	Juncaceae	*Juncus holoschoenus*	-	Grass (Grass Like)
81.	Juncaceae	*Juncus subsecundus*	Finger Rush	Grass (Grass Like)
82.	Cyperaceae	*Lepidosperma concavum*	-	Grass (Grass Like)
83.	Cyperaceae	*Lepidosperma laterale*	Variable Sword-sedge	Grass (Grass Like)
84.	Cyperaceae	*Lepidosperma neesii*	-	Grass (Grass Like)
85.	Restionaceae	*Lepyrodia scariosa*	-	Grass (Grass Like)
86.	Lomandraceae	*Lomandra cylindrica*	-	Grass (Grass Like)
87.		*Lomandra multiflora*	#N/A	Grass (Grass Like)
88.	Lomandraceae	*Lomandra obliqua*	-	Grass (Grass Like)
89.	Poaceae	*Microlaena stipoides var. stipoides*	Weeping Grass	Grass (Grass Like)
90.	Cyperaceae	*Ptilothrix deusta*	-	Grass (Grass Like)
91.	Cyperaceae	*Schoenus apogon*	Fluke Bogrush	Grass (Grass Like)
92.	Cyperaceae	*Schoenus brevifolius*	-	Grass (Grass Like)
93.	Poaceae	*Sporobolus virginicus*	-	Grass (Grass Like)
94.	Asparagaceae	*Themeda australis*	Many-flowered Mat-rush	Grass (Grass Like)
95.	Poaceae	*Andropogon virginicus*	Whisky Grass	High Threat Weed
96.	Asparagaceae	*Asparagus aethiopicus*	Asparagus Fern	High Threat Weed
97.	Poaceae	*Cenchrus clandestinum*	Kikuyu Grass	High Threat Weed
98.	Poaceae	*Ehrharta erecta*	Panic Veldtgrass	High Threat Weed

No.	Family	Scientific Name	Common Name	Form
99.	Poaceae	*Hyparrhenia hirta*	Coolatai Grass	High Threat Weed
100.	Verbenaceae	*Lantana camara*	Lantana	High Threat Weed
101.	Poaceae	*Paspalum dilatatum*	Paspalum	High Threat Weed
102.	Rosaceae	*Rubus anglocandicans*	Blackberry	High Threat Weed
103.	Asteraceae	*Senecio madagascariensis*	Fireweed	High Threat Weed
104.	Pittosporaceae	*Billardiera scandens*	Hairy Apple Berry	Other
105.	Lauraceae	*Cassytha glabella*	-	Other
106.	Fabaceae (Faboideae)	*Glycine tabacina*	Hairy Apple Berry	Other
107.	Fabaceae (Faboideae)	*Hardenbergia violacea*	False Sarsaparilla	Other
108.	Apocynaceae	*Parsonsia straminea*	Common Silkpod	Other
109.	Xanthorrhoeaceae	*Xanthorrhoea fulva*	-	Other
110.	Xanthorrhoeaceae	*Xanthorrhoea latifolia*	-	Other
111.	Xanthorrhoeaceae	*Xanthorrhoea media*	-	Other
112.	Fabaceae (Mimosoideae)	*Acacia fimbriata*	Fringed Wattle	Shrub
113.	Fabaceae (Mimosoideae)	*Acacia longifolia*	-	Shrub
114.	Fabaceae (Mimosoideae)	*Acacia suaveolens*	Sweet Wattle	Shrub
115.	Fabaceae (Mimosoideae)	*Acacia ulicifolia*	Prickly Moses	Shrub
116.	Proteaceae	*Banksia oblongifolia*	Fern-leaved Banksia	Shrub
117.	Fabaceae (Faboideae)	*Daviesia ulicifolia*	Gorse Bitter Pea	Shrub
118.	Fabaceae (Faboideae)	*Dillwynia retorta*	-	Shrub
119.	Sapindaceae	*Dodonaea triquetra*	Large-leaf Hop-bush	Shrub
120.	Ericaceae	*Epacris pulchella*	Wallum Heath	Shrub
121.	Fabaceae (Faboideae)	*Gompholobium latifolium*	Golden Glory Pea	Shrub
122.	Fabaceae (Faboideae)	*Hovea linearis*	-	Shrub
123.	Myrtaceae	*Leptospermum polygalifolium*	Tantoon	Shrub
124.	Myrtaceae	*Leptospermum trinervium*	Slender Tea-tree	Shrub

