The Maltings - Vegetation Management Plan

Maltings Holdings Pty Ltd

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Template 2.8.1

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Abbreviations

Abbreviation	Description
BC Act	*Biodiversity Conservation Act 2016*
CAA	Controlled Activity Approval
DA	Development Application
ELA	Eco Logical Australia
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999*
MZ	Management Zone
NRAR	Natural Resources Access Regulator
IPA	Inner Protection Area
OPA	Outer Protection Area
RC	Riparian Corridor
SHSW	Southern Highlands Shale Woodlands
VMP	Vegetation Management Plan
WM Act	*Water Management Act 2000*
WoNS	Weed of National Significance
WSC	Wingecarribee Shire Council

Updates to existing Vegetation Management Plan 2024

ELA understands that Maltings Holdings Pty Ltd proposes a modification application (s4.55) regarding redevelopment of the Maltings, located at 2 Colo Street, Mittagong (herein referred to as the study area). The modification application would apply to the Southern Sheds, M1, M2, Northern Shed and Malsters House. Furthermore, Maltings Holdings propose a development application for the alterations, additions, and adaptation of M3 and minor internal changes to M4, in addition a façade change.

A Flora and Fauna Assessment (FFA) and Vegetation Management Plan (VMP) were prepared for the site by ELA in 2019/2020. As the assessments were over 3 years old, a site inspection was required to ensure validity of the report to current conditions.

An inspection of the study area was undertaken by ELA senior ecologist Stacey Wilson on 16 January 2024. The focus of the inspection was to ensure that the condition of the vegetation, particularly the threatened ecological community had remained the same. The survey recorded any opportunistic threatened flora or fauna sightings, and aimed to identify any threatened fauna habitat, not previously present.

One significant finding of the field survey was the confirmation of an occupied camp of *Pteropus poliocephalus* (Grey-headed Flying-fox (GHFF)). This species is listed as a vulnerable species under the NSW *Biodiversity Conservation Act 2016* and vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). There were approximately 50 to 75 individuals occupying the camp at the time of survey. The small camp present were using a patch of exotic vegetation approximately four *Salix* sp. (Willows). The individuals present are likely to relying on other native and exotic canopy species for roosting including *Eucalyptus* spp., and *Ligustrum* spp. (Privet). Willows are listed as a Weed of National Significance (WoNS).

The *Biosecurity Act 2015* and regulations provide specific legal requirements for state level priority weeds. One of the objectives of the VMP are to treat the riparian corridor with staged removal of *Salix* sp. and replacement planting with local indigenous belonging to the native community Southern Highlands Shale Woodland species along the riparian corridor.

However, considering the significant finding of the GHFF camp during the 2024 site inspection within the riparian corridor. The objectives of the VMP require update to manage threatened species habitat within the VMP area.

This report has been updated in 2024 to include the recommendation of a buffer zone of 20 m around the occupied GHFF trees. No treatment of weeds are proposed within the 20 m buffer zone of the GHFF camp. The aim of the buffer zone is to limit any disturbance to the GHFF camp, so that the exotic species within the riparian corridor can continue to provide an important foraging and sheltering resource for these vulnerable species.

It is recommended that annual monitoring of the GHFF camp be undertaken during the annual progress reports provided for the VMP. Annual monitoring would aim to provide information as to how these species are utilising the site. If during the years of monitoring the camp is not being utilised by GHFF,

there may be scope to include the excluded areas into the VMP management zones. Revision of the VMP to include these areas should be considered in consultation with Wingecarribee Shire Council.

1. Introduction

This Vegetation Management Plan (VMP) has been prepared by Eco Logical Australia Pty Ltd (ELA) on behalf of Maltings Holdings Pty Ltd to support the proposed redevelopment of the Maltings study area at 2 Colo Street, Mittagong (Lot 21 DP 1029384) in the local government area (LGA) of Wingecarribee Shire Council. Maltings Holdings Pty Ltd is proposing to refurbish existing buildings on the study area; construct new hotel accommodation, swimming pool, gymnasium, private residential development and associated infrastructure.

1.1 Background

The study area is located approximately 120 km southwest of Sydney, 600m north east of Mittagong Railway Station, 100m from the Old Hume Highway and is on the south-eastern fringe of the Mittagong Township (Figure 1).

The land within the study area comprises cleared land, gardens and native remnant trees, riparian vegetation and is dissected diagonally by the Nattai River (A 4th order Strahler stream). The study area comprises malthouse buildings on the western side of the Nattai River and fronting the Main Southern Railway line. In addition to these structures there are a number of ancillary/out buildings which include large barley stores, sheds, a service building complex (engine rooms and pumps), a company cottage and bridges over Nattai River. A 3rd order Strahler stream also crosses through the south-east portion of the study area.

The Maltings is a state significant heritage item. Under the Heritage Conservation of the Mittagong DCP condition Section A2.2.3 states:

Applicants are directed to the provisions of Clause 5.10 of WLEP 2010 which relates to the conservation of Items of Heritage and Heritage Conservation Areas and also to the associated Schedule 5.

In assessing a land use application, Council will consider the extent to which the proposal contributes to the achievement of both zone objectives and the following Heritage Conservation objectives:

a. *Preserve and protect buildings of heritage and cultural value.*

b. *Ensure that redevelopment immediately adjacent to buildings of heritage or cultural value in no way detracts from the visual quality or amenity of heritage buildings.*

c. *Ensure that redevelopment within or immediately adjacent to Conservation Areas reflects the high heritage value of the Area and contributes to that value.*

The Mittagong Town Plan DCP Part C Section 15 (i) also states:

Any development within the Maltings neighbourhood shall incorporate improvements to the ecological value for the foreshores and adjoining riparian zones of Nattai River and the quality of water flowing from land within the Maltings precinct, into the Creek.

As a best practice guideline, the Vegetated Riparian Zone (VRZ) as identified by the NSW Department of Primary Industries (DPI) Water for a Strahler 4th order stream is a 40 meter (m) vegetated buffer from

the top of the highest bank (TOB) on both sides of the watercourse and 30 meter vegetated buffer from TOB for a Strahler 3rd order stream. (DPI 2012).

Due to Bushfire, Heritage and Flooding requirements this VMP has deviated from the 40 m vegetated buffer from the top of bank of Nattai River and the 30 m vegetated buffer from the 3rd order stream in the south-east. However, this VMP has been prepared to meet the development control by improving the riparian zone by removing exotic species and revegetation of the riparian corridor which will overall, improve the water quality from overland flow into Nattai River. The VMP has also been prepared to meet the object of the *Water Management Act 2000* (WM Act) *'to provide for the sustainable and integrated management of the water sources of the State for the benefit of both present and future generations'.*

The conditions of the development controls above and the objective of the WM Act have been captured in the VMP objectives as described in Section 1.2 below and incorporated approaches to meet these objective within the VMP.

1.2 Objectives of the Vegetation Management Plan

This VMP has been prepared to reflect the high heritage value of the area. This VMP will guide vegetation works which aim to maintain significant planted flora species with heritage value areas throughout the Maltings and preserving the meadow appearance within the areas around the heritage buildings. The remnant woodland within the study area; the Southern Highlands Shale Woodland (SHSW) is listed as a threatened ecological community under the *Biodiversity Conservation 2016* (BC Act) and *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The remnant woodland will be retained and will include including targeted control of exotic species and additional plantings consistent with SHSW where appropriate.

This VMP does not aim to recreate native vegetation communities, but to maintain the remnant vegetation within the VMP area and trees of significant heritage value. This VMP will control weed species found in the management zones and reduce the abundance of these weed species and provide for the maintenance of ecological communities through a combination of bush regeneration and native species planting. This VMP will also direct revegetation plantings with the purpose of stabilising selected areas (e.g. riparian zone) and weed control works.

The VMP will run for five years or until the objectives and performance criteria outlined in this VMP are met. The objectives for the VMP are summarised in **Table 1.**

Table 1: VMP Objectives

Objectives	Approach
Maintain and enhance habitat values	• Protect existing native vegetation, in particular the Southern Highlands Shale Woodland in the south of the study area • Control weeds and prevent new outbreaks • Assist in the natural regeneration of species across the VMP area.
Provide a stable watercourse and riparian corridor	• Remove exotic *Salix* sp. from the riparian zone in a mosaic pattern or staged manner to reduce bank erosion and sedimentation into Nattai River. • Revegetate the riparian zone of Nattai River with locally indigenous native species

Objectives	Approach
Provide a plan for the Asset Protection Zone (APZ)	• Manage vegetation areas within the APZ to Rural Fire Service Standards for Asset Protection Zones • Strategic placement of revegetation with native species • Control weeds and prevent new outbreaks • Protect area from soil erosion
Cultural Heritage	• Ensure that redevelopment immediately adjacent to buildings of heritage or cultural value in no way detracts from the visual quality or amenity of heritage buildings, o this will be achieved by maintaining significant planted flora species with heritage value areas throughout the Maltings o preserving the appearance of European meadows directly adjacent to the buildings through planting of native daisies, herbs, forbs, etc.
Flood management	• Planting will need to consider the Manning's roughness assumptions of the Nattai River Flood Study (CSS, 2014) and any planting will need to be the same (match these assumptions). The Manning's assumption across most of the study area is 0.035, representing open space (i.e. grass).
Stormwater quality	• Stormwater quality will be enhanced by the introduction of eight biofilters/ bioretention systems that will utilise native sedges to uptake pollutants and improve water quality • Drainage swales and bioretention systems will be located to minimise impacts on existing trees • Grassed swales will utilise native grasses
Enhance native fauna habitat	• Retention of hollow-bearing trees within the SHSW to the south of the study area • Installation of nest-boxes to mitigate loss of hollow-bearing trees (if applicable) • Increase native flora species diversity to provide native fauna habitat • Install woody debris for native fauna habitat
Promote community education regarding the VMP area	• Installation of signage at key locations along the VMP boundary • Promote community involvement in weed control and prevention activities
Management of the riparian corridor for Grey-headed Flying Fox	• A 20 m 'no-work' buffer has been applied around the occupied Grey-headed Flying-fox camp. No weed removal works or revegetation works are to occur within the buffer zone. All trees, including exotic *Salix* sp. will be retained to provide foraging and sheltering habitat for GHFF. • Annual progress reports are to include monitoring of the GHFF camp. Monitoring results are recommended to be provided to WSC. • If annual monitoring report data shows that after several years the camp is not being occupied, there may be scope to revise the VMP to include management actions within the buffer zone, however, this would be subject to consultation with WSC.

1.3 Preparation and implementation of this plan

This VMP has been prepared and updated by a suitably qualified senior ecologist, Stacey Wilson, with over 7 years' experience in environmental consultancy and relevant Master of Environmental Science degree. Technical review has been carried out by Diane Campbell with over 20 years' experience in environmental management in local government, four years in environmental consulting, a relevant Bachelor of Science Degree and is an accredited Biodiversity Assessment Method Assessor and Biobank Assessor.

1.4 Implementation of this plan

A suitably qualified and experienced bush regeneration contractor is required to implement this VMP. They should be a member of the Australian Association of Bush Regenerators (AABR) or should possess the required qualifications and experience for membership. In addition to this, team leaders should have, as a minimum, a Certificate III in Conservation & Land Management or equivalent. The contractor will need to carry out best practice bush regeneration techniques as described by Buchanan (2009).

1.5 Key terms

For the purpose of this VMP, the following terminology has been adopted:

- Subject Study area: The extent of 2 Colo Street, Mittagong (Lot 21 DP 1029384)
- Development area: The proportion of the study area to be redeveloped, specifically the existing and proposed dwellings and ancillary features, as well as roads and parking spaces. This area is outside the scope of the VMP area.
- VMP area: The proportion of the study area to be conserved and managed by this VMP, specifically the 4.53 ha that encompasses the remnant Southern Highlands Shale Woodland and the riparian zone of Nattai River and all areas outside of the development area.

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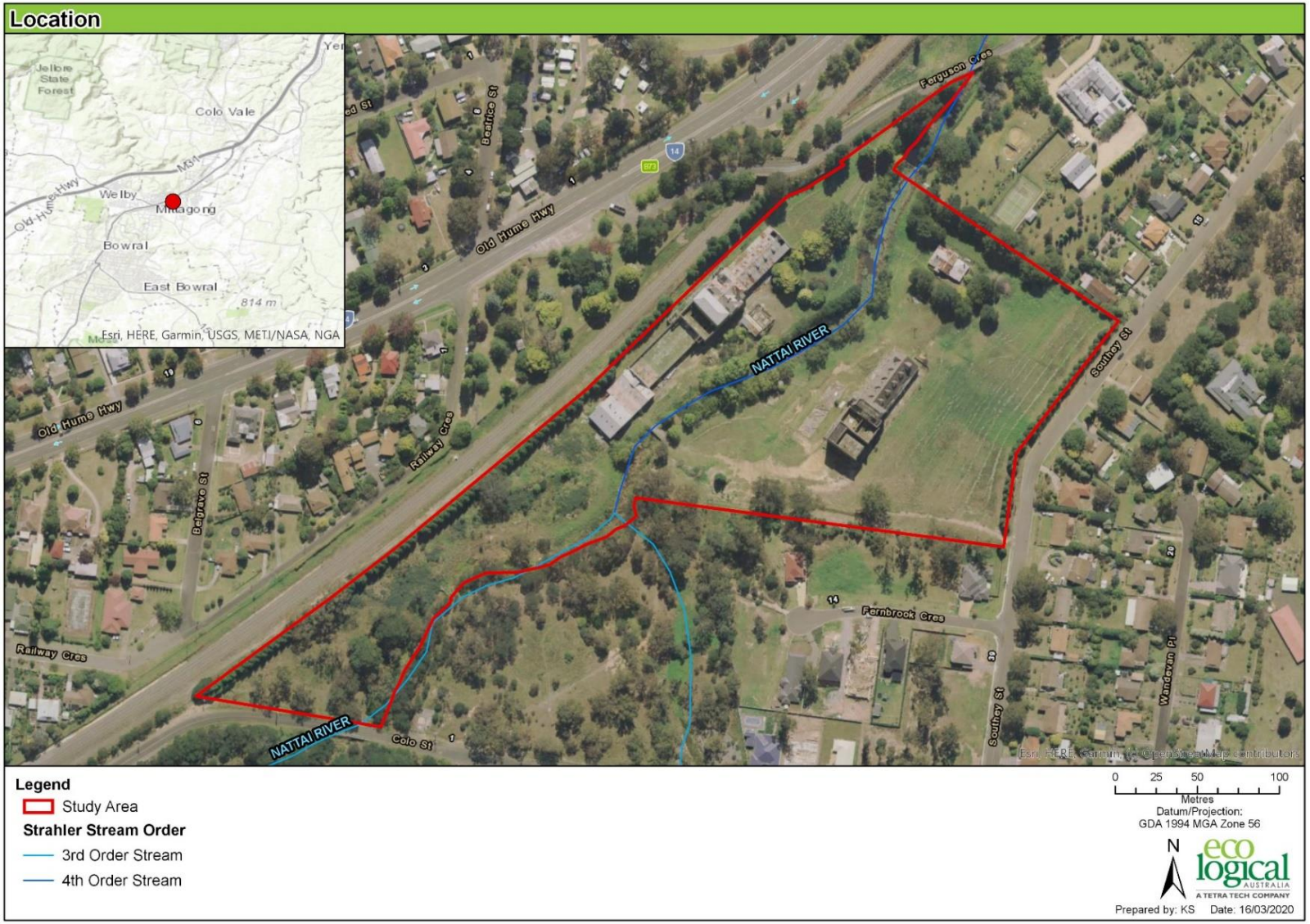

Figure 1: Location of the study area

2. Description of the environment

2.1 Topography and hydrology

The study area is dissected diagonally by the Nattai River and has established adjoining riparian zones. Nattai River is classified as a 4th order Strahler stream with Nattai River flowing in a northly direction. An unnamed 3rd order Strahler stream also crosses into the south-east of the study area where it joins confluence with Nattai River.

2.2 Vegetation Validation

A detailed description of each validated vegetation community is provided below and a summary of the vegetation communities and their corresponding Plant Community Type (PCT) is provided in Table 2.

A map of the validated vegetation on study area is provided in Figure 2.

Table 2: Vegetation communities and their condition listing under the BC and EPBC Act criteria within the study area

Plant Community Type	Vegetation community	BC Act Status	EPBC Act Status
PCT 944 Mountain Grey Gum - Narrow-leaved Peppermint grassy woodland on shales of the Southern Highlands, southern Sydney Basin Bioregion.	Southern Highlands Shale Woodland (moderate condition)	EEC	CEEC
N/A	Exotic vegetation	N/A	N/A
N/A	Exotic Pines	N/A	N/A
N/A	Exotic with scattered Acacias	N/A	N/A

EEC = Endangered Ecological Community
CEEC = Critically Endangered Ecological Community

2.2.1 Southern Highlands Shale Woodland

Despite the large amount of clearing and development impacts throughout the local area, Southern Highlands Shale Woodlands (SHSW) persists within the VMP area of The Maltings. SHSW in the Sydney Basin Bioregion is listed as an endangered ecological community under the BC Act and as a critically endangered ecological community under the EPBC Act. The vegetation community meets the size criteria to be considered as part of the EPBC listed community (ELA, 2020).

SHSW community occurs in the southern part of the study area in moderate condition. The best fit Plant Community Type (PCT) is PCT 944 *Mountain Grey Gum - Narrow-leaved Peppermint grassy woodland on shales of the Southern Highlands, southern Sydney Basin Bioregion*. The SHSW identified within the study area contained a canopy dominated by *Eucalyptus quadrangulata* (White-topped Box) and *Eucalyptus piperita* (Sydney Peppermint), with *Eucalyptus radiata* (Narrow-leaved Peppermint) and *Eucalyptus cypellocarpa* also present. The midstorey was sparse, dominated by *Acacia mearnsii*. The groundcover was degraded and contained a mixture of native and exotic grasses and forbs.

2.2.2 Exotic vegetation

A large portion to the east of the derelict buildings was comprised of exotic grasses and opportunistic weeds. Large exotic Willows (*Salix* sp.) also occur along the banks of the Nattai River (Figure 6).

2.2.3 Exotic Pines

Large, planted exotic *Pinus* sp. (Pine) and *Cupressus* sp. (Cypress pine) were mapped within the north-east of the study area as were two large pine trees in the south of the study area. The large pines are considered a significant heritage feature of the Maltings.

2.2.4 Exotic with scattered Acacias

Other planted exotic trees were prevalent across the study area with a mix of scattered Acacias. The scattered, planted Acacias do not form part of any PCT.

2.2.5 Priority Weeds

The *Biosecurity Act 2015* and regulations provide specific legal requirements for state level priority weeds (**Table 3**). Under the Act all plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.

Specific legal requirements apply to State determined priorities under the *South East Regional Strategic Weed Management Plan 2017-2022*. Weeds listed as 'other weeds of regional concern' under the plan warrant resources for local control or management programs and are a priority to keep out of the region. Inclusion in this list may assist Local Control Authorities and/or land managers to prioritise action in certain circumstances where it can be demonstrated the weed poses a threat to the environment, human health, agriculture etc.

Of the weeds identified during the field survey, three have been listed as state level priority weeds and two listed as other weeds of regional concern. The weeds present, their priority listing under the Act, the associated asset / value at risk and whether they are Weeds of National Significance (WoNS), are presented in Table 3**.**

A full list of weeds recorded during the field survey is provided in **Appendix B**.

Table 3: Priority weed species recorded in the study area

Scientific Name	Common Name	WoNS	*Biosecurity Act 2015*
State level priority weeds (Whole of State)			**Priority Weed Objective**
Asparagus aethiopicus	Ground Asparagus	Yes	Asset protection[1]
Rubus fruiticosus spp. agg.	Blackberry	Yes	Asset protection
Salix sp.	Willow	Yes	Asset protection
Other weeds of regional concern[2]			
Asparagus aethiopicus	Ground Asparagus	Yes	Species subject to local management programs
Salix sp.	Willow	Yes	Species subject to local management programs

[1] *Asset protection:* These weeds are widely distributed in some areas of the State. As Weeds of National Significance, their spread must be minimised to protect priority assets.

[2] Refer to South East Regional Strategic Weed Management Plan 2017 - 2022 for specific regional legal requirements

Figure 2 :Validated vegetation communities within the study area and location of GHFF occupied trees within the riparian corridor

2.3 Current and Proposed Vegetated Riparian Zone (VRZ)

The Nattai River that dissects the site is currently in a degraded condition with banks that are highly eroded and lacking native trees and shrubs. Current vegetation consists of exotic woody and herbaceous weeds, being dominated by *Salix* sp. (Willow), a state level priority weed and a Weed of National Significance (WoNS) (Figure 3 and Figure 4)**.**

Whilst the proposal is non-compliant with the *Guidelines for controlled activities on waterfront land*, it seeks to meet the requirements of the WM Act and demonstrate that minimal harm will occur to waterfront land. The site is highly constrained by the location of the heritage buildings within proximity to the Nattai River, and their redevelopment requires landscaping elements to allow for public usage within the heritage part of the site. It should be noted that the Landscape Plan utilises locally indigenous species.

Comments were received from the Natural Resources Access Regulator (NRAR) to improve the treatment of the Vegetated Riparian Zone (VRZ). In response, the proposed riparian corridor has been widened to 10 m width in the north western part of the site, 10 m width near the existing buildings on the east bank and remains at 5 m width on the west bank near the existing buildings. The VRZ covers 1.4 ha of the site. The VRZ is shown on Figure 5 and in the southern part of the site includes several different treatments east of the access road. Treatments include revegetation of the riparian corridor, as well as assisted regeneration and revegetation of the Southern Highlands Shale Woodland, as outlined in Section 4 and **Appendix D.**

This will result in minimisation of harm and improvements to waterfront land, including a wider VRZ within the heritage part of the site and restoration works including staged removal of Willow, bank stabilisation, as well as assisted regeneration and revegetation of locally indigenous species. There are a range of measures to stabilise banks using commonly available and widely used methods. These can include vegetation to strategic application of other materials. The need to stabilise banks has been deemed to be a necessary consideration when devising the best solution for the remediation of the site and can be a detailed assessment matter for future design development.

Figure 3 Riparian zone eastern bank

Figure 4 Riparian zone western bank

3. Construction and management works

The civil construction company shall be responsible for the following works.

3.1 Temporary fencing and interpretive signage

3.1.1 Temporary construction fencing

The edge of the VMP area where it borders the development footprint is to be fenced with temporary construction fencing to prevent civil construction machinery from entering the VMP area unless under supervision from a suitably qualified ecologist or bush regenerator.

3.1.2 Interpretive signage

Interpretative signage is to be located at strategic locations to advise local residents and visitors of the importance of the ecological community and its flora and fauna. Signage should be located at key access locations as per Figure 5. Signage should contain the following information:

'The vegetation within the Maltings Conservation Area is protected. Activities such as firewood collection, bushrock removal, picking of native flowers and dumping of garden waste are prohibited.'

3.1.3 Soil and water management

An Erosion and Sediment Control Plan, preferably as part of a Construction Environmental Management Plan, must be developed and implemented prior to any on-ground works. These should be in accordance with best management practices as described in Landcom's Blue Book (2004).

Prior to construction commencing sediment fencing will be required around any construction areas to prevent sediment running into the VMP area and limit the spread of weed propagules in soil sediments during the construction period.

3.1.4 Pre-clearance and earthworks

During construction activities, when clearing areas of existing vegetation, earthworks and tree removal should be undertaken with the fauna ecologist or wildlife carer to supervise works. All native timber should be retained, with mulch stockpiled for use within VMP area, all viable seed and genetic material to be collected and all timber cut into logs to be utilised as habitat for native fauna.

3.1.5 Soil preparation

During all earthworks in the VMP area, e.g. for stormwater connections, the natural topsoil is to be retained and returned to the area following works. Topsoil will need to be a loose, friable soil free suitable for planting.

3.1.6 Pest control

Pest control is the responsibility of the land holders, which is to be undertaken by relevant contractors in consultation with Local Land Services and WSC.

3.1.7 Fauna habitat enhancement

The protection of native biodiversity is important in the long-term health and rehabilitation of native ecological communities. Although the VMP contains a high proportion of exotic vegetation, native

fauna, namely birds, reptiles and amphibians, have adapted to these environments. The removal of a large coverage of weeds from within the VMP area in a relatively short timeframe may result in the displacement of native fauna species. This is a concern for maintaining local biodiversity, considering the amount of urban development in adjacent areas.

Bringing the bush back manual by Department of Infrastructure, Planning and Natural Resources (2003) provides practical management techniques to minimise the impacts to native fauna during bush regeneration works. Recommendations relevant to this VMP include:

- spray herbicides in cooler seasons to reduce impacts on amphibians
- work in areas where native resilience is higher before targeting degraded patches.

Eucalypts earmarked for removal within the development area should be used as habitat structures within the VMP area. This includes the use of fallen woody debris as habitat or for mulch. Mulch should be free of weed propagules. It is assumed that no hollow-bearing trees will be removed under the development footprint.

It is assumed that there will be minimal fencing within the VMP area. Any fencing installed will be required to be Koala-friendly. Table 5 provides some examples of the specifications used to aid Koala movement. Further information is provided in Appendix E.

Table 4: Koala fencing objective and design method

Objective	Method
Provide Koalas an alternate route over fencing	• Planting or retaining trees or sturdy shrubs near the fence. • Installation of timber posts or logs of at least 125mm diameter leaning against the top of the existing fence at an angle no greater than 60 degrees with the ground • Installation of a koala bridge – timber logs of at least 125mm diameter on either side of the fence, connected between the two at the top with a shorter log so the koala can easily climb up one side and down the other (particularly good for barbed wire topped security fences). • Adding a continuous series of flat boards at the top of the fence to allow a koala to walk along the fence without needing to come to the ground.
Allow Koalas to climb over fencing by using:	• Posts with close horizontal rails that allow at least 20mm between rails or with open rails and closed vertical slats spaced at least 10mm apart to allow room for koalas to grip. • Fences made from materials that koalas can easily grip and climb, such as round timber posts or chain wire mesh.
Allow Koalas to move under or through a fence	• Posts and open horizontal rails with a gap of at least 300mm between rails. • Solid fencing material that a koala is unable to climb but may pass under via a 300mm gap between the ground and the bottom of the fence.

4. Vegetation management works

4.1 Management zones

The total VMP area is 4.53 ha and encompasses all landscaped and non-landscaped areas outside of the building envelopes and ancillary structures.

There are five VMP management zones:

- Zone 1: Revegetation - Southern Highlands Shale Woodlands (Outer Protection Area)
- Zone 2: Assisted regeneration - Southern Highlands Shale Woodlands (Outer Protection Area)
- Zone 3: Revegetation - Riparian corridor
- Zone 4: Great meadow
- Zone 5: Landscaping

A 20 m buffer area from the outside of the occupied Grey-headed Flying-fox trees will be excluded from the management zones within the VMP.

The purpose of the buffer zone will be to limit disturbances to the GHFF camp present within the riparian corridor. No works, including weed control or revegetation are to occur within the buffer zone of the GHFF camp. This area has been excluded from the VMP management works, and costs accordingly.

Further descriptions are provided below.

4.1.1 Management Zone 1: Revegetation of Southern Highlands Shale Woodlands (Outer Protection Area) (MZ 1)

Zone 1 encompasses 0.65 ha of remnant Southern highlands Shale Woodland located in the eastern portion of the VMP area. The vegetation in this zone is in moderate condition with a semi-intact native canopy and disturbed understorey.

Revegetation works will be required to reinstate the native vegetation community to maximise ecological value throughout MZ1 as identified in **Section 4.2.3**, with species as per the recommended plant list in **Appendix D**.

MZ1 is to be managed as Outer Protection Area (OPA) to comply with NSW Rural Fire Service's *Planning for Bushfire Protection* (2006) as such canopy species within the remainder of this zone should be planted at 1 canopy species for every 50 m^2. This density would achieve the OPA requirement for 30 percent cover. Shrub arrangement may be restricted to a projected foliage cover of 30 percent (moderate fuel load) equating to a density planting of one shrub every 2 m^2 with shrub height to be less than two metres. Groundcover plantings within this area could be at densities of four plants every 1 m^2.

Ongoing maintenance of this zone following revegetation works will be required to fulfil OPA specifications. All grasses and groundcovers will require regular monitoring and maintenance to prevent excessive fuel loads within the zone, which will be achieved through brush cutting or mowing. This is particularly important leading up to the start and for the duration of fire seasons.

Exotic grasses within this zone should be slashed and sprayed using a non-selective herbicide (e.g. Roundup Biactive®) in preparation for revegetation works. This will reduce competition on native plantings. Care must be taken to prevent off-target spraying of native groundcovers.

4.1.2 Management Zone 2: Assisted Regeneration - Southern Highlands Shale Woodlands (MZ 2)

Management Zone 2 encompasses 0.20 ha of remnant Southern highlands Shale Woodland located in the south of the VMP area. The vegetation in this zone is in moderate condition with a semi-intact native canopy and disturbed understorey. Assisted regeneration is proposed throughout this zone to allow for the natural regeneration of SHSW species. No revegetation worked are proposed for this zone.

Weed management works will involve the removal of exotic species including *Rubus fruiticosus* (Blackberry), *Ligustrum* spp., *Cirsium vulgare* (Spear Thistle), *Asparagus asparagoides* (Bridal Creeper), *Ehrharta erecta* and *Cynodon dactylon* (Common Couch) and *Cenchrus clandestinus* (Kikuyu Grass). All vegetative waste will be composted or removed from study area in green waste collection.

The two large *Pinus* spp. in the southern area of the zone will be retained due to maturity and local heritage significance. However, regular maintenance is required to prevent the spread of *Pinus* spp. seedlings the management zone, maintenance actions should include the following:

- An aerial inspection of the large *Pinus* spp. via an Elevated Work Platform (EWP) is recommended to remove any remaining pinecones.
- Re-inspection and removal of immature fruits is recommended at intervals of 12-18 months after pollination. This will reduce the incidence of cones attaining a mature size before removal of dispersal.
- Mulch extending to the outer canopy drip line below the *Pinus* spp. where practically possible softens the fall and effectively diminishes the bounce of any fruit that may fall onto the mulched area.

Any trees removed within the study area should be relocated to this management zone to provide additional habitat opportunities for ground-dwelling fauna. It is expected that the hollow-bearing trees identified in (Figure 2) will be retained.

4.1.3 Management Zone 3: Revegetation of riparian corridor (MZ 3)

Zone 3 encompasses 0.83 ha of the riparian corridor ha which includes 5 m either side of the top of bank (TOB) of Nattai River.

IMPORTANT: MZ 3 excludes the buffer zone around the Grey-headed Flying-fox camp. No weed control or revegetation works are to occur within the excluded 20 m buffer zone around the GHFF camp.

The guidelines for riparian corridors on waterfront land state:

'The overarching objective of the controlled activities provisions of the WM Act is to establish and preserve the integrity of riparian corridors.'

Currently, the riparian corridor is severely degraded. The banks of the River are highly eroded, and the riparian corridor lacks native trees, shrubs and has been replaced by exotic woody and herbaceous weeds, including Weeds of National Significance (WoNS); *Salix* sp. (Willow). As such, any WoNS and all woody exotic species will be removed from the riparian corridor. These species should be removed in a mosaic pattern or in a staged manner to reduce bank erosion sedimentation into Nattai River. The riparian corridor will be revegetated with native species such as *Allocasuarina littoralis* (Black Sheoak), and other canopy consistent with Southern Highlands Shale Woodland, and with sedges, grass swales, aquatic and semi-aquatic species.

The revegetation of sedges, rushes and aquatic plants along the riparian corridor will improve water quality by effectively removing stormwater pollutants from the overland flow into Nattai River. Additionally, a total of 8 Bio-retention raingardens will be strategically placed along the riparian corridor. Bio-retention raingardens consist of a filtration bed with either gravel or sandy loam media and an extended detention zone typically from 100-300 mm deep designed to detain and treat first flush flows from the upstream catchment (Wyndham Prince, 2019).

Any weed removal within this management zone should not use herbicide or use a selective herbicide safe to use in or around waterways. If herbicide use is required within this zone, the bush regenerator contractor should avoid applying herbicide during rainfall events.

The riparian corridor of Nattai River is partially located within the APZ of the redevelopment. As such, revegetation within the riparian corridor will need to be achieve Inner Protection Area (IPA) specifications to achieve a surface-fuel of less than 8 tonnes per hectare.

Any revegetation of canopy species within this zone should be planted at a ratio of 1:100 m^2. This density would achieve the IPA requirement for 15 percent cover. Low growing shrubs and ground covers such as *Lomandra longifolia* and native reeds/ sedges should be used in revegetation to stabilise the banks. Groundcover plantings within this zone should be separated into discrete clumps and slashed prior to fire season to meet the specifications of an IPA.

A recommended planting list for this zone is provided in Appendix D.

4.1.4 Management Zone 4: Great meadow (MZ 4)

Management Zone 4 covers an area of 1.71 ha of exotic grassland surrounding the existing buildings. This area is expected to be 100% revegetated with native grasses and low growing forbs and herbs specifically aimed to preserve the European heritage impression of a meadow, to ensure that the landscape compliments the heritage listed buildings.

The meadow area will be managed under the specifications of an Inner Protection Area. No Trees or shrubs will be planted within this zone. Species for planting could include a mix of local and non-local native and grasses and herbs including; *Themeda triandra* (Kangaroo Grass), *Dichopogon strictus* (Chocolate Lily), *Brachyscome* sp., *Rhodanthe anthemoides* (Chamomile Sunray), *Veronica gracilis* (Slender Speedwell) *Stellaria pungens* (Prickly Starwort), *Thelionema caespitosum,* (Tufted Blue Lily), *Thysanotus tuberosus* ssp. *tuberosus* (Common Fringe Lily), *Caesia calliantha, Burchardia umbellata* (Milkmaids), *Bulbine bulbosa* (Bulbine Lily), *Craspedia variabilis* (Common Billy Buttons), *Calocephalus citreus* (Lemon Beauty-heads) and *Chrysocephalum apiculatum* (Common Everlasting).

4.1.5 Management Zone 5: Landscaping (MZ 5)

Management Zone 5 includes all landscaping within the Maltings which covers an area of 1.13 ha within the VMP.

Landscaped areas within MZ5 will not aim to recreate the Southern Highland Shales Woodland community, however, it is encouraged that native species be used throughout this management zone.

Landscaped plantings will require regular maintenance to comply with IPA specifications. Trees will not be planted around buildings and where planting of trees is proposed, they should be planted at a ratio of 1 tree every 100 m^2. Mulch used within the garden beds should be made of a non-combustible material. Landscape plantings be kept to an area less than 10 m^2 to ensure that the near-surface fuels are discontinuous. Any paving and mulch applied within the zone must be consistent with IPA specifications.

4.2 Weed control

4.2.1 Primary and secondary weed control

All weeds, including woody weeds in the understorey will require treatment. Secondary and maintenance weed control will be required following revegetation. During these weed control activities care must be taken to avoid off target damage to natural regeneration of native species.

Primary and secondary weed control will include woody weed and exotic grass control. Chemical and mechanical control techniques will be required in follow up treatments. For more information on specific weed control techniques, see **Appendix C**.

4.2.2 Maintenance

Following secondary weed removal and revegetation, all areas will require ongoing maintenance to control weed regrowth from the soil seed bank. Maintenance work is to be undertaken by a qualified bush regeneration contractor(s) as per specifications provided in **Appendix C.**

Maintenance will be undertaken on a regular basis in the peak growing seasons (spring and summer), with less frequent visits in cooler periods (autumn and winter). Maintenance programs will also comment on other study area issues such as rabbit activity. Maintenance work will include actions to encourage native regeneration where it is not occurring naturally. These actions include techniques such as soil disturbance, niche seeding and transplanting.

4.2.3 Revegetation

Revegetation works are required within MZ1, MZ3, MZ4 and MZ5.

Revegetation works within MZ1 will include planting of groundcover, grass / sedge, shrub and canopy species using species consistent with Southern Highlands Shale Woodlands. Planting of Hiko / Viro cells is the preferred revegetation method for ground cover species and grasses.

Mulch, where needed, is to be applied providing a depth of 100 mm. Mulch can be sourced from native vegetation earmarked for removal from the development area or externally sourced. Mulch should be of a non-combustible material such as sandstone.

Jute Matting is to be used instead of mulch in any areas of high erosion potential, such as the riparian corridor.

Planting densities for the management zones are listed below (Table 6). Specifications for revegetation activities, including seed collection is provided in **Appendix C**. A recommended planting list of are provided **Appendix D.**

Table 5: Planting assumptions and mulch requirements

Zone	Description	Total area (m^2)	Revegetation Area (%)	Revegetation. area (m^2)	Jute Matting (%)	Mulch (%)	Jute matting (m^2)	Mulch area (m^2)
MZ1	Revegetation of Southern Highlands Shale Woodlands (Outer Protection Area)	6,500	80	5,200	-	100-	-	5,200
MZ2	Assisted Regeneration - Southern Highlands Shale Woodlands	2,000	-	-	-	-	-	-
MZ3	Revegetation of riparian corridor	8,300	100	8,300	100	-	8,300	-
MZ4	Great meadow	17,100	100	17,100	-	100	-	17,100
MZ5	Landscaping	11,300	100	11,300	-	100	-	11,300
Total		**45,200**	**93**	**41,900**	**13**	**38**	**8,300**	**33,600**

Table 6: Revegetation densities and plant number requirements

Zone	Description	Revegetation Area (m^2)	Total plant number requirements				
			Trees	Shrubs	Herbs / scramblers	Sedges / Grasses	Total
MZ1	Revegetation of Southern Highlands Shale Woodlands (Outer Protection Area)	5,200	1/50	1/20	1.00	3.00	**21,164**
MZ2	Assisted Regeneration - Southern Highlands Shale Woodlands	-	-	-	-	-	**-**
MZ3	Revegetation of riparian corridor	8,300	1/100	1/50	1.00	3.00	**33,449**
MZ4	Great meadow	17,100	-	-	1.00	3.00	**68,400**
MZ5	Landscaping	11,300	1/100	1/50	1.00	3.00	**45,539**
Total		**41,900**					**168,552**

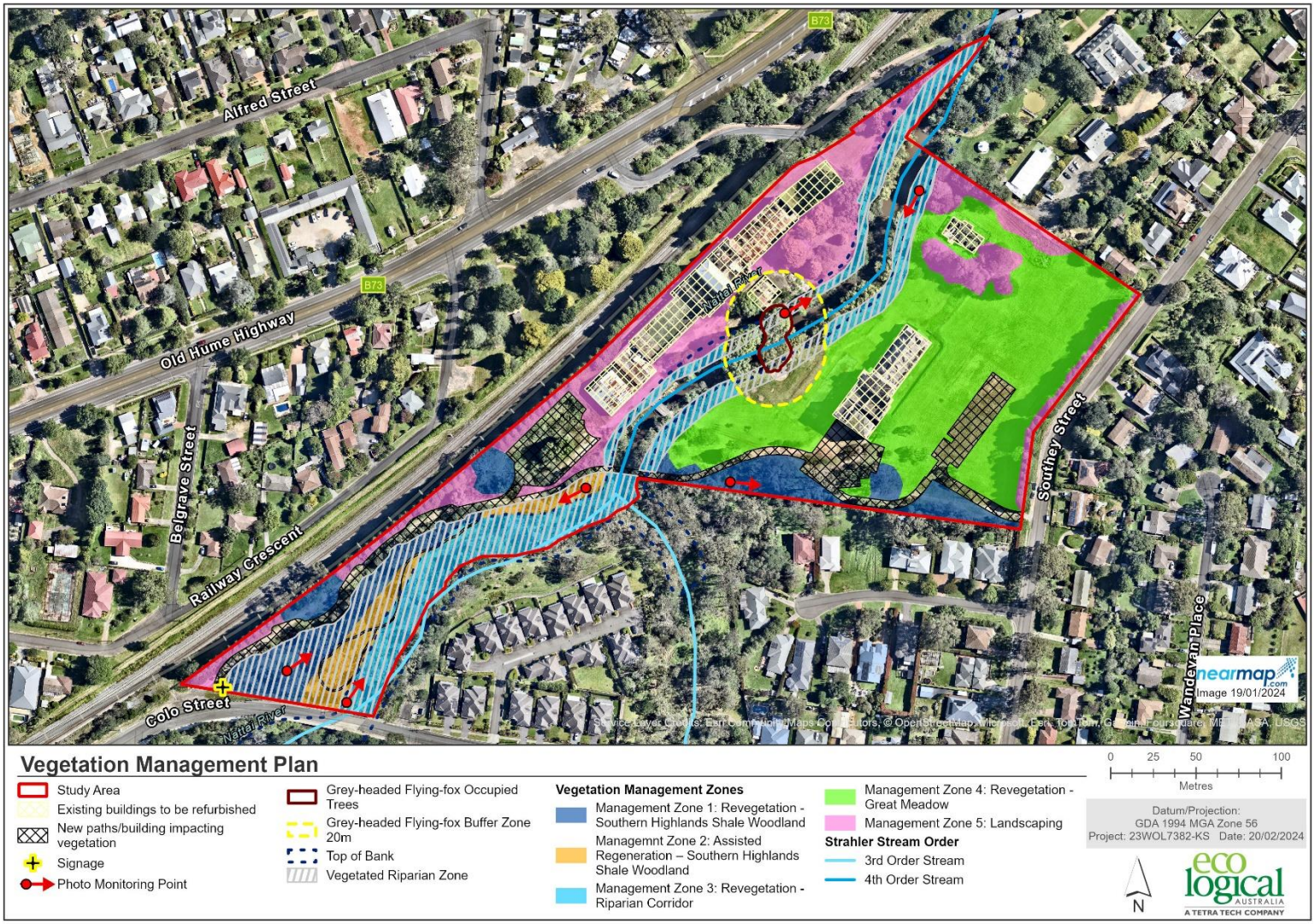

Figure 5: Vegetation Management Zones and 20m buffer zone around the GHFF camp excluded from the VMP works.

5. Implementation schedule and cost

5.1 Implementation schedule

The VMP will have an implementation period of five (5) years or until the required objectives for the VMP area as identified in are met, whichever is longer.

An indicative implementation schedule has been provided in Table 8.

Responsibilities have been identified as below:

Key	Civil construction activities (i.e. fencing)	
	Vegetation management works	

5.2 Adaptive management

As this is a long-term project that will be implemented over a number of years, an adaptive management approach will be implemented that enables the successful contractor to learn from and respond to successful and unsuccessful techniques used on the study area. In its simplest form this may include the substitution of species identified in the planting table or for undertaking advanced direct seeding techniques in place of manual planting techniques for revegetation.

The success of the works will be determined by meeting the performance criteria identified in **Table 9**. Contractors have the flexibility to implement different techniques to those specified here providing that performance criteria are met. Any major departures from the VMP or proposed changes to performance criteria must be approved in writing by WSC.

After the completion of all works described within this VMP, on-going inspection of the vegetation within the VMP area is to be carried out at least every three years to ensure the study area meets the performance criteria. Areas that do not conform to the performance criteria are required to be rehabilitated using the methods outlined within this VMP. Survey at these inspections is to include both priority and environmental weed populations.

The following performance criteria will need to be achieved annually in-perpetuity by the landowner

- across the VMP area, <2% priority weeds cover and <4% environmental weeds cover
- no infiltration by exotic lawn species into SHSW area
- no dumped garden waste within into SHSW area
- no bare areas >5m^2 or erosion into SHSW area or riparian corridor
- species richness and cover goals after the initial 5-year implementation period based on BioNet benchmark conditions for vegetation communities present on study area and as a reference for the riparian vegetation within the SHSW area (**Table 7**).

Table 7: Benchmark conditions for vegetation communities within the VMP area

Plant Community Type	PCT Common Name	Species richness[3]			Cover* (%)		
		Canopy	Shrub	Groundcover[4]	Canopy	Shrub	Groundcover
PCT 944 Mountain Grey Gum - Narrow-leaved Peppermint grassy woodland on shales of the Southern Highlands, southern Sydney Basin Bioregion	Southern highlands Shale Woodlands – 'tall wet' form[5]	5	8	22	54	12	46

[3] Based on monthly average following average rainfall year.

[4] Note: groundcovers include grasses and forbs but does not include ferns or other vegetation types within the groundstorey strata.

5 The 'tall wet' form typically occurs in areas with higher rainfall, soil moisture and fertility and in areas of sheltered topography.

Table 8: Implementation schedule

Treatment	Year 1				Year 2				Year 3				Year 4				Year 5			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Civil works																				
Install construction fencing																				
Install sediment fencing																				
Install permanent fencing (if required)																				
Install informational signage (if required)																				
Revegetation																				
Seed collection, cleaning, storage																				
Study area Preparation																				
Install mulch / Jute matting																				
Tubestock, supply and install																				
Replacement tubestock, supply and install																				
Irrigation																				
Weed control																				
Primary																				
Secondary																				
Maintenance																				
Other works																				
Monitoring and reporting																				
Implement rabbit control (if required)																				

6. Monitoring and reporting

The bush regeneration contractor and the land manager will monitor the vegetation for changes over time. Information gained through the monitoring and reporting process will identify works that have, and have not been successful, and the reasons for their success or failure.

The aim of monitoring is to measure the effectiveness of the control actions being undertaken to achieve the desired outcome. It will identify non-conformance and provide the land manager with the ability to implement corrective actions. Information derived from the results of monitoring will also be used in adaptive management (i.e. learning from past experience to inform future priorities and work plans). For example, as annual grass weeds are removed, herbaceous and perennial weeds may establish.

Finally, monitoring and reporting will help determine and quantify the costs related to weed management and the cost effectiveness of the VMP.

6.1 Monitoring

Monitoring will be undertaken by vegetation surveys and photo monitoring. Monitoring will need to be implemented prior to works commencing to establish a benchmark for performance, and to occur on an annual basis until the completion of the project. Monitoring results will be included in the progress report.

Photo monitoring points should be set-up using a permanent reference point to provide a visual reference of changes in the vegetation. Photo monitoring to include:

- set up a minimum of four photo monitoring points within the VMP area
- place two six-foot star pickets 10 m apart
- record the location (eastings and northings) of the first star picket with a GPS
- as well as the bearing to the second star picket
- take a digital photo from the first star picket looking towards the second star picket, the entire length of the star picket visible in the photo to act as a reference point
- label each digital image with a unique reference number that indicates where the photo was taken (i.e. the photo monitoring point) and the date it was taken (e.g. 01_190330 for a photo taken at the first photo monitoring point on the 30th March 2019).

Monitoring results will be included in progress reports as per **Section 6.2.**

6.2 Progress reports

Progress reports are to be provided on an annual basis until the completion of the project. This reporting includes the implementation of the monitoring actions specified in **Section 6.1** and a description of the works that have been undertaken. These reports will be submitted to WSC. Reports will include at a minimum:

- the time period the report relates to
- qualifications and experience of contractors
- certification of seed and local provenance stock

- a summary of works carried out within the period including
  - date and time of study area visits
  - works completed on the study area at each visit
  - a table detailing total man hours for each task carried out on study area
  - methods of weeding undertaken and details of herbicide use
  - numbers of tubestock planted if applicable
  - methods implemented for Assisted Natural Regeneration
- photo and quadrat monitoring results to date
- a description of any problems encountered in implementing the works recommended in the VMP and how they were overcome
- any observations made, including new plant species recorded (native and weed species), comments on rates of regeneration and any problems which impact on the implementation of the VMP
- if applicable, the results of the implementation works in relation to the relevant performance criteria.
- Annual monitoring of the Grey-headed Flying-fox camp should be undertaken by a suitably qualified ecologist. Monitoring is to include:
  - date and time of GHFF monitoring (monitoring should occur between October and February)
  - count of individuals
  - species identification of occupied trees and count of trees
  - estimated area of occupancy (m2)
  - Photo point displaying evidence of occupation or evidence of non-occupation. A baseline photo monitoring point should be established of one of the currently occupied trees. This tree should be used as a basis of displaying occupation or non-occupation of the trees if possible.
  - Commentary of the activity levels within the camp and identification of any suspected juveniles to determine if the camp is being used as a maternity camp.
  - Results of the GHFF monitoring are recommended to be provided to WSC.

6.3 Performance criteria

The performance criteria are detailed in **Table 9**.

Failure to meet these performance criteria will mean that the maintenance period will be extended until they are achieved. Therefore, maintenance must continue until WSC agrees that the objectives and performance criteria have been met and the maintenance period has concluded. The author of this VMP or equally qualified and experienced person must prepare a statement certifying the compliance of the performance criteria at the end of 5-year period.

If monitoring indicates that the VMP tasks are not resulting in achievement of the performance criteria, the task program will be revised. The civil contractor and the bush regeneration contractor, in consultation with Wingecarribee Shire Council, can adapt these criteria as required in response to the success of rehabilitation works

Table 9: Performance criteria

Management Zone	Year 1 (Establishment)	Year 2	Year 3 - 4	Year 5
All Zones	Commencement of all tasks outlined in the VMP or evidence of planning for their implementation *Civil construction works:* All construction and sediment fencing installed Information signage installed All earthworks completed under the supervision of an ecologist or bush regenerator Pest control management plan in consultation with LLS, with rabbit fencing installed as required Soil preparation works completed to specifications in Section 3.1.5 All rubbish and debris removed *Vegetation management works:* Revegetation is to be undertaken with a minimum of 60% of the benchmark levels for species diversity provided in Table 5 A minimum of 85% survival rate of all vegetation strata planted in each zone (e.g. tree, shrub and groundcover) No area greater than 2m x 2m without surviving revegetation Maintenance replanting is to replace plants by the same species, or where that species is not available, with the same growth form (i.e. tree for tree, etc.) and must not decrease species diversity. Any new species must be from the community being emulated and of local provenance Treatment of any new weed breakouts APZ should be maintained in perpetuity to ensure ongoing protection from the impact of bush fires. Maintenance of the IPA and OPA as described below should be undertaken regularly, particularly in advance of the bush fire season. Monitoring and reporting undertaken in accordance with Section 6 Priority weed cover less than 2% cover by Year 5 Monitoring of rabbit activity and adaptive control across the VMP area Monitoring and reporting undertaken in accordance with **Section 6**.			
MZ1: Revegetation of Southern Highlands Shale Woodlands (managed to meet standards of an Outer Protection Area (OPA))	• Treat 100% of priority weeds • Treat 95% of other weeds • Treatment of new weed breakouts • tree canopy cover should be less than 30%; and canopies should be separated by 2 to 5m.	• No greater than 10% cover by both priority weeds • No greater than 25% cover by other weeds • Suppression of all weeds during revegetation • Shrub and groundcover cover no less than 40% of their respective benchmark levels provided in Table 7	• No greater than 5% cover by priority weeds • No greater than 10% cover by other weeds • Shrub and groundcover cover no less than 60% of benchmark levels provided in Table 7 • tree canopy cover should be less than 30%; and	• No greater than 2% cover by priority weeds • No greater than 4% cover by other weeds • Shrub and groundcover cover no less than 75% of benchmark levels provided in Table 5 • tree canopy cover should be less than 30%; and

	• shrubs should not form a continuous canopy; and • shrubs should form no more than 20% of ground cover. • grass should be kept mown to a height of less than 100mm; and • leaf and other debris should be removed.	• 85% survival rate of plantings, replacement plantings where required • tree canopy cover should be less than 30%; and canopies should be separated by 2 to 5m. • shrubs should not form a continuous canopy; and • shrubs should form no more than 20% of ground cover. • grass should be kept mown to a height of less than 100mm; and • leaf and other debris should be removed.	canopies should be separated by 2 to 5m. • shrubs should not form a continuous canopy; and • shrubs should form no more than 20% of ground cover. • grass should be kept mown to a height of less than 100mm; and • leaf and other debris should be removed.	canopies should be separated by 2 to 5m. • shrubs should not form a continuous canopy; and • shrubs should form no more than 20% of ground cover. • grass should be kept mown to a height of less than 100mm; and • leaf and other debris should be removed.
MZ2: Assisted Regeneration - Southern Highlands Shale Woodlands	• Treat 100% of priority weeds • Treat 95% of other weeds • Treatment of new weed breakouts	• No greater than 10% cover by both priority weeds • No greater than 25% cover by other weeds	• No greater than 5% cover by priority weeds • No greater than 10% cover by other weeds	• No greater than 2% cover by priority weeds • No greater than 4% cover by other weeds
MZ3: Revegetation of riparian corridor (managed to meet standards of an Inner Protection Area (IPA)) **IMPORTANT - DOES NOT APPLY TO EXCLUDED BUFFER AREA FOR GHFF**	• Remove Weeds of National Significance in a staged manger • Treat 95% of other weeds • Treatment of new weed breakouts • Revegetation of riparian corridor (trees and groundcovers only) • Installation of Bio-retention raingardens	• Remove Weeds of National Significance in a staged manger • No greater than 25% cover by other weeds • Suppression of all weeds during revegetation • Shrub and groundcover • 85% survival rate of plantings, replacement plantings where required	• Remove Weeds of National Significance in a staged manger • No greater than 10% cover by other weeds	• Remove Weeds of National Significance in a staged manger • No greater than 4% cover by other weeds

MZ4 and MZ5 (managed to meet standards of an Inner Protection Area (IPA))	• Treat 100% of priority weeds • Treat 95% of other weeds • Treatment of new weed breakouts • tree canopy cover should be less than 15% at maturity; • trees at maturity should not touch or overhang the building; • lower limbs should be removed up to a height of 2m above the ground; • tree canopies should be separated by 2 to 5m; and • preference should be given to smooth barked and evergreen trees. • create large discontinuities or gaps in the vegetation to slow down or break the progress of fire towards buildings should be provided; • shrubs should not be located under trees; • shrubs should not form more than 10% ground cover; and • clumps of shrubs should be separated from exposed windows and doors by a distance of at least twice	• No greater than 10% cover by both priority weeds • No greater than 25% cover by other weeds • tree canopy cover should be less than 15% at maturity; • trees at maturity should not touch or overhang the building; • lower limbs should be removed up to a height of 2m above the ground; • tree canopies should be separated by 2 to 5m; and • preference should be given to smooth barked and evergreen trees. • create large discontinuities or gaps in the vegetation to slow down or break the progress of fire towards buildings should be provided; • shrubs should not be located under trees; • shrubs should not form more than 10% ground cover; and • clumps of shrubs should be separated from exposed windows and doors by a distance of at least twice the height of the vegetation.	• No greater than 5% cover by priority weeds • No greater than 10% cover by other weeds • tree canopy cover should be less than 15% at maturity; • trees at maturity should not touch or overhang the building; • lower limbs should be removed up to a height of 2m above the ground; • tree canopies should be separated by 2 to 5m; and • preference should be given to smooth barked and evergreen trees. • create large discontinuities or gaps in the vegetation to slow down or break the progress of fire towards buildings should be provided; • shrubs should not be located under trees; • shrubs should not form more than 10% ground cover; and • clumps of shrubs should be separated from exposed windows and doors by a distance of at least twice the height of the vegetation.	• No greater than 2% cover by priority weeds • No greater than 4% cover by other weeds • tree canopy cover should be less than 15% at maturity; • trees at maturity should not touch or overhang the building; • lower limbs should be removed up to a height of 2m above the ground; • tree canopies should be separated by 2 to 5m; and • preference should be given to smooth barked and evergreen trees. • create large discontinuities or gaps in the vegetation to slow down or break the progress of fire towards buildings should be provided; • shrubs should not be located under trees; • shrubs should not form more than 10% ground cover; and • clumps of shrubs should be separated from exposed windows and doors by a distance of at least twice the height of the vegetation.

the height of the vegetation. • grass kept regularly mown, especially immediately prior to and during bush fire season and • leaves and vegetation debris should be removed.	• grass kept regularly mown, especially immediately prior to and during bush fire season and • leaves and vegetation debris should be removed.	• grass kept regularly mown, especially immediately prior to and during bush fire season and • leaves and vegetation debris should be removed.	• grass kept regularly mown, especially immediately prior to and during bush fire season and • leaves and vegetation debris should be removed.

7. Cost

The cost of implementation for five-year period is approximately **$ $1,002,735**exclusive of GST and CPI. An indicative annual costing timeline is provided in Table 10.

Rates and costs are based on typical commercial rates. Assumptions that have been made in regard to estimating costs have been outlined below.

7.1 Construction and preparation works

Civil construction activities are identified in Table 8 these have not been included in Table 10.

7.2 Vegetation management works

7.2.1 Weed control techniques

Bush regeneration contractors will implement the weed control treatments identified in this VMP. These works have been estimated to cost **$2,000** for a team of four bush regenerators, including a supervisor, per day. The cost of bush regeneration works includes the costs of herbicide, vehicles and equipment which are required to implement the VMP.

7.2.2 Revegetation treatments

Bush regeneration contractors will implement the revegetation treatments identified in this VMP. Tubestock costs have been budgeted at an estimated $5.50 per tree and shrub including tree guards, planting, water crystals, fertiliser and initial watering, and an estimated $2.50 per grass, sedge and groundcover including planting, water crystals and initial watering.

A total of approximately **168,552** plants will be required to achieve the densities identified in the VMP, including a 10% replacement rate. The total estimated cost of revegetation is approximately **$464,565**for tubestock installation, including a 10% replacement rate.

The cost of mulch material has **not** been provided. Coats relating to mulch include the spreading / installation only. This has been estimated at a cost of $2.50 / m².

7.2.3 Seed collection

Budget for the collection of seed has been included as a separate task. If further seed collection works are required, this may be an additional cost.

7.2.4 Monitoring and reporting

Bush regeneration contractors or ecologists will undertake the monitoring and reporting identified in this VMP. This includes:

- initial setup of the photo points and conducting the baseline surveys
- preparing a yearly report, including photo points and vegetation surveys until the completion of the project

7.2.5 Pest control works

Costs for pest control works over the length of the maintenance period are difficult to predict and as such have not been included in the costings. The need and level of pest control works will be assessed in the monitoring reports and an approach will be determined in consultation with WSC.

Table 10: Implementation costs

Treatment	Establishment	Year 2	Year 3	Year 4	Year 5	Total
Revegetation						
Seed collection, cleaning, storage	$25,283	$0	$0	$0	$0	$25,283
Site Preparation	$20,950	$0	$0	$0	$0	$20,950
Jute Matting / Mulch	$142,100	$0	$0	$0	$0	$142,100
Tubestock, supply and install	$422,332	$0	$0	$0	$0	$422,332
Replacement tubestock, supply and install	$0	$42,233	$0	$0	$0	$42,233
Irrigation	$41,900	$0	$0	$0	$0	$41,900
Weed control						
Primary	$147,200	$0	$0	$0	$0	$147,200
Secondary	$23,675	$71,025	$0	$0	$0	$94,700
Maintenance	$0	$0	$20,200	$15,150	$15,150	$50,500
Associated costs						
Waste costs and other disbursements	$17,088	$7,103	$2,020	$1,515	$1,515	$29,240
Monitoring & Reporting - Years 1-5	$1,239	$1,239	$1,239	$1,239	$1,239	$6,197
Total	**$841,767**	**$121,600**	**$23,459**	**$17,904**	**$17,904**	**$1,022,635**

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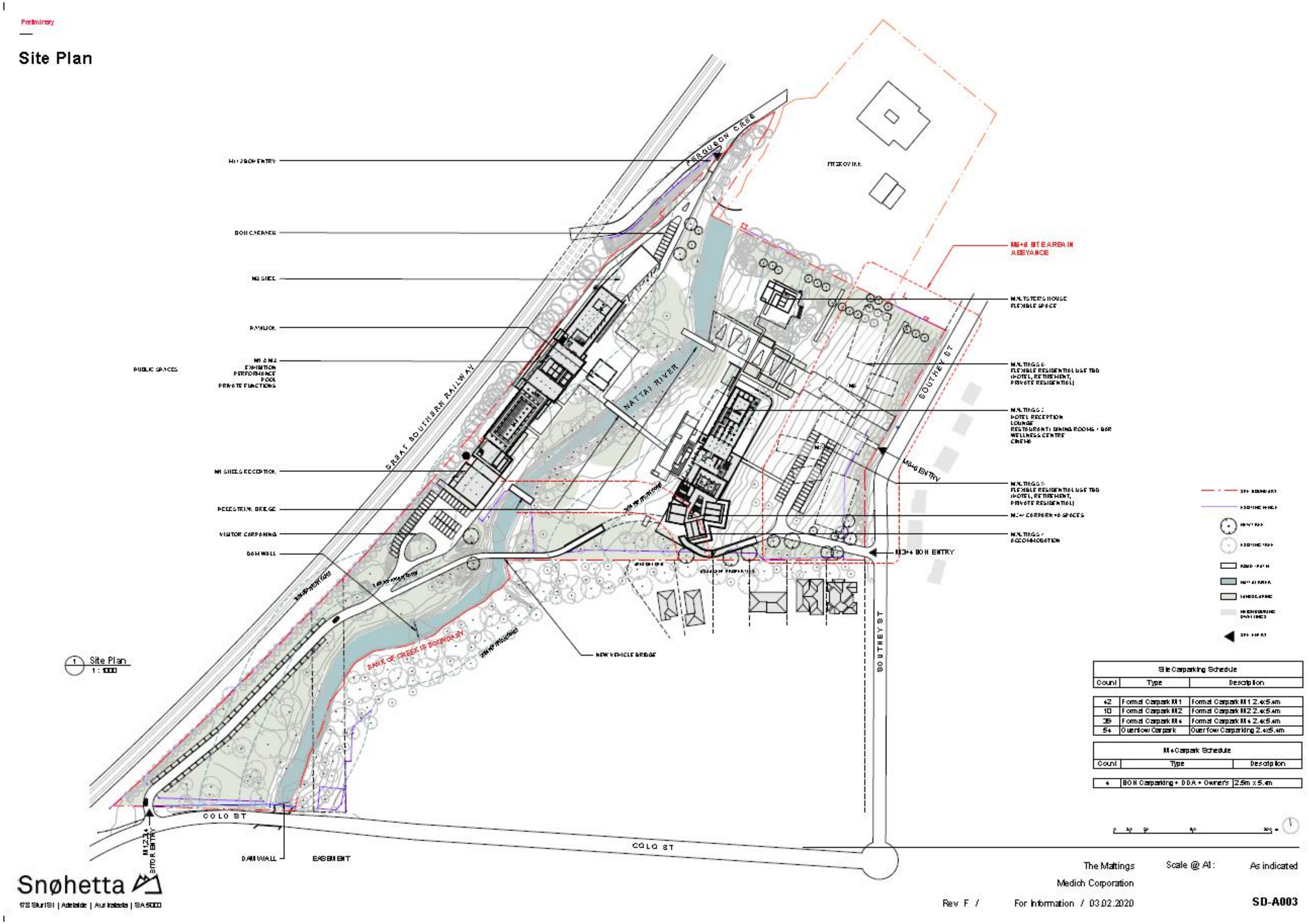
Appendix A : Study area Plan (Provided by Snohetta REV A (dated 09.03.2020))


Site Plan
GREAT SOUTHERN RAILWAY
NATTAI RIVER
COLO ST
SOUTHEY ST
NEW VEHICLE BRIDGE
Site Plan
1 : 1000
The Maltings
Medich Corporation
Scale @ A1:
As indicated
Rev F /
For Information / 03.02.2020
SD-A003
Snøhetta

Appendix B : Species identified within the study area

Scientific Name	Common Name	Exotic (*)	Priority	WoNS
Acacia mernsii	Black Wattle			
Agapanthus praecox	Blue Lily	*		
Amyema sp.				
Asparagus aethiopicus	Ground Asparagus	*		*
Asparagus asparagoides	Bridal Creeper			*
Cenchrus clandestinus	Kikuyu Grass	*		
Centella asiatica	Indian Pennywort			
Cirsium vulgare	Spear Thistle	*		
Cynodon dactylon	Common Couch	*		
Dianella caerulea	Blue Flax-lily			
Dichondra repens	Kidney Weed			
Ehrharta erecta	Panic Veldtgrass	*		
Einadia sp.				
Entolasia stricta	Wiry Panic			
Eucalyptus cypellocarpa	Mountain Grey Gum			
Eucalyptus piperita	Sydney Peppermint			
Eucalyptus quadrangulata	White-topped Box			
Eucalyptus radiata	Narrow-leaved Peppermint			
Exocarpos stricta	Dwarf Cherry			
Geranium solanderi	Native Germanium			
Glycine clandestina	Twining glycine			
Glycine tabacina				
Hardenbergia violacea	False Sarsaparilla			
Hedera helix	English Ivy	*		
Hypochaeris radicata	Catsear	*		
Juncus sp.		*		
Ligustrum lucidum	Large-leaved Privet	*		
Ligustrum sinense	Small-leaved Privet	*		
Lomandra filiformis	Wattle Mat-rush			
Lomandra longifolia	Spiny-headed Mat-rush			
Lomandra multiflora subsp. *multiflora*	Many-flowered Mat-rush			
Ludwigia sp.		*		
Lysimachia arvensis	Scarlet pimpernel	*		

Scientific Name	Common Name	Exotic (*)	Priority	WoNS
Medicago sp.		*		
Melaleuca linariifolia	Narrow-leaved Paperbark			
Microlaena stipoides	Weeping Grass			
Oxalis perennans				
Paspalum sp.		*		
Pinus sp.		*		
Pittosporum undulatum	Sweet Pittosporum			
Plantago lanceolata	Lamb's Tongues	*		
Poa sp.				
Rubis fruiticosus aggregate	Blackberry	*	*	*
Rumex crispus	Curly Dock			
Salix sp.	Willow			
Sida rhombifolia	Paddy's Lucerne	*		
Stellaris media	Chickweed	*		
Taracaxum officinale		*		
Typha orientalis	Bullrush			
Veronica plebeia	Trailing Speedwell			
Vicia sativa	Vetch	*		
Vulpia sp.		*		
Yucca sp.		*		

Appendix C : Techniques and specifications

WEED CONTROL

Weed control involves a combination of mechanical, physical and chemical techniques to remove the weeds and prevent regrowth. Weed control will be undertaken across the entire zone. A selection of the best suited weed control method within the study area depends on a number of factors including:

- the species or combination of weeds being targeted
- the density of the weeds
- resources available (time, labour, equipment and finances)
- weather conditions of the day

WEED CONTROL TECHNIQUES

Detail of specific weed control techniques to be used such as cut and paint, scrape and paint, herbicide spraying, and hand weeding are given in Brodie (1999). The principles of bush regeneration and techniques to trigger natural regeneration are to be in accordance with the Bradley Method and other techniques described in Buchanan (2000). Management techniques for different types of weeds are provided below.

ANNUAL GRASSES

Annual grasses should be hand removed or spot sprayed where isolated or in low concentrations. Larger patches of annual grasses may be slashed/brush cut in late spring to early summer, after flowering, but prior to seed set. For most species, slashing/brush cutting prior to late spring through to early summer will promote vigorous growth and should not occur. However, some annual grasses can grow and produce seed at any time of the year dependent on climatic conditions such as high rainfall and warm temperatures. Monitoring of annual species should be undertaken and if new growth occurs, the same treatment will be applied to the new growth to prevent seed production. Individual plants should be hand removed, bagged and disposed of appropriately off site.

PERENNIAL GRASSES

Perennial grasses, such as *Cynodon dactylon* (Common Couch), *Paspalum dilatatum* (Paspalum), *and Cenchrus clandestinus* (Kikuyu Grass) will be hand removed where isolated or in low concentrations. Larger patches may be slashed prior to seed production in spring or summer (depending on the growth cycle of the species) and the regrowth spot-sprayed 2-3 weeks later when it is actively growing and approximately 10 cm in length. Monitoring of these species will occur and if new seed production occurs, the same treatment will be applied again as required. However, slashing will not reduce the presence of exotic grasses on its own and must always be combined with targeted removal to reduce densities and allow for native regeneration. Individual plants should be hand removed, bagged and disposed of appropriately off site.

WOODY WEEDS

Follow up treatment of woody weeds will be controlled by the cut and paint or drill and fill method using a non-selective herbicide. The most appropriate method to be used depends on the size of the individual to be removed and will be determined by the bush regeneration contractor. Primary weed control

should use techniques that will not encourage flushes of secondary weed growth. All seedlings of woody weeds will be hand pulled or spot-sprayed with a non-selective herbicide.

CREEPERS AND CLIMBERS

The control of creepers varies depending on the species. For the most part, seedlings will be hand pulled, while mature plants can be controlled by the stem-scrape method or spot spraying using a non-selective herbicide. The precise method to be used will be determined by the bush regeneration contractor depending on the species, size and reproductive status of the individual. All vegetative material removed should be bagged, removed from study area and disposed of appropriately.

HERBACEOUS WEEDS

Where individual plants of herbaceous weeds are found, they will be hand pulled prior to flowering. Where large swaths of these species occur, they will be sprayed using a non-selective herbicide. If high densities of mature stands occur, weeds may be slashed first using a brush cutter and any subsequent regrowth sprayed. Regular monitoring of these species will be required to prevent seed production. *Cirsium vulgare* (Spear Thistle) if present, will not be hand-pulled due to its thorns and instead will be treated using cut and paint methods or spot sprayed for larger infestations using a non-selective herbicide. All vegetative material that is pulled out and has the potential to regrow if deposited on ground will be bagged and removed from study area.

MANAGEMENT OF WEED WASTE

All weed propagules, especially priority weeds, will be bagged and disposed of as directed by legislation at facility licensed to receive green waste. All weed waste without propagules will be composted on site area in small unobtrusive piles.

HERBICIDE USE

The use of herbicide to control weeds should be carefully considered. Herbicide must only be used for the purpose described on the product label, as per the NSW *Pesticides Act 1999.* Herbicide use should assess potential long-term impacts of the technique, including whether the proposed works address the source of the weed infestation. However, herbicide application forms an important and useful component of an integrated weed management approach and can be the most appropriate method for the control and eventual eradications of some weed species.

Herbicide use should occur during the active growing season for plants to encourage the chemical uptake into the plant. The selection of herbicides should also consider the type of weed and the location. Where non-selective herbicides are required for use, glyphosate is the most suitable. A glyphosate-based herbicide, formulated for use near waterways, will be used if works require herbicide application near waterways, a (e.g. Roundup Biactive®).

Broad-leaf selective herbicide may be used as per the NSW Weed Control Handbook (DPI 2018). However, this type of herbicide is extremely toxic to aquatic life and must not be used in, or adjacent to, waterways.

Registration and records must be kept in accordance with the NSW *Pesticides Regulation 2017*.

REVEGETATION WORKS

Revegetation has the dual aim of both re-establishing the original native vegetation community at the study area and reducing erosion along the length of the riparian corridor, which will carry greatly increased peak flows due the increased run-off from the hard surfaces created by the associated residential development.

Revegetation works within any APZ must be undertaken in accordance with NSW Rural Fire Service's *Planning for Bushfire Protection* (2006). Any plantings should consist of local provenance stock.

Planting of Hiko for trees and shrub species and Hiko or Viro cells for grasses and other groundcover species is the preferred method. Planting should be done via a low impact method such as hand digging or hand auger. The holes dug for each plant should be at least 1.5x the width and 2x the depth of the root ball. Fertiliser should be added to each hole dug as per the label specifications. Water crystals or wetting agents should be added to each plant hole. This will increase the water holding capacity of the soil and reduce watering schedules. Initial irrigation of the plantings is essential to ensure that the soil forms around the root ball and air pockets are removed. This will be required unless sufficient rainfall (approx. 10mm) occurs on the day of planting.

Tree guards will need to be installed on each tree or shrub to protect seedlings from extreme weather (frosts and heat), herbivorous grazing and herbicide drift during maintenance works. Bio-degradable tree guards are recommended to protect the seedlings. Following the revegetation works, irrigation needs to be undertaken for at least 8 weeks following planting to ensure the establishment of the plants. The level of irrigation will be determined by rainfall and temperature experienced at the planting study area.

A temporary irrigation system should be installed to assist in the establishment of vegetation. Timing of the planting of these areas will need to take into consideration surrounding civil works and erosion/sediment control requirements, these areas will not be planted until earthworks have been completed. A maximum rate of attrition of 10% is to be tolerated, with any plant loss above this rate to be replaced at the contractor's expense.

Mulch can be derived from vegetation removed from the development area, if available. Alternately, mulch should be comprised of un-composted wood (preferably wood waste), with a particle size of 15 mm to 40 mm, with no fines, and good air-filled porosity. Mulch should not contain any weed seeds, nor be derived from diseased trees or from any part of the tree lower than 1 m above the ground. Mulch, where required, should be installed to a depth of 100 mm.

Jute matting is to be installed in any areas of potential erosion i.e. steep creek banks. Jute matting, where required, must be comprised of 100% biodegradable jute fibres with a minimum weight of 680g/m^2 (~6 mm thickness). Jute must be pegged with at least 3 x 150 mm pins per m^2 and each roll overlapped by 100 mm.

Seed collection

For the growth of the plants used in the revegetation works, seed must be collected from local provenance species. Groundcovers, shrubs and trees should be collected as within proximity (i.e. <20km) to the study area. However, soil type, climate and aspect of the collection study area(s) should

also be considered. Native grasses and wetland species typically have much larger dispersal mechanisms and are to be collected from within the Sydney Basin.

Where species identified in this VMP cannot be sourced, they may be substituted for other SSTF species as identified by Tozer (2003). Species must be substituted with species of a similar form, e.g. trees for tree, grasses for grasses, etc. Only wild native species are to be used. Plants are not to be substituted with horticultural varieties under any circumstances.

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

Bush regeneration contractors

All vegetation management works in the establishment phase will be undertaken by suitably qualified and experienced bush regeneration contractors who are members of the Australian Association of Bush Regenerators (AABR) or fulfil the membership criteria. Additionally, team leaders should have, as a minimum, a Certificate III in Conservation & Land Management or equivalent. The contractor will need to carry out best practice bush regeneration techniques as described by Buchanan (2009). A flexible approach to this study area is recommended since techniques may need to be changed or modified to suit study area conditions. This approach is consistent with adaptive management and allows the contractor to develop and build on study area knowledge whilst implementing this VMP. Monitoring will assist in the development of the VMP actions in subsequent years.

Hygiene protocols

To avoid introducing soil pathogens / diseases in particular *Phytophthora cinnamomi* (Root rot disease) onto study area a hygiene protocol should be undertaken as per the guidelines developed by the Royal Botanic Gardens in '*Best Practice Management Guidelines for Phytophthora cinnamomi with the Sydney Metropolitan Catchment Management Authority*'.

For Bush Regenerators all tools and boots should be washed down and thoroughly cleaned of soil / mud using a solution of water and disinfectants prior to undertaking works on site. All machinery should be thoroughly cleaned of all soil / mud / debris prior to working within the VMP area.

Rabbit exclusion fencing

Rabbit proof fencing may be required to be installed to the guidelines in the Commonwealth Department of the Environment Catalogue of fence designs. The fencing will need to be a minimum of 90mm high, with a 180 mm skirt as per the figure below.

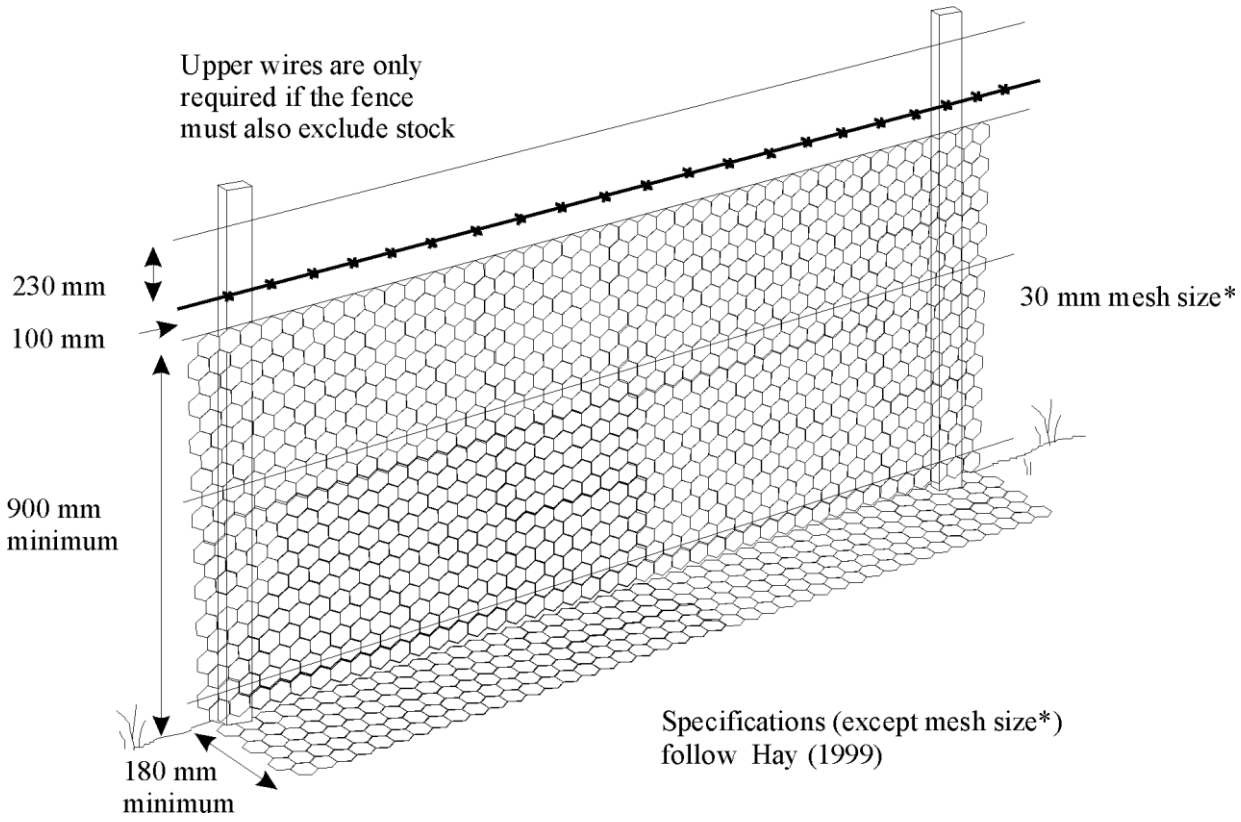


Figure C1: Recommended fencing for rabbit exclusion (DoEE 2004)

Appendix D : Recommended Planting List

Table 11: Recommended planting list

Stratum	Scientific Name	Common Name	Southern Highlands Shale Woodland species (MZ1 &, MZ3)	Aquatic species (MZ3)	Great Meadow (MZ4)
Canopy	*Angophora floribunda*	Rough-barked Apple	X		
	Eucalyptus amplifolia	Cabbage Gum	X		
	Eucalyptus cinerea	Argyle Apple	X		
	Eucalyptus cypellocarpa	Mountain Grey Gum	X		
	Eucalyptus dives	Broad-leaved Peppermint	X		
	Eucalyptus elata	River Peppermint	X		
	Eucalyptus fastigata	Brown Barrel	X		
	Eucalyptus globoidea	White Stringybark	X		
	Eucalyptus macarthurii	Camden woollybutt	X		
	Eucalyptus mannifera	Brittle Gum	X		
	Eucalyptus obliqua	Stringybark	X		
	Eucalyptus obliqua	Messmate	X		
	Eucalyptus ovata	Swamp Gum	X		
	Eucalyptus pauciflora	Snow Gum	X		
	Eucalyptus piperita	Sydney Peppermint	X		
	Eucalyptus punctata	Grey Gum	X		
	Eucalyptus quadrangulata	White-topped Box	X		
	Eucalyptus radiata	Narrow-leaved Peppermint	X		
	Eucalyptus rubida	Candlebark	X		
	Eucalyptus smithii	Gully Peppermint / Blackbutt Peppermint	X		

Stratum	Scientific Name	Common Name	Southern Highlands Shale Woodland species (MZ1 &, MZ3)	Aquatic species (MZ3)	Great Meadow (MZ4)
	Eucalyptus smithii	Ironbark Peppermint	X		
	Eucalyptus tereticornis	Forest Red Gum	X		
	Eucalyptus viminalis	Ribbon Gum	X		
Midstorey	*Acacia binervata*	Two-veined Hickory	X		
	Acacia buxifolia	Box-leaf Wattle	X		
	Acacia decurrens	Black Wattle	X		
	Acacia falciformis	Broad-leaved Hickory	X		
	Acacia implexa	Hickory Wattle	X		
	Acacia longifolia	Sydney Golden Wattle	X		
	Acacia mearnsii	Black Wattle	X		
	Acacia melanoxylon	Blackwood	X		
	Acacia parramattensis	Parramatta Wattle	X		
	Acacia penninervis	Mountain Hickory	X		
	Acacia rubida	Red-stemmed Wattle	X		
	Acacia stricta	Straight Wattle	X		
	Allocasuarina spp.	-	X		
	Amperea xiphoclada	Broom Spurge	X		
	Billardiera scandens	Hairy Apple Berry	X		
	Bursaria spinosa	Native Blackthorn	X		
	Cassinia aculeata	Common Cassinia	X		
	Coronidium elatum subsp. *minus*		X		

Stratum	Scientific Name	Common Name	Southern Highlands Shale Woodland species (MZ1 &, MZ3)	Aquatic species (MZ3)	Great Meadow (MZ4)
	Daviesia ulicifolia	Gorse Bitter Pea	X		
	Dillwynia ramosissima		X		
	Exocarpos cupressiformis	Cherry Ballart	X		
	Goodenia ovata	Hop Goodenia	X		
	Helichrysum leucopsideum	Satin Everlasting	X		
	Helichrysum scorpiodes		X		
	Hibbertia empetrifolia		X		
	Indigofera australis	Australian Indigo	X		
	Leptospermum polygalifolium	Yellow Tea-tree	X		
	Leucopogon juniperinus		X		
	Leucopogon lanceolatus		X		
	Leucopogon lanceolatus		X		
	Melaleuca linariifolia	Tea-tree	X		
	Melaleuca thymifolia	Thyme Honey-myrtle			
	Olearia microphylla		X		
	Olearia viscidula	Daisy Bush	X		
	Ozothamnus diosmifolius	White Dogwood	X		
	Persoonia linearis	Narrow-leaved Geebung	X		
	Plectranthus parviflorus	Cockspur Flower	X		
	Podolobium ilicifolium	Prickly Shaggy Pea	X		
	Polyscias sambucifolia	Elderberry Panax	X		

Stratum	Scientific Name	Common Name	Southern Highlands Shale Woodland species (MZ1 &, MZ3)	Aquatic species (MZ3)	Great Meadow (MZ4)
	Pultenaea blakelyi		X		
	Pultenaea flexilis	Graceful Bush-pea	X		
	Zieria smithii	Sandfly Zieria	X		
Groundcovers	*Asperula conferta*	Common Woodruff	X		
	Austrostipa rudis subsp. *nevosa*		X		
	Blechnum cartilagineum	Gristle Fern	X		
	Brunonia australis	Blue Pincushion			X
	Brachyscome multifida	Cut Leaf Daisy			X
	Bulbine bulbosa	Bulbine Lily			X
	Burchardia umbellata	Milkmaids			X
	Caesia calliantha,	-			X
	Calocephalus citreus	Lemon Beauty-heads			X
	Calochlaena dubia	Rainbow Fern	X		
	Chrysocephalum apiculatum	Common Everlasting			X
	Coronidium scorpioides	Button Everlasting	X		
	Craspedia variabilis	Common Billy Buttons			X
	Dianella longifolia	Blueberry Lily	X		
	Dichelachne crinita	Longhair Plumegrass	X		
	Dichondra spp.		X		
	Dichopogon strictus	Chocolate Lily			X
	Echinopogon caespitosus var. *caespitosus*	Tufted Hedgehog Grass	X		

Stratum	Scientific Name	Common Name	Southern Highlands Shale Woodland species (MZ1 &, MZ3)	Aquatic species (MZ3)	Great Meadow (MZ4)
	Eustrephus latifolius	Wombat Berry	X		
	Eryngium ovinum	Blue Devil			X
	Geranium homeanum		X		
	Geranium solanderi var. *solanderi*	Native Geranium	X		
	Gonocarpus tetragynus	Poverty Raspwort	X		
	Goodenia gracilis	Slender Goodenia			X
	Goodenia heterophylla	Variable Goodenia			X
	Hardenbergia violacea	Purple Coral Pea	X		
	Hibbertia scandens	Guinea flower	X		
	Hypericum gramineum	Small St. John's Wort	X		
	Imperata cylindrica	Blady Grass	X		
	Leptorhynchos squamatus	Scaly Buttons			X
	Leptorhynchos tenuifolius	Wiry Buttons			X
	Libertia paniculata	Branching Grass-Flag			X
	Lobelia purpurascens	Whiteroot	X		
	Lomandra longifolia	Spiny-headed Mat-rush	X		
	Lomandra multiflora	Many-flowered Mat-rush	X		
	Lotus australis	Austral trefoil			X
	Lythrum salicaria	Purple Loosestrife			X
	Microlaena stipoides var. *stipoides*	Weeping Grass	X		X
	Microseris walteri	Yam Daisy			X

Stratum	Scientific Name	Common Name	Southern Highlands Shale Woodland