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Biodiversity Management Plan

657 - 769 Mamre Road, Kemps Creek, Mamre South Precinct

Prepared for: Altis Frasers JV Pty Ltd

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PREPARED FOR	Altis Frasers JV Pty Ltd			
AUTHOR/S	Will Introna, Kieren Northam (GIS), Sophie Starrett			
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Glossary and abbreviations

Acronym	Description
*	Denotes exotic species
BC Act	NSW *Biodiversity Conservation Act 2016*
DA	Development Application
DCP	Development Control Plan
EES	Environment, Energy and Science Group (former Office of Environment and Heritage)
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
ha	Hectares
LGA	Local Government Area
PCT	Plant Community Type
MZ	Management Zone
NRAR	Natural Resources Access Regulator
SSD	State Significant Development
TOB	Top of Bank
VMA	Vegetation Management Area
VRZ	Vegetated Riparian Zone
WoNS	Weeds of National Significance

1 Introduction

1.1 Purpose of Biodiversity Management Plan

This updated Biodiversity Management Plan (BMP) has been prepared to manage impacts to biodiversity values during earthworks, clearing and dam decommissioning and to guide the management of River-Flat Eucalypt Forest (RFEF) (mapped as Alluvial Woodland) vegetation within the Vegetated Riparian Zone (VRZ) on South Creek and within the north-west of the study area for the State Significant Development application (SSD9522) (Ecoplanning 2020).

The SSD is the Kemps Creek Warehouse, Logistics and Industrial Facilities Hub (the Yards), which is a regional warehouse and distribution complex located at Kemps Creek within the Penrith local government area (LGA) within the Western Sydney Employment Area (WSEA).

The Yards is located at 657-769 Mamre Road, Kemps Creek and is legally described as Lot 34 DP 1118173, Lot X DP 421633, Lot 1 DP 1018318, Lot Y DP 421633 & Lot 22 DP 258414. It is located at the western extent of the WSEA within the Penrith LGA.

The site is bound by the following land uses:

- North – the Water NSW Pipeline and SSD 7173 approved 'First Estate' industrial development, with the Erskine Business Park beyond
- South – rural residential properties
- East – Mamre Road with rural residential properties, schools and age care beyond
- West – South Creek with rural residential properties beyond.

The site has historically been used for low intensity agriculture and is primarily covered with pasture grass and limited stands of vegetation. The site has several dams in the central area and has a gradual fall from east to west towards South Creek. River-flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and East Corner Bioregions is endangered ecological community listed under the NSW *Biodiversity Conservation Act 2016* identified within the study area. River-Flat Eucalypt Forest on Coastal Floodplains of Southern New South Wales and Eastern Victoria is a critically endangered ecological community (CEEC) listed under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* that is located within the study area.

Frasers Property Australia Pty Ltd (Frasers) and Altis Bulky Retail Pty Ltd (Altis) jointly identified as 'the Proponent' (Altis Frasers JV Pty Ltd) obtained Development Consent SSD (State Significant Development) 9522 on 21 December 2020 from the Department of Planning, Industry and Environment (DPIE) for the '*Kemps Creek Warehouse, Logistics and Industrial Facilities Hub'* comprising the construction of eight warehouse buildings over eight lots as the first stage of development, with estate works across the broader site comprising bulk earthworks to create building pads for future development, stormwater infrastructure and an internal road network including a north south collector road connecting to the adjacent property, intersection upgrades and the widening of Mamre Road.

Specifically, SSD 9522 permits the following development:

- Demolition of existing structures, site-wide earthworks, landscaping, stormwater and other infrastructure and an internal road network;
- Construction and operation of eight warehouses comprising 162,355 m2 of floor space;
- Intersection upgrade works in Mamre Road;
- 744 parking spaces; and
- 21-lot Torrens title subdivision over two stages, being Stage 1 residual lot subdivision (5 lots) and Stage 2 residual and development lot subdivision (17 lots).

This BMP forms part of the Construction and Environment Management Plan (CEMP) required for the proposed development.

The BMP has been prepared in accordance with consent condition B68 (Biodiversity Management Plan) and C1 (Management Plan Requirements) of the development consent for application number SD-9522. It should be noted that the according to the consent conditions that the Planning Secretary may waive some of the requirements of C1 if they are deemed unnecessary for particular management plans.

In addition, this updated BMP details measures to protect and remediate the retained RFEF in the north-west of the study area which is identified in Figure 1 of the Annexures of the EPBC Referral and also shown here in **Figure 1.1**.

Condition requirements and where they have been addressed in this report are detailed in **Table 1.1**.

Table 1.1: Consent conditions

Number	Consent condition	Where addressed in this report
Biodiversity Management Plan		
B68	Prior to clearing for construction, the Applicant must prepare a Biodiversity Management Plan (BMP) for the development to the satisfaction of the Planning Secretary. The BMP must be approved by the Planning Secretary prior to the commencement of clearing for construction and must form part of the CEMP in accordance with condition C2. The BMP must include the following:	This report
(a)	notification and engagement of qualified wildlife carer organisations;	Table 5.2
(b)	measures to carry out soft felling of hollow bearing trees;	Section 5.1.2
(c)	reuse of materials associated with vegetation clearing;	Table 5.2

Number	Consent condition	Where addressed in this report
(d)	a pre-clearance and dam dewatering protocol to ensure appropriate timing would be achieved for vegetation removal and dam dewatering;	Table 5.1 and 5.2
(e)	an ecologist plan for managing affected protected fauna during vegetation removal; and	Section 5.1.1, Section 5.1.2, Table 5.2
(f)	an unexpected finds protocol detailing managing measures for any encountered threatened species and notification of the EES Group and Council (see CEMP for contact details).	Table 5.2
Management Pan Requirements		
C1.	Management plans required under this consent must be prepared in accordance with relevant guidelines, and include:	This report
(a)	detailed baseline data	Section 2.0
(b)	details of: (i) the relevant statutory requirements (including any relevant approval, licence or lease conditions);	Section 1.1
	(ii) any relevant limits or performance measures and criteria; and	Section 4.1
	(iii) the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the development or any management measures;	Section 4.1, Section 5.1.3
(c)	a description of the measures to be implemented to comply with the relevant statutory requirements, limits, or performance measures and criteria;	This report, Tables 5.1, 5.2 and 5.3
(d)	a program to monitor and report on the: (i) impacts and environmental performance of the development; and	This report, Section 4, Tables 5.1, 5.2 and 5.3
	(ii) effectiveness of the management measures set out pursuant to paragraph (c) above;	Section 4 and 5.1.3 and Table 5.2

Number	Consent condition	Where addressed in this report
(e)	a contingency plan to manage any unpredicted impacts and their consequences and to ensure that ongoing impacts reduce to levels below relevant impact assessment criteria as quickly as possible;	Section 4 and Table 5.2
(f)	a program to investigate and implement ways to improve the environmental performance of the development over time;	This BMP
(g)	a protocol for managing and reporting any: (i) incident and any non-compliance (specifically including any exceedance of the impact assessment criteria and performance criteria);	Table 5.2 (Clearing report)
	ii) complaint;	Table 5.2 (Clearing report)
	(iii) failure to comply with statutory requirements; and	Table 5.2 (Clearing report)
(h)	a protocol for periodic review of the plan.	Section 4.1 and CEMP.
Pests, Vermin and Priority Weed Management		
B78	The Applicant must:	
(a)	implement suitable measures to manage pests, vermin and declared priority weeds on the site; and	Section 3, Table 5.1, Table 5.2, Table 5.3
(b)	inspect the site on a regular basis to ensure that these measures are working effectively, and that pests, vermin or priority weeds are not present on site in sufficient numbers to pose an environmental hazard or cause the loss of amenity in the surrounding area.	Section 4.2

For this report, the '**study area**' refers to the entirety of Lot 34 // DP 1118173, Lot 1 // DP 1018318, Lot X // DP 421633, Lot Y // DP 421633 and Lot 22 // 258414 (Mamre Road, Kemps Creek, NSW) and the Mamre Road intersection area (**Figure 1.1**). It is 118 ha in size.

Within the study area, the land proposed for development is referred to as the '**subject land**' and covers an area of 86.77 ha. The subject land is within the eastern portion of the study area, and is predominately comprised of exotic pasture, degraded vegetation, scattered paddock trees and farms dams.

1.2 Site description and staging

The subject land is zoned IN1 – Industrial under the Western Sydney Employment Lands SEPP. Land to the north of the subject land (Altis First Estate) and the adjacent Erskine Business Park, east of Mamre Road, is land developed for warehouse, logistics and industrial facilities.

The subject land is bounded by Mamre Road in the east, the Upper Canal System in the north and the 1 in 100-year flood line in the west (**Figure 1.1**). Bakers Lane runs off Mamre Road in a westerly direction and extends along the southern perimeter of Lot 34 // DP 1118173. The site currently contains residential dwellings in Lot 34 // DP 1118173, Lot 1 // DP 1018318, Lot Y // DP 421633 and Lot 22 // 258414 and a small business (Mamre Produce) along Bakers Lane in Lot X // DP 421633.

The Stage 1 development of the Yards comprises the subdivision of five lots within the site, along with demolition and site wide earthworks, landscaping, utilities, stormwater and the internal road networks. Stage 1 also includes the construction and operation of eight warehouses inclusive of 744 parking spaces and intersection upgrade works on Mamre Road.

The Stage 2 development comprises the subdivision of the remaining portion of the site into a further 17 lots.

Development on these lots is then anticipated to occur over a period of time to meet market demand and would be subject to future development applications.

The subject land does not include the proposed freight rail corridor in the north of the study area. South Creek, a fifth order stream flows along the western edge of the study area. An unnamed tributary of South Creek flows west, just south of the study area.

The vegetation along South Creek is connected to Cosgroves Creek and to vegetated patches along Blaxland Creek, which is north-west of the 1,500 m buffer around the subject land (Ecoplanning 2020). The landscape surrounding the study area is highly modified and these riparian corridors provide the only vegetated corridors through the landscape. However, these corridors area thin and therefore the native vegetation in the subject land and study area is poorly connected to vegetation in reserves north, west and east of the study area (Ecoplanning 2020).

The study area contains scattered patches of disturbed woodland and ‘derived natural grasslands’ as well as planted exotic, indigenous and non-indigenous trees, exotic pastures and farm dams.

In addition, the ‘Vegetation Management Area’ (VMA) refers to the areas proposed for management of RFEF including the VRZ along South Creek and the RFEF located in the north-west of the study area(12.49 ha in size). The VRZ encompasses land within 40 m of the Top of Bank (ToB) of South Creek and any vegetation within the channel. See **Figure** 1.1.

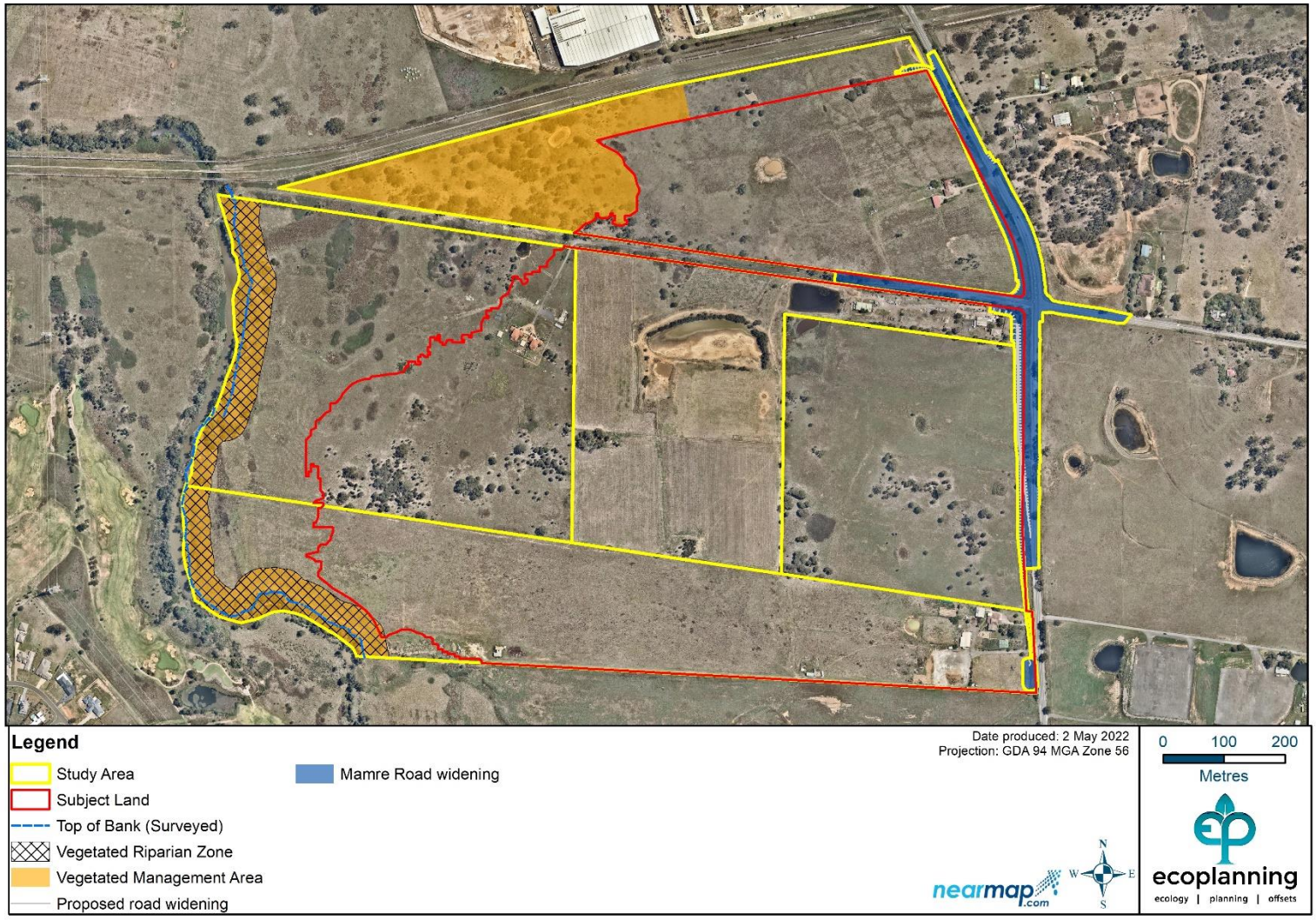

Figure 1.1: Study area

2 Site Assessment

2.1 Methods

Field survey was undertaken on 30 April 2018 by Lucas Mckinnon (Principal Ecologist, Director), Thomas Hickman (Ecologist) and Kieren Northam (Ecologist) (Ecoplanning, 2020). Additional field survey was undertaken by Lucas Mckinnon on the 7 April 2020, which assessed the south western corner of the study area. A supplementary assessment within the Mamre Road widening area was undertaken by Declan Moylan (Ecologist) on 28 April 2022.

The field assessments aimed to map Plant Community Types (PCTs) and to determine the overall resilience of the subject land and of the VRZ, and thus their capacity to respond to regeneration works. The site was surveyed to determine the problematic exotic species on site and aimed to identify all priority weeds and Weeds of National Significance (WoNS). During the survey, appropriate weed control techniques for the dominant exotic species were considered within the site context. Potential erosion issues were also assessed.

All vegetation patches within the study area were assessed to determine their location, extent, structure and floristics.

2.2 Results

Vegetation mapping of OEH (2015) has mapped Shale Plains Woodland (MU10) and Alluvial Woodland (MU11) within the study area (**Figure 2.1**). Alluvial Woodland was mapped in a large patch in the north of the study area flanked by four patches of Shale Plains Woodland. Alluvial Woodland was also mapped along some southern sections of South Creek. Two other smaller patches of Shale Plains Woodland were mapped in the south of the study area. Other regional vegetation mapping by Tozer et al. (2010) mapped only one small patch of Cumberland Shale Plains Woodland in the south of the study area and one small patch of Cumberland River Flat Forest in the south of the VRZ.

Field assessment (Ecoplanning 2020 and Ecoplanning 2022) determined that vegetation in the study area was consistent with the following two Plant Community Types (PCTs):

- Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 835; HN526)
- Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849; HN528).

The PCTs are in a disturbed, underscrubbed or ‘derived natural grassland’ condition.

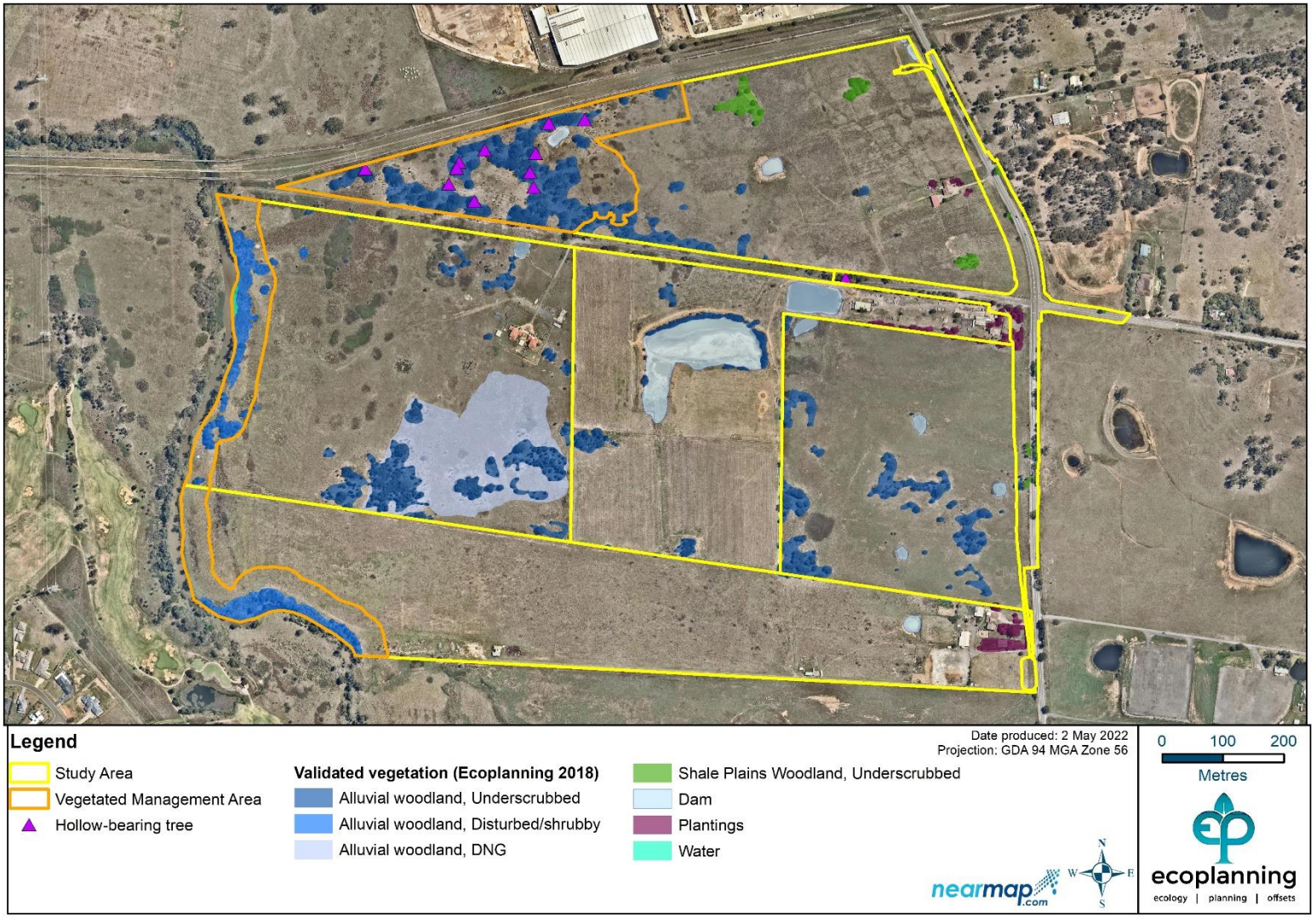

Figure 2.1: Vegetation within the study area

2.2.1 Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion

'Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion' (PCT 835) corresponds to Alluvial Woodland was present in three distinct condition classes, comprising 'underscrubbed', 'Disturbed/shrubby' and 'Derived Native Grassland' (DNG) (**Figure 2.1**) (Ecoplanning 2020). It occurs on broad alluvial flats mostly throughout the study area (DNG and underscrubbed), particularly in the western part of the subject land. This PCT also occurs along South Creek in a 'Disturbed/shrubby' condition. This vegetation community consisted of a grassy woodland dominated by *Eucalyptus amplifolia* (Cabbage Gum) and *Angophora floribunda* (Rough-barked Apple), with *Casuarina glauca* (Swamp Oak) also present around the perimeter of the large dam in the centre of the subject land. A sparse shrub layer was present within this vegetation community including *Bursaria spinosa* subsp. *spinosa* (Blackthorn), *Grevillea juniperina* subsp. *juniperina* and *Melaleuca decora*. Several patches of vegetation almost exclusively dominated by *Melaleuca decora* were identified within the subject land, including several patches of vegetation with substantial distance from Kemps Creek. These patches were often dominated by *Carex appressa* (Tall Sedge) in the groundlayer, which suggests some level of floodplain influence.

A grassy understorey was present throughout this vegetation community including grasses, forbs and sedges such as *Carex appressa*, *Centella asiatica* (Indian Pennywort), *Commelina cyanea*, *Cynodon dactylon* (Couch), *Juncus usitatus*, *Lomandra filiformis* (Wattle Mat-rush), *Microlaena stipoides* subsp. *stipoides* (Weeping Grass), *Themeda triandra* (Kangaroo Grass) and *Paspalidium distans* Exotic species occurred sporadically through the vegetation community; with a higher proportion observed between the interface of the community and the cleared land 'exotic grassland'. Dominant exotic grasses and herbaceous weeds included, *Axonopus fissifolius** (Narrow-leafed Carpet Grass), *Eragrostis curvula** (African Lovegrass), *Hypochaeris radicata** (Flatweed), *Paspalum dilatatum** (Paspalum), *Senecio madagascariensis** (Fireweed) and *Setaria parviflora** (Pigeon Grass).

This PCT forms part of the 'River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions' EEC listed under the BC Act.

2.2.2 Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion

Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion corresponds to Shale Plains Woodland occurs in the higher elevation areas of the study area nearer to Mamre Road in the subject land and also along South Creek. This PCT was present in three small patches of Grey Box – Forest Red Gum grassy woodland in the subject land and was identified in an 'underscrubbed' condition class (**Figure 2.1**).

Of the three small patches of this vegetation; one exclusively dominated by *Eucalyptus moluccana* (Grey Box) and the other two by *Melaleuca decora*. The midstorey is devoid of a shrub layer a result of past underscrubbing and ongoing grazing of the vegetation community. The groundlayer was dominated by exotic grasses, including *Cenchrus clandestinus** (Kikuyu

Grass), *Eragrostis curvula** and *Paspalum dilatatum**. Native grasses, forbs and sedges occurred within the vegetation community in low abundance and cover, including *Carex inversa*, *Commelina cyanea*, *Microlaena stipoides* var. *stipoides* and *Sporobolus creber* (Western Rat-tail Grass).

The Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain (Shale Plains Woodland) vegetation community within the subject landforms part of the 'Cumberland Plain Woodland in the Sydney Basin Bioregion' CEEC listed under the BC Act.

2.2.3 Other vegetation

Planted 'exotic, indigenous and non-indigenous trees'

This vegetation type consists of planted exotics, native indigenous and non-indigenous trees surrounding the dwellings in the northeast of the site and to the south of Bakers Lane. Planting included species such as, *Eucalyptus maculata* (Spotted Gum) and *Photinia serratifolia** (Chinese Photinia).

Cleared land 'exotic grassland'

Cleared land 'exotic grassland' within the subject land which was not assigned to a native vegetation community or an equivalent PCT. This included large areas throughout the subject land which have been subject to previous clearing and now support grasslands dominated by exotic grasses and herbaceous weeds including *Axonopus fissifolius**, *Briza subaristata**, *Eragrostis curvula**, *Hypochaeris radicata** and *Paspalum dilatatum**. Native species were generally absent or rare within this vegetation community although several species were infrequently present and at low abundance including *Bothriochloa macra* (Red-leg Grass), *Eragrostis leptostachya* (Paddock Lovegrass), *Tricoryne elatior* (Yellow Autumn-lily), *Themeda australis* (Kangaroo Grass).

This grassland vegetation was noted to be predominantly exotic (approximately 90-95 % cover), with the most abundant native species recorded as, *Cynodon dactylon*†, which is a cosmopolitan species that is quite possibly introduced given the overall site context and propensity of other introduced exotic pasture grasses.

2.2.4 Flora species

A total of 85 flora species were identified within the study area during field investigations, of which 35 are exotic or introduced species (**Appendix A**). Five priority weeds listed under the NSW Biosecurity Act 2015 for Greater Sydney were recorded in the study area, four of which are Weeds of National Significance (WoNS) (**Table 2.1**).

Table 2.1: Priority Weeds and Weeds of National Significance

Common name	Scientific name	WoNS[1]	Duty
Blackberry	*Rubus fruticosus*	Y	**Prohibition on dealings** Must not be imported into the State or sold. All species in the *Rubus fruiticosus* species aggregate have this requirement, except for the varietals Black Satin, Chehalem, Chester Thornless, Dirksen Thornless, Loch Ness, Murrindindi, Silvan, Smooth Stem, and Thornfree
Prickly Pears	*Opuntia* sp.	Y	**Prohibition on dealings** Must not be imported into the State or sold. Except for *Opuntia ficus-indica* (Indian fig)
Green Cestrum	*Cestrum parqui*	N	**Regional Recommended Measure** Land managers should mitigate the risk of new weeds being introduced to land used for grazing livestock. Land managers should mitigate spread from their land. Plant should not be bought, sold, grown, carried or released into the environment.
African Boxthorn	*Lycium ferocissimum*	Y	**Prohibition on dealings** Must not be imported into the State or sold
Fireweed	*Senecio madagascariensis*	Y	**Prohibition on dealings** Must not be imported into the State or sold

[1] http://www.environment.gov.au/biodiversity/invasive/weeds/weeds/lists/wons.html

One threatened flora species, *Grevillea juniperina* subsp. *juniperina* was identified in the study area and is listed as vulnerable under the BC Act. A total of 29 individuals were counted in a well-defined patch in the north of the study area.

3 Vegetation management, pests and vermin

Vegetation management works and management of declared weeds will begin prior to subdivision of the development area. A suitably qualified and experienced bush regeneration contractor must be engaged to carry out weed management works.

3.1 Preliminary Works

Seed collection

Seed collection will be required to ensure indigenous species are available for revegetation works. All plantings will be of local provenance and collected from adjacent patches of vegetation. However, nurseries that supply indigenous seedling stock, (not horticultural varieties), may also be used to supplement the plantings.

Seed collection zones can extend within a radius of 3 km for groundcover, shrubs and trees and up to 10 km for grasses. The collection site will reflect the natural conditions that exist for the area being regenerated.

Record keeping of seed collection and planting locations is to be as per the Flora Bank guidelines (Mortlock 2000), the bush regeneration contractor is responsible for recording this information. A Section 132C licence under the NSW *National Parks and Wildlife Act 1974* will be required to undertake seed collection works.

Fencing

Stock proof fencing will be installed around the perimeter of the VRZ and the VMA in the north of the study area to prevent access by cattle and deer. The fencing will consist of strained wire fences and include barbed wire if stock is adjacent to the fence. Fencing will be installed prior to the initiation of the contract, particularly prior to revegetation works being undertaken.

Signage

Signage in accordance with Penrith City Council (PCC) standardised signs for conservation areas will be installed at select locations along the perimeter of VMA. The exact information and location of these signs will be determined during implementation of the works in accordance with the BMP. At a minimum, the signage will be positioned at all main access points or visual areas along the perimeter of the VMA and will state that the area is being managed for conservation purposes.

3.2 Weed Management Techniques

Weed management will be carried out using primary and secondary weed control followed by ongoing maintenance. Weed control will include mechanical removal techniques, herbicide application and natural shading techniques. Disturbance of the soil during the weed management process will be minimised at all times (see Buchanan 2000, Bradley 2002). Weed control objectives and treatment techniques are outlined below (**Appendix B**) in accordance with weed type.

In areas that will be cleared, weeds will be removed prior to general vegetation clearing and will be disposed of appropriately. Stripped topsoil from weed-infested areas will be removed off-site and disposed of at an appropriate green-waste facility.

Primary Weed Control

Primary weed control is the initial removal of weed species. Mechanical removal techniques relevant to the weed being removed (Buchanan 2000; Bradley 2002; DPI 2018) will be used for all woody weeds and herbaceous plants. Herbicide application, such as backpack spraying will be avoided where off target loss of native species is likely to occur.

Secondary Weed Control

Secondary weed control involves follow-up weed control to remove seedlings that have emerged after primary control and treatment of any existing plants that reshoot. Any new weed infestation areas identified must also be treated.

Maintenance

Maintenance is the long-term management of a site to prevent weeds from becoming re-established after primary and secondary work. Substantial effort will be focussed on reducing the weed seed bank, eradicating problematic weeds and supporting the growth of native vegetation. Areas of high resilience will be the focus of intensive maintenance works, which will include fine hand-weeding. A structured maintenance regime following primary and secondary work will reduce the time taken for the site to reach a reasonable level of stability.

Weed Disposal

All seeding herbaceous/grass material and tubers will be bagged, removed from site and disposed of at an appropriate green-waste facility. Woody weeds, such *as Lycium ferocissimum** and *Ligustrum sinense** will be removed offsite. However, small piles of dead woody weeds may be stored onsite for fauna habitat if not be located within the flooding extent of the watercourses, or in a position that will make the future treatment of exotic grasses and herbaceous weeds difficult.

3.3 Vegetation Management Zones

The VMA has been categorised into four management zones (MZs), based on the different management actions required to manage the vegetation within the VMA (**Figure 3.1).**

3.3.1 Management Zone 1 - Alluvial Woodland Regeneration

Management Zone 1 (MZ1) includes areas of the VRZ consisting of exotic grassland which are located between patches of Alluvial Woodland (disturbed/shrubby), comprising 3.66 ha or approximately 69.32 % of the VRZ.

Following primary and secondary weed treatment, this zone will be revegetated and managed. Revegetation of this zone will aim to reconstruct the native vegetation community of RFEF and will therefore be revegetated with a combination of native midstorey and overstorey tubestock species based on the planting densities outlined in **Section 3.4**. Additional groundlayer species are required in this zone to assist in maintaining soil structure

and to prevent wind erosion. The establishment of native canopy and midstorey vegetation will be ensured through regular spot-spraying, brush-cutting and hand-weeding in proximity of the plantings.

Future planting in the zone will expand out from the planted areas, with the aim of gradually reducing the extent of *Cenchrus clandestinus** and consolidating previously planted areas. These areas will be augmented with additional shrub species and a small amount of groundlayer species.

3.3.2 Management Zone 2 - Alluvial Woodland (disturbed/shrubby) Rehabilitation

Management Zone 2 (MZ2) includes sections of the VRZ mapped as Alluvial Woodland (disturbed/shrubby) consistent with RFEF, comprising 1.62 ha, or approximately 30.68 % of the VRZ.

The broad-scale removal of exotic grasses will be avoided. All annual and perennial weed species along the watercourse will be hand-weeded, with any regrowth sprayed with herbicide suitable for use around waterways. Removal of riparian weeds and revegetation needs to be carefully implemented to avoid erosion to the bank and prevent bank collapse.

3.3.3 Management Zone 3 - Alluvial Woodland (underscrubbed) Rehabilitation

Management Zone 3 (MZ3) includes Alluvial Woodland (underscrubbed) consistent with RFEF located in the north of the study area, comprising 3.02 ha.

The aim of this management zone is to control of weeds to allow the natural regeneration of indigenous species. The broad-scale removal of exotic grasses will be avoided. All annual and perennial weed species can be sprayed with appropriate herbicide.

3.3.4 Management Zone 4 - Exotic Pasture Management

The aim of this zone is to control the spread and dispersal of exotic plant species into MZ3 and is approximately 4.18 ha in size. This zone is not proposed for planting or revegetation. Instead, the control of exotic species will help to promote the long-term regeneration of native species and will also protect the Alluvial Woodland in MZ3.

3.4 Revegetation

Revegetation of the MZ1 will be necessary to achieve a reasonable restoration outcome in the VRZ. The densities for revegetation have been calculated based on the disturbed condition of the VRZ and the low likelihood of native species recruiting following restoration works.

3.4.1 Staging and logic

Management Zone 1

This MZ is heavily degraded, and thus will require revegetation, as opposed to assisted natural regeneration in MZ2. One native vegetation community (Alluvial Woodland) has been

confirmed adjacent to this zone during field survey in (Ecoplanning 2020). Riparian vegetation will be revegetated on the banks of the creek and as such, this MZ will be revegetated to reflect Alluvial Woodland.

The abrupt removal of all exotic grasses on the banks of South Creek would likely increase the erosive potential of the watercourse and result in an influx in herbaceous weeds. Therefore, revegetation will commence with the establishment of 50 cm diameter weed free zones, where native midstorey and canopy tubestock will be installed. This will be achieved using herbicides, such as Roundup Biactive® at a solution suitable for the target species and will be conducted within the first 6 months of the contract.

The extent of *Cenchrus clandestinus** and other exotic grasses will gradually be reduced, as the midstorey and canopy species become established. This will coincide with the installation of native groundlayer species. Two planting events of native groundlayer species have been scheduled, one mid-way through the second year and one mid-way through the third year. The timing of groundlayer species revegetation can differ from these recommendations, so long as the recommended number of plants are installed through the zones. Supplementary planting is recommended for the end of the fourth year and will account for a 10% attenuation rate of all plantings conducted in this MZ.

3.4.2 Planting densities and species

Plantings will be installed at a density resembling Alluvial Woodland within MZ1. Revegetation will aim to recreate the densities of the community in an 'unmodified' condition. The native species used for revegetation will be consistent with the characteristic species of Alluvial Woodland. Planting densities have been determined for each MZ based on site condition/flooding capacity of the VRZ as follows:

- 1 canopy per 25 m^2
- 1 shrub species per 10 m^2
- 3 groundcover (grass, fern, forb or sedge) per 1 m^2

Table 3.1: Planting density table for revegetation works.

Zone	Area (m^2)	Revegetation densities (m^2)			Zone total
		Canopy	Shrub	Groundcover	
MZ1	36,600	1,464	3,660	109,800	114,924

3.4.3 Equipment, installation and timing

Prior to commencing planting, stock proof fencing will be installed to protect new vegetation from herbivory by deer. Plantings will be planned for late winter leading up to spring when regular rainfall is naturally occurring, and growth conditions are ideal. Planting of tube-stock (tree and shrub species) and Hiko or Viro cells (grasses and other groundcover species) will be favoured over broad-scale seed application, such as direct seeding or brush matting.

A water retaining and fertilising product (e.g. Terraform™) will be applied to each hole, to assist in the establishment of the plants. Each plant will be sufficiently watered on the same

day as installation and regular watering will continue in lieu of rainfall for a period of 6 weeks, or until plantings have taken.

3.5 Concurrent works

Vegetation management works will be carried out concurrently with civil construction works for the two water outlets in the north and the south of the VRZ, therefore planning between the bush regeneration contractor and civil works supervisor must be undertaken.

The civil works team will install environmental management controls across their sites including exclusion zone fencing and erosion and sediment control. It is the responsibility of the bush regeneration contractor not to damage these controls and if any damage is observed or inadvertently caused it must be notified to the civil works supervisor immediately.

3.6 Maintenance

The maintenance phase will continue for 3 years, following 1 year of primary and 1 year of secondary works. Regular inspections of site condition will be conducted, including general site monitoring for potential new infestation areas and subsequent weed control of any identified weed species. Inspections and site monitoring must occur every month. This schedule could be revised depending on performance criteria recorded.

Weed maintenance works will include:

- Removal of all herbaceous weeds prior to establishment and seeding, which will be achieved by hand-weeding in close proximity to plantings or the riparian zone. A broad-leaf selective herbicide (i.e. Starane Advanced), may be used to treat herbaceous weeds away from the watercourse and planted native vegetation
- Careful spot spraying of exotic grasses and herbaceous weeds amongst plantings in all management zones
- Gradual removal of exotic grasses, such as *Cenchrus clandestinus** in response to the spread and growth of planted vegetation
- Regular sweeps for woody weeds, which will be cut and painted with neat Roundup Biactive® prior to establishment

Re-vegetation maintenance works will include:

- replacement of poorly growing or diseased individuals consistent with the prescribed planting,
- management of insect damage, if necessary,
- watering during dry periods,
- augmenting past planting areas where attenuation has occurred.

3.7 Ongoing maintenance

Ongoing maintenance will continue beyond Year 5 for a minimum of 15 years (i.e. 20 years in total), however it is considered that maintenance is a ongoing requirement for the current or future landholder. Regular inspections will be undertaken over a 20-person day period within a year (i.e. one team of 3-4 bush regenerators undertake inspections every 2 months).

If required, additional management including weed maintenance and re-vegetation maintenance will be carried out during this period. Ongoing maintenance will

3.8 Costs of implementation

The costing for the implementation of the management zones has been calculated over a twenty-year period and is estimated at a total of $603,576.00 (**Table 3.2**), including the cost of monthly and annual reporting. This figure reflects a first-year cost of $361,716, second year costs of $11,820, third and fourth year costs $29,100, fifth year costs of $23,340 and ongoing maintenance costs $148,500.

The costs have been calculated based on the employment of trained bush regenerators at a rate of $480 pp/day ($60 pp/hr for an 8-hour working day), which covers crew and supervisor wages, equipment, herbicides, and all other associated business costs.

The costing indicates how many crew members are required to attend the site one day per month in the first year and then one day every four months in the remaining years, based on the size of the site, extent of weed infestation and expected timeframes for the completion of primary, secondary works and initiation of maintenance works. The costs are indicative of commercial bush regeneration charge-out rates, and some variation is expected depending on the bush regeneration company used and their associated charge-out rates. The cost of weed implementation is slightly higher in the third and fourth years of the contract. This amount factors in the likely reduction in herbicide application and increase in hand-weeding methods, as a result of the establishment of plantings, particularly groundlayer species, which will ideally have substantially increased in cover and abundance by the third and fourth years of the contract.

Table 3.2: Cost of vegetation management implementation over the 5-year period.

Timing	Task	Cost
Year 1	Primary and secondary weed control based on the cost of employing a team of 2 bush regenerators at $480 ($60 per hour for 8 hours) pp/day to attend site monthly.	$11,520
First 6 months	Revegetation of MZ1 a total of 114,924 canopy, shrub and groundcover plants (see **Table 3.1**).	$349,896.00
Reporting	Cost of 12-monthly report. The report will consist of a one to two-page report detailing the works conducted on site ($300 per report).	$300
	Year 1 total	***$361,716***
Year 2	Secondary weed control based on the cost of employing a team of 2 bush regenerators at $480 ($60 per hour for 8 hours) pp/day to attend site monthly.	$11,520

Timing	Task	Cost
Reporting	Cost of 12-monthly report. The report will consist of a one to two-page report detailing the works conducted on site ($300 per report).	$300
	Year 2 total	***$11,820***
Year 3	Maintenance weed control based on the cost of employing a team of 5 bush regenerators at $480 ($60 per hour for 8 hours) pp/day to attend site monthly.	$28,800
Reporting	Cost of 12-monthly report. The report will consist of a one to two-page report detailing the works conducted on site ($300 per report).	$300
	Year 3 total	***$29,100***
Year 4	Maintenance weed control based on the cost of employing a team of 5 bush regenerators at $480 ($60 per hour for 8 hours) pp/day to attend site monthly.	$28,800
Reporting	Cost of 12-monthly report. The report will consist of a one to two-page report detailing the works conducted on site ($300 per report).	$300
	Year 4 total	***$29,100***
Year 5	Final year of maintenance weed control based on the cost of employing a team of 4 bush regenerators at $480 ($60 per hour for 8 hours) pp/day to attend site monthly.	$23,040
Reporting	Cost of 12-monthly report. The report will consist of a one to two-page report detailing the works conducted on site ($300 per report).	$300
	Year 5 total	***$23,340***
Ongoing	Ongoing maintenance based on the cost of employing bush regenerators for 20 person days a year at $480 ($60 per hour for 8 hours) per day for 15 years.	$144,000

Timing	Task	Cost
Reporting	Cost of 12-monthly report. The report will consist of a one to two-page report detailing the vegetation conditions works conducted on site ($1,000 per report for 15 years).	$15,000
	Ongoing maintenance	***$159,000***
	Grand Total (ex GST)	***$615,076***

3.9 Pests and vermin

Pests and vermin are considered to consists of the following vertebrate pest animals identified by the Department of Primary Industries (DPI 2020b):

- Camels
- Feral deer
- Feral goats
- Feral pigs
- Foxes
- Pest birds
- Rabbits
- Wild dogs.

Pests recorded on the site include the Common Myna (*Sturnus tristis*) and European Red Fox (*Vulpes vulpes*).

Given that the development includes clearing, subdivision, construction as well as management of weeds and vegetation, it is unlikely that the proposed would increase the available habitat for these species. However, the Common Myna could establish on the site following construction and landscaping.

While consent condition B86 (Landscaping) is not part of the scope of this BMP, the developer will make a general recommendation to Penrith City Council to not choose exotic trees (especially palms and conifers) which would encourage breeding of the Common Myna and/or Australian White Ibis (*Threskiornis moluccus*). Appropriate waste management protocols across future development stages will also limit the establishment of resident pest birds and vermin.

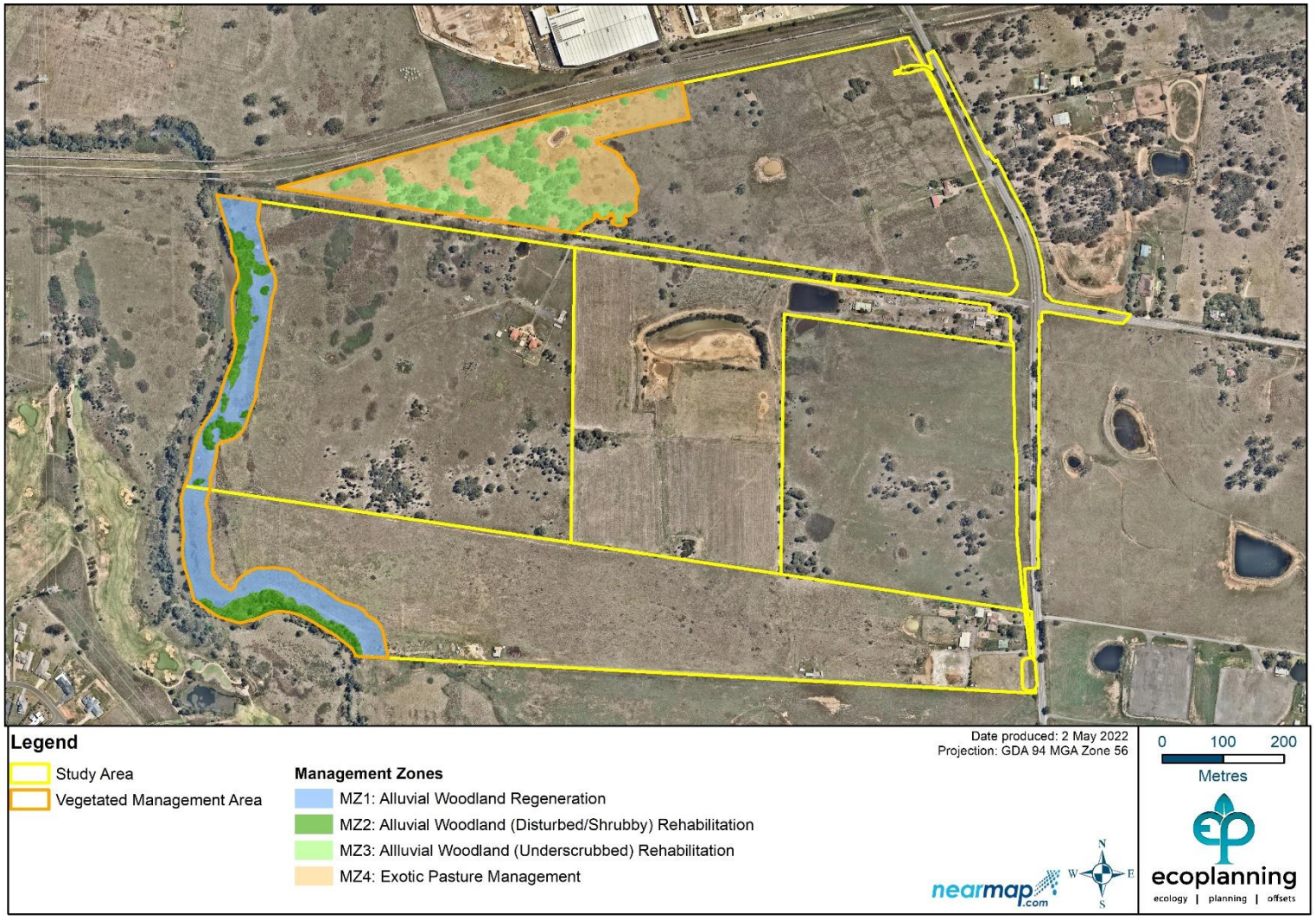

Figure 3.1: Proposed management zones within the study area.

4 Performance criteria and monitoring

4.1 Performance criteria

The progress of and compliance with the BMP will be monitored during the development and reviewed annually by the bush regeneration contractor and land owner and developer. A report detailing the outcomes of the review is to be provided to the Commonwealth Department of Agriculture, Water and Environment. The performance criteria listed in **Table** 4.1 below are considered to be best practice and are not linked with any specific legislation. Photo monitoring points will be established in each patch of Alluvial Woodland and each patch of Exotic grassland in the areas proposed for weed management. The bush regeneration contractor, in consultation with Penrith City Council can adapt these criteria as required in response to the success of restoration works. Based on the success of the management works, further performance criteria may need to be developed for the maintenance phase.

Table 4.1: Vegetation management performance monitoring criteria.

Treatment Zones	Year 1	Year 2	Year 3	Year 4	Year 5	Ongoing Maintenance (Year 5+)
All Zones	Commencement of all tasks outlined in this report or evidence of planning for their implementation.					Maintain as per year 5.
	A demonstrated increase in native cover and diversity and a demonstrated decrease in exotic species cover and diversity by the end of the 3rd year.					Maintain as per year 5.
	A minimum of 90% survival rate of all planted revegetation in MZ1.					Maintain as per year 5.
	A visible improvement of soil stability along the riparian zone in the VRZ.					Maintain as per year 5.
	No exotic vines >5 cm in length with low abundance and cover (<5%) throughout the site.					Maintain as per year 5.
	A 20% reduction in exotic grass cover.	A 40% reduction in exotic grass cover.	A 60% reduction in exotic grass cover.	A 70% - 80% reduction in exotic grass cover.	Exotic grasses maintained at <5% cover.	Maintain as per year 5.
	A 20% reduction in herbaceous weed cover.	A 40% reduction in herbaceous weed cover.	A 60% reduction in herbaceous weed cover.	A 70% - 80% reduction in herbaceous weed cover.	Herbaceous weed cover maintained at <5% cover.	Maintain as per year 5.
	A 90% reduction in woody weed cover.	No woody weeds >10 cm in height remaining, with low cover (<5%) and abundance throughout the site.				Maintain as per year 5.

4.2 Monitoring reports

A monthly monitoring report will be provided to Penrith Council by the last day of every month, which will shortly be followed by an inspection of the subject site with relevant Council staff and the contractor(s) implementing the BMP. The aim of the inspection will be to ensure that reporting is consistent with the on-ground implementation of the BMP and to revise the costings accordingly. An example report is detailed in **Table 4.2**, the report will include:

- Works carried out, including weed species targeted and their location;
- An approximation of the time spent on each task;
- Any observations, such as the occurrence of new weed species;
- Results from photo monitoring points;
- Rates of regeneration and herbivory of native species;
- A description of any problems encountered and how they were overcome;
- A summary of how the site-specific objectives have been met (or not);
- Herbicide and other chemicals used, including quantity, dilution rate and other relevant information;
- Weed control mechanisms used during the period;
- Climatic conditions which may have influenced weed germination and growth;
- Performance criteria and success; and
- If required, maps of weed distribution and density.

4.3 Bush regeneration contractors

Suitably qualified and experienced bush regeneration contractors that are members of the Australian Association of Bush Regenerators or fulfil the membership criteria must undertake all vegetation management works. In addition to this, team leaders will hold a Certificate III in Conservation & Land Management or possess equivalent field experience and certification. The contractor will carry out best practice bush regeneration techniques as described by Buchanan (2009).

Table 4.2: Example monitoring report template.

Date			
Name of Contractor:			
Hours worked on site since last monitoring report:			
Site Condition:	Zone		
	Weed cover %		
	Seedling survival %		

	Planting numbers		
	Herbicide used (in Litres)		
	Other		
Describe relevant weed management techniques:			
Describe problems; e.g. weed invasions, damage to planted material, etc.:			
Photographic evidence:			
Planned work before next monitoring report:			

5 Biodiversity management measures

This section outlines the proposed management measures for biodiversity values during earthworks, clearing and dam decommissioning within the subject site (Ecoplanning 2020). These measures are focussed on protection of biodiversity values that will be retained as well as the safe and ethical decommission of dams. General measures are provided in **Table** 5.1, **Table 5.2** and **Table 5.3**.

It should be noted that consent conditions B65 and B66 (retirement of credits) and B67 (Provision of evidence of credit retirement) and B68 (Biodiversity Management Plan) are required to be met prior to any clearing.

5.1 Pre-clearance protocols

Several non-threatened fauna species such as birds, arboreal mammals and amphibians are likely to be present at the development site. Appropriate pre-clearance protocols including dam dewatering protocols will be put in place at the time of construction to avoid and mitigate any potential harm or injury to these individuals. These protocols are discussed below and will be included as a component of the Construction Environmental Management Plan (CEMP).

5.1.1 On-site supervision of habitat tree felling and relocation of fauna

An ecologist will be required to be present onsite when felling habitat trees (hollow bearing and/or stag trees). The ecologist will confirm which areas to be cleared prior to any clearing.

Hollows will be inspected from an elevated work platform or cameras mounted to telescopic poles, prior to felling operations. Any fauna occupying a hollow during felling operations will be relocated (where feasible) to bushland immediately adjacent to the site.

The ecologist will need to work closely with the plant operators to identify each hollow and to stop work if an animal is observed and requires rescue. The ecologist will encourage any fauna species that may be present to move from site or if considered necessary capture, store and actively relocate them to another area. All habitat trees will be left over night to give species that are not possible to handle, further opportunity to relocate. Advice on appropriate actions for individuals that continue to utilise habitat of trees will be provided by the onsite ecologist. Any variation to this protocol must be approved by onsite ecologist.

The ecologist will ensure that any injured animals receive the appropriate levels of care. The nearest veterinary clinics will be contacted prior to the works beginning to ensure that they have the capabilities to care for injured native animals.

5.1.2 Soft felling operations

Soft felling of hollow bearing trees is encouraged to avoid unnecessary injuries to undetected fauna. This process involves an excavator or bulldozer softly ‘nudging’ trees before felling, in order to encourage any fauna that may be occupying a hollow or crevice to vacate the tree prior to being felled. Once the tree has been felled, the ecologist will undertake further searches of the tree for any animal that has not fled or is unable to flee. As above, fauna will

be relocated to bushland adjacent to the site, or if required, veterinary clinics and/or qualified wildlife carers contacted.

5.1.3 Performance criteria and follow-up

Performance criteria for the biodiversity management plan include the actions outlined in **Tables 5.1**, **5.2** and **5.3**. These actions guide and outline the measures that will manage biodiversity on the site.

Monitoring of these actions will be undertaken via submission of a report to Council (see Section 4 and **Table 5.2**).

Table 5.1: Prior to construction

Stage: Prior to construction	Objectives: Establish protected areas so that targeted vegetation and habitat is not cleared during construction			
Action detail	**Location**	**Performance indicators**	**Corrective action**	**Responsibility**
Engage an ecologist for the implementation of the BMP	N/A	Ecologist is engaged for the implementation of the BMP	No work until ecologist is engaged	Landowner/Developer
Install protective fencing that clearly identifies no-go-zones around vegetation and trees to be retained at a distance of 5 m from the dripline (outer edge of canopy). No stockpiling of materials or vehicle or pedestrian access will be allowed within the protective fencing.	Trees to be retained and perimeter of the VRZ and the VMA	Fencing installed and maintained Induction records No evidence of material stored within protective fencing	Non-compliance reporting completed, and submitted Immediate removal of items Development of remediation actions, if required	Landowner/Developer/Ecologist
Engage arborist to inspect the safety of trees to be retained	Isolated native trees to be retained	Arborist undertakes safety inspection of trees to be retained Induction records	If non-compliance reported, Arborist is engaged to complete inspection	Landowner/Developer
Dewater the farms dam in two stages. Stage 1: Reduce capacity by two thirds. Stage 2: Reduce capacity by the final third while an ecologist is present to capture/release/humanely dispose of fish (including eels), reptiles and crustaceans.	Farm dams	Ecologist is present during the final third of dewatering Wildlife is captured/released/humanely disposed of Induction records	Non-compliance reporting completed, and submitted Stop works order issued Ecologist to be present before works commencing again	Landowner/Developer/Ecologist

Stage: Prior to construction	Objectives: Establish protected areas so that targeted vegetation and habitat is not cleared during construction			
Action detail	**Location**	**Performance indicators**	**Corrective action**	**Responsibility**
Ecologist will provide clearance for activities to proceed after each dam dewatering	Farm dams	Ecologist to provide clearance in writing to the site supervisor	Non-compliance reporting completed, and submitted Stops works order issued Ecologist to provide clearance before works commencing again	Ecologist
Install erosion and sediment control devices	According to the Soil and Water Management Plan	Sediment and erosion control structures in place with no visible failings Soil suitably compacted around silt fencing to ensure no seepage is occurring No visible collection of sediment outside of sediment fence	Non-compliance reporting completed, and submitted Reinstatement of sediment and erosion control structures	Landowner/Developer/Ecologist
Commencement of control of priority weeds according to this BMP and the New South Wales Weed Control handbook (Department of Primary Industries 2018) and NSW WeedWise website (DPI 2020a).	Noxious weeds locations	Weed extent has not increased since the implementation of the BMP	Non-compliance reporting completed, and submitted Implement weed control	Landowner/Developer/Ecologist

Table 5.2: During construction

Stage: During construction		Objective: Undertake clearing in a manner that protects biodiversity values		
Action detail	**Location**	**Performance indicators**	**Corrective action**	**Responsibility**
Do not undertake work inside protective fencing. Do not stockpile materials or access the area inside the protective fencing with vehicles or on foot.	Retained vegetation, VRZ and the VMA	Fencing is installed with no visible failings No evidence of access, construction activity or other, within protective fencing No evidence of material stored within protective fencing	Non-compliance reporting completed, and submitted Immediate removal of items Development of remediation actions, if required Fencing maintained	Developer/Project Manager

Stage: During construction		Objective: Undertake clearing in a manner that protects biodiversity values		
Action detail	**Location**	**Performance indicators**	**Corrective action**	**Responsibility**
If trees are felled during spring the following actions will be undertaken: The ecologist will inspect the tree prior to felling and make recommendations that ensure no bird nests are harmed during the process. Felling will be supervised by a fauna specialist appropriately licensed under the NSW National Parks and Wildlife Act 1974, for the purpose of rescuing displaced fauna. The fauna specialist will be suitably attired with protective clothing and have suitable equipment to undertake the work. A “green card” from an Occupational Health and Safety Induction Training Course for Construction Work will also be held by the fauna specialist, who may also need to be suitably vaccinated (especially if there is potential for handling bats). An appropriately skilled local wildlife carer shall be engaged and notified at least 24 hours prior to the tree felling, that animals may be captured and that these animals may need care.	Trees that are cleared	Qualified ecologist onsite prior to felling and during felling. Induction records	Non-compliance reporting completed, and submitted Stop works order issued Ecologist to complete survey prior to works commencing again	Developer/Project Manager/Ecologist

Stage: During construction		Objective: Undertake clearing in a manner that protects biodiversity values		
Action detail	**Location**	**Performance indicators**	**Corrective action**	**Responsibility**
If any threatened fauna species is encountered during pre-clearing surveys the following protocol will be followed: - Work will be stopped - The Developer/site manager will be notified - Ecologist will assess the significance of the likely impact of clearing on the individual or individuals encountered - Ecologist will notify the EES and Council - If the impact on the fauna is not likely to be significant then work will commence, - If the impact is considered to be significant then work will not commence until advice has been obtained and following from EES regarding any necessary approvals.	Trees that will be cleared	Qualified ecologist onsite prior to clearing works commencing Induction records	Non-compliance reporting completed, and submitted Stop works order issued Ecologist to complete survey prior to works commencing again	Developer/Project Manager/Ecologist
Cleared vegetation and large woody debris that is weed-free will be reused on-site if required for erosion control measures and habitat.	Cleared vegetation	Cleared vegetation reused on-site if practical for erosion control measures and habitat	Non-compliance reporting completed, and submitted Reinstatement of reused cleared vegetation where practical	Developer/Project Manager/Ecologist

Stage: During construction		Objective: Undertake clearing in a manner that protects biodiversity values		
Action detail	**Location**	**Performance indicators**	**Corrective action**	**Responsibility**
Ensure that all clearing works are supervised by an ecologist, who will submit clearing report to Council	N/A	Qualified ecologist onsite during clearing works Induction records Council receive a copy of the clearing report	Non-compliance reporting completed, and submitted Stop works order issued Ecologist to be onsite prior to clearing works commencing again	Developer/Project Manager/Ecologist
Continue control of priority weeds if required.	Priority weed locations	Weed extent has not increased since the implementation of the BMP	Non-compliance reporting completed, and submitted Implement weed control	Landowner/Developer/Ecologist

Table 5.3: Post-construction

Stage: After construction		Objective: Undertake post-construction activities in a manner that protects biodiversity values		
Action detail	**Location**	**Performance indicators**	**Corrective actions**	**Responsibility**
Follow up of control of priority weeds if required.	Weeds locations / VMA	Implementation of follow up control of priority weeds Weed control to be completed in accordance with Section 3.2 of this BMP	Non-compliance reporting completed, and submitted Implement weed control	Landowner/Developer/Ecologist

Stage: After construction		Objective: Undertake post-construction activities in a manner that protects biodiversity values		
Action detail	**Location**	**Performance indicators**	**Corrective actions**	**Responsibility**
Remove protective fencing once construction has been completed.	Protective fences in Subject land/Development footprint	Protective fencing removed within the development footprint	Non-compliance reporting completed, and submitted Remove protective fencing within the development footprint	Developer/Land holder /Project Manager
Weed maintenance	VMA	Weed maintenance carried out in accordance with Section 3.2 of the BMP Weed maintenance achieves performance criteria outlined in Section 4.1 of the BMP	Non-compliance reporting completed, and submitted Implement weed maintenance	Developer/Land holder/Project Manager/Bush regeneration contractors
Revegetation	VMA	Revegetation carried out in accordance with Section 3.4 of this BMP Revegetation achieves performance criteria outlined in Section 4.1 of this BMP	Non-compliance reporting completed, and submitted Implement revegetation program in accordance with Section 3.4 of this BMP	Developer/Land holder/Project Manager/Bush regeneration contractors

Stage: After construction		Objective: Undertake post-construction activities in a manner that protects biodiversity values		
Action detail	**Location**	**Performance indicators**	**Corrective actions**	**Responsibility**
Ongoing maintenance	VMA	Maintenance continued in accordance with 3.7 this BMP Vegetation maintained in accordance with the Performance criteria outlined in accordance with Section 4.1 of this BMP	Non-compliance reporting completed, and submitted Implement ongoing maintenance in accordance with Section 3.7 of this BMP	Land holder / Bush regeneration contractors

6 References

Barrell, J., 2001. *SULE: Its use and status into the New Millennium.* Sydney, National Arborists Association of Australia (NAAA).

Conroy, E. et al., 2016. The impact of cattle access on ecological water quality in streams: Examples from agricultural catchments within Ireland. *Science of the Total Environment,* March, Volume 547, pp. 17-29.

Appendix A Flora species list for the study area

Family	Scientific Name	Common name	Native/Exotic	Form	BAM01		BAM02		BAM03		BAM04		BAM05		BAM06		BAM07	
					C	A	C	A	C	A	C	A	C	A	C	A	C	A
Alliaceae	*Nothoscordum gracile*	Onion Weed	Exotic	F														
Amaranthaceae	*Alternanthera denticulata*	Lesser Joyweed	Native	F														
Anthericaceae	*Tricoryne elatior*	Yellow Autumn-lily	Native	F					0.1	10	0.1	50	0.1	2				
Apiaceae	*Centella asiatica*	Indian Pennywort	Native	F			0.1	20			0.1	5	1	50				
Apiaceae	*Foeniculum vulgare*	Fennel	Exotic	F														
Apocynaceae	*Araujia sericifera*	Moth Vine	Exotic	L													0.1	5
Asteraceae	*Bidens subalternans*	Greater Beggar's Ticks	Exotic	F													5	100
Asteraceae	*Cirsium vulgare*	Spear Thistle	Exotic	F														
Asteraceae	*Conyza* sp.		Exotic	F	0.1	1			0.1	5			0.1	1				
Asteraceae	*Gamochaeta* sp.		Exotic	F					0.1	1								
Asteraceae	*Hypochaeris radicata*	Flatweed	Exotic	F	0.1	20			1	200	1.5	200	3	200				
Asteraceae	*Senecio madagascariensis*	Fireweed	Exotic	F	0.1	5	0.1	2			0.1	1	0.1	5	0.1	10	0.1	10
Asteraceae	*Senecio pterophorus*		Exotic	F	0.1	1												
Asteraceae	*Senecio quadridentatus*	Cotton Fireweed	Native	F														
Cactaceae	*Opuntia sp.*		Exotic	F														
Campanulaceae	*Wahlenbergia gracilis*	Tufted Bluebell	Native	F														
Casuarinaceae	*Casuarina glauca*	Swamp Oak	Native	T														

Family	Scientific Name	Common name	Native/Exotic	Form	BAM01		BAM02		BAM03		BAM04		BAM05		BAM06		BAM07	
					C	A	C	A	C	A	C	A	C	A	C	A	C	A
Chenopodiaceae	*Einadia nutans*	Climbing Saltbush	Native	F														
Chenopodiaceae	*Einadia trigonos*	Fishweed	Native	F													0.1	5
Commelinaceae	*Commelina cyanea*		Native	F	0.1	50									0.1	5	0.1	10
Convolvulaceae	*Convolvulus erubescens*	Blushing Bindweed	Native	L														
Convolvulaceae	*Dichondra repens*	Kidney Weed	Native	F													0.1	10
Cyperaceae	*Carex appressa*	Tall Sedge	Native	V	15	100	65	1000			0.1	1						
Cyperaceae	*Carex inversa*		Native	V											0.1	10		
Cyperaceae	*Cyperus spp.*		Exotic	F											0.1	1		
Fabaceae – Faboideae	*Desmodium varians*	Slender Tick-trefoil	Native	F													0.1	20
Fabaceae – Faboideae	*Glycine clandestine*		Native	F													0.1	10
Fabaceae – Faboideae	*Glycine tabacina*		Native	F													0.1	2
Fabaceae - Mimosoideae	*Acacia parramattensis*	Parramatta Wattle	Native	S/T														
Hypericaceae	*Hypericum gramineum*	Small St. John's Wort	Native	F							0.1	1						
Hypoxidaceae	*Hypoxis hygrometrica*	Golden Weather-grass	Native	F														
Juncaceae	*Juncus cognatus*		Exotic	R			1	20										
Juncaceae	*Juncus continuus*		Native	R			0.1	10										
Juncaceae	*Juncus* sp.		Exotic	R	0.1	20									0.1	10		
Juncaceae	*Juncus usitatus*		Native	R	0.1	10	0.5	50	0.1	10	0.1	10	0.1	2				
Lobeliaceae	*Pratia purpurascens*	Whiteroot	Native	F	0.1	50											0.1	1

Family	Scientific Name	Common name	Native/Exotic	Form	BAM01		BAM02		BAM03		BAM04		BAM05		BAM06		BAM07	
					C	A	C	A	C	A	C	A	C	A	C	A	C	A
Lomandraceae	*Lomandra filiformis*	Wattle Mat-rush	Native	F					3	200	0.5	10					0.1	10
Lomandraceae	*Lomandra multiflora*	Many-flowered Mat-rush	Native	F					2	50								
Malvaceae	*Modiola caroliniana*	Red-flowered Mallow	Exotic	F														
Malvaceae	*Sida rhombifolia*	Paddy's Lucerne	Exotic	F											0.1	1	0.1	20
Marsileaceae	*Marsilea* sp.		Native	E	0.1	10	0.1	5										
Myrtaceae	*Angophora floribunda*	Rough-barked Apple	Native	T			1	1										
Myrtaceae	*Eucalyptus amplifolia*	Cabbage Gum	Native	T	25	20	8	1	0.2	2							20	5
Myrtaceae	*Eucalyptus eugenioides*	Thin-leaved Stringybark	Native	T														
Myrtaceae	*Eucalyptus moluccana*	Grey Box	Native	T														
Myrtaceae	*Eucalyptus tereticornis*	Forest Red Gum	Native	T														
Myrtaceae	*Melaleuca decora*		Native	S/T			1	1							5	1	30	13
Oleaceae	*Ligustrum sinense*	Small-leaved Privet	Exotic	S														
Oxalidaceae	*Oxalis perennans*		Native	F					0.1	1							0.1	5
Phyllanthaceae	*Phyllanthus virgatus*		Native	F					0.1	1								
Pittosporaceae	*Bursaria spinosa* subsp. *spinosa*	Blackthorn	Native	S	3	100											5	20
Plantaginaceae	*Plantago lanceolata*	Lamb's Tongue	Exotic	F														
Poaceae	*Axonopus fissifolius*	Narrow-leafed Carpet Grass	Exotic	G	0.5	50	1	50	4	200	10	500	5	300				
Poaceae	*Bothriochloa macra*	Red-leg Grass	Native	G					0.5	50			0.1	2				

Family	Scientific Name	Common name	Native/Exotic	Form	BAM01		BAM02		BAM03		BAM04		BAM05		BAM06		BAM07	
					C	A	C	A	C	A	C	A	C	A	C	A	C	A
Poaceae	*Briza subaristata*		Exotic	G					2	100	5	200	30	1000				
Poaceae	*Cenchrus clandestinus*	Kikuyu Grass	Exotic	G											0.2	50	0.1	5
Poaceae	*Chloris gayana*	Rhodes Grass	Exotic	G														
Poaceae	*Cynodon dactylon*	Couch	Native	G	500	80	15	500	2	50	3	200	10	200	5	100		
Poaceae	*Eragrostis brownii*	Brown's Lovegrass	Native	G					2	100	3	200					0.1	10
Poaceae	*Eragrostis curvula*	African Lovegrass	Exotic	G	0.1	1	0.1	5	0.5	2					25	50	1	50
Poaceae	*Eragrostis leptostachya*	Paddock Lovegrass	Native	G									0.1	5				
Poaceae	*Eriochloa sp.*		Native	G														
Poaceae	*Imperata cylindrica*	Blady Grass	Native	G														
Poaceae	*Microlaena stipoides*	Weeping Grass	Native	G	1	100	2	200	3	200	5	200			0.1	10	75	1000
Poaceae	*Paspalidium distans*		Native	G					5	200	1	50						
Poaceae	*Paspalum dilatatum*	Paspalum	Exotic	G	2	100	2	200	4	300	5	500	65	2000	10	50	0.1	2
Poaceae	*Setaria parviflora*	Pigeon Grass	Exotic	G	0.1	1	0.1	2	0.1	50	1	100	1	50			1	50
Poaceae	*Sporobolus creber*	Western Rat-tail Grass	Native	G					0.1	10			0.1	10	0.1	5	0.1	5
Poaceae	*Stenotaphrum secundatum*	Buffalo Grass	Exotic	G														
Poaceae	*Themeda australis*	Kangaroo Grass	Native	G					65	2000	80	2000	0.5	10			0.1	2
Poaceae	*Vulpia* sp.		Exotic	G			1	100										
Polygonaceae	*Persicaria* sp.		Native	F														
Proteaceae	*Grevillea juniperina* subsp. *juniperina*		Native	S														
Proteaceae	*Hakea sericea*	Needlebush	Native	S														

Family	Scientific Name	Common name	Native/Exotic	Form	BAM01		BAM02		BAM03		BAM04		BAM05		BAM06		BAM07	
					C	A	C	A	C	A	C	A	C	A	C	A	C	A
Pteridaceae	*Cheilanthes sieberi*		Native	F													0.1	1
Rosaceae	*Rubus fruticosus*		Exotic	L	1	10												
Rubiaceae	*Asperula conferta*	Common Woodruff	Native	F														
Solanaceae	*Cestrum parqui*	Green Cestrum	Exotic	S														
Solanaceae	*Lycium ferocissimum*	African Blackthorn	Exotic	S														
Solanaceae	*Solanum sisymbriifolium*		Exotic	F											0.1	3	0.1	5
Solanaceae	*Solanum nigrum*	Black-berry Nighshade	Exotic	F											0.1	2	0.1	1
Typhaceae	*Typha orientalis*	Broadleaf Cumbungi	Native	F														
Verbenaceae	*Verbena bonariensis*	Purpletop	Exotic	F														
Verbenaceae	*Verbena rigida*	Veined Verbena	Exotic	F														

Appendix B Weed treatment methods

Zone	Objective	Main Weeds	Method	Key Performance Indicators (KPI)
All	Control and suppress exotic grasses.	• *Axonopus fissifolius, Eragrostis curvula, Cenchrus clandestinus, Chloris gayana, Setaria parviflora.*	• Primary and secondary works will consist of targeted removal of seeding annual and perennial exotic grasses, such as *Chloris gayana* and *Cenchrus clandestinus**. This will be achieved using a combination of brush-cutting and regular spot spraying. • Pasture and lawn grasses, including *Cenchrus clandestinus* will be targeted for removal in preparation for the revegetation of native midstorey and canopy species. This will be achieved by establishing 50 cm weed free zones, where all exotic species will be eradicated. • The broadscale removal of *Cenchrus clandestinus** will be avoided, given that it is likely suppressing an established herbaceous weed seed bank and assisting with soil stability along the riparian zone. The removal of *Cenchrus clandestinus** will be gradual and will correspond with the expansion and consolidation of previously planted areas, particularly leading up to the installation of native groundlayer species.	• A 20% reduction in exotic grass cover by the end of year 1 • A 40% reduction in exotic grass cover by the end of year 2. • A 60% reduction in exotic grass cover by the end of year 3. • A 70% - 80% reduction in exotic grass cover by the end of year 4. • Exotic grasses maintained at <5% cover by the end of year 5.
	Control and suppress herbaceous weeds.	• *Bidens subalternans, Cirsium vulgare, Hypochaeris radicata, Araujia sericifera*, *Senecio madagascariensis, Sida rhombifolia, Opuntia* spp., *Solanum* spp. and *Verbena* spp..	• Primary and secondary works will consist of selective brush-cutting and spot spraying through the subject site. It is recommended that a broad-leaf selective herbicide (i.e. Starane Advanced) is used to prevent unwanted removal of large areas of *Cenchrus clandestinus** in the early years of the contract. The uncontrolled removal of *Cenchrus clandestinus** will likely result in the germination and establishment of herbaceous weeds. As such, it is recommended that *Cenchrus clandestinus** is only removed in preparation for planting. This will be followed by a strict maintenance regime to suppress	• A 40% reduction in herbaceous weed cover by the end of year 1. • A 60% reduction in herbaceous weed cover by the end of year 2 and 3. • A 70% - 80% reduction in herbaceous weed cover by the end of year 4. • Herbaceous weed cover maintained at <5% cover by the end of year 5.

Zone	Objective	Main Weeds	Method	Key Performance Indicators (KPI)
			herbaceous weed growth and reduce the exotic weed seed bank. • Herbaceous weeds will be hand weeded or cut and painted with neat Roundup Biactive® when in close proximity to planted vegetation or watercourses in the subject site. • Herbaceous weeds will be treated prior to seeding, bagged, removed from site and disposed at a licensed green waste facility.	
	Treatment of all woody weeds.	• *Ligustrum sinense, Rubus fruticosus* spp. agg., Cestrum parqui, *Lycium ferocissimum* and *Solanum mauritianum.*	• Primary woody weed removal will be conducted in the first three months of the contract. Primary works will aim to eradicate all woody weed species. All woody weeds will be treated by cut and painting with neat Roundup Biactive®. • Secondary and maintenance woody removal will consist of sweeps through the VMA to prevent woody weeds from becoming re-established. Maintenance works will be conducted regularly, with a focus on removing woody weeds before reaching >50 cm, or prior to seeding. • It is recommended that all cut woody weed material is removed from site and disposed of at a licenced green waste facility.	• A 90% reduction in woody weed cover by the end of year 1. • No woody weeds >10 cm in height remaining, with low cover (<5%) and abundance throughout the site from year 2 onwards.