No.	Family	Scientific Name	Common Name	Form
125.	Myrtaceae	*Melaleuca sieberi*	-	Shrub
126.	Myrtaceae	*Melaleuca thymifolia*	Thyme Honey-myrtle	Shrub
127.	Fabaceae (Faboideae)	*Mirbelia rubiifolia*	Heathy Mirbelia	Shrub
128.	Ericaceae	*Monotoca elliptica*	Tree Broom-heath	Shrub
129.	Thymelaeaceae	*Pimelea linifolia*	Slender Rice Flower	Shrub
130.	Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum	Shrub
131.	Fabaceae	*Pultenaea sp.*	-	Shrub
132.	Fabaceae (Faboideae)	*Pultenaea rosmarinifolia*	-	Shrub
133.	Fabaceae (Faboideae)	*Pultenaea tuberculata*	-	Shrub
134.	Casuarinaceae	*Allocasuarina littoralis*	Black She-Oak	Shrub
135.	Myrtaceae	*Angophora costata*	Sydney Red Gum	Tree
136.	Myrtaceae	*Angophora floribunda*	Rough-barked Apple	Tree
137.	Arecaceae	*Archontophoenix cunninghamiana*	Bangalow Palm	Tree
138.	Myrtaceae	*Corymbia gummifera*	Red Bloodwood	Tree
139.	Myrtaceae	*Eucalyptus acmenoides*	White Mahogany	Tree
140.	Myrtaceae	*Eucalyptus capitellata*	Brown Stringybark	Tree
141.	Myrtaceae	*Eucalyptus haemastoma*	Broad-leaved Scribbly Gum	Tree
142.	Myrtaceae	*Eucalyptus racemosa*	Narrow-leaved Scribbly Gum	Tree
143.	Myrtaceae	*Eucalyptus resinifera*	Red Mahogany	Tree
144.	Myrtaceae	*Eucalyptus robusta*	Swamp Mahogany	Tree
145.	Phyllanthaceae	*Glochidion ferdinandi*	Cheese Tree	Tree
146.	Arecaceae	*Livistona australis*	Cabbage Palm	Tree
147.	Myrtaceae	*Melaleuca quinquenervia*	Broad-leaved Paperbark	Tree

APPENDIX 2. RECOMMENDED PLANTING LISTS

Table B1: Conservation Areas Recommended Planting List

Stratum	Scientific Name	Common Name	Management Zone 3	Management Zone 4
Canopy	*Angophora costata*	Sydney Red Gum		*
	Corymbia gummifera	Red Bloodwood		✓*
	Eucalyptus resinifera	Red Mahogany	✓	
	Eucalyptus robusta	Swamp Mahogany	✓	
	Melaleuca quinquenervia	Broad-leaved Paperbark	✓	
Shrubs	*Allocasuarina littoralis*	Black She-oak		✓*
	Leptospermum trinervium	Flaky-barked Tea-tree	✓	✓*
	Acacia myrtifolia	Myrtle wattle		✓*
	Persoonia levis	Broad-leaved geebung		✓*
	Lambertia formosa	Mountain Devil		✓*
	Livistona australis	Cabbage-tree Palm	✓	
	Pimelea linifolia	Slender Rice Flower		✓*
	Melaleuca sieberi		✓	
	Melaleuca nodosa	Prickly-leaved Paperbark	✓	
	Leptospermum polygalifolium	Tantoon	✓	
	Pultenaea paleacea	Chaffy Bush-pea	✓	
Ground	*Themeda australis*	Kangaroo Grass	✓	✓*
	Lomandra obliqua	-		✓*
	Panicum simile	Colour Panic	✓	
	Entolasia stricta	Wiry Panic	✓	✓*
	Gahnia clarkei	Tall Saw-sedge	✓	

*Supplementary Plantings

Table B2: Management Zone 2 Recommended Planting List

Stratum	Scientific Name	Common Name
Ground (where suitable)	*Cladium procerum*	-
	Cynodon dactylon	Couch
	Persicaria strigosa	Spotted Knotweed
	Typha orientalis	Broad-leaved Cumbungi

Table B3: Management Zone 1 Recommended Planting List for 5m buffer.

Stratum	Scientific Name	Common Name
Canopy	*Angophora costata*	Smooth Bark Apple
	Corymbia gummifera	Red Bloodwood
	Eucalyptus robusta	Swamp Mahogany
Shrubs	*Acacia myrtifolia*	Myrtle wattle
	Persoonia levis	Broad-leaved Geebung
	Lambertia formosa	Mountain Devil
	Pimelea linifolia	Slender Rice Flower
Ground (If Suitable)	*Themeda australis*	Kangaroo Grass
	Lomandra obliqua	-
	Panicum simile	Colour Panic
	Entolasia stricta	Wiry Panic

APPENDIX 3. STAFF CONTRIBUTIONS

The following staff were involved in the project:

Name	Qualifications	Title	Contribution
Mark Dean	BEnvSc & Mgt	Ecologist	Report Author
David Martin	Master of Science BEnvSc & Mgt Accredited BAM Assessor	Senior Ecologist	Report Review
Samara Schulz	BEnvSc & Mgt (Hons)	Principal Botanist	GIS and figure preparation
Kane Blundell	BEnvSc & Mgt	Ecologist	GIS and figure preparation

APPENDIX 4. SCIENTIFIC LICENCING AND PERMITS

Wedgetail employees involved in the current study are licensed or approved under the *Biodiversity Conservation Act 2016* (License Number: SL102506, Expiry: 28 February 2023) and the *Animal Research Act 1985* to harm/trap/release protected native fauna and to pick for identification purposes native flora and to undertake fauna surveys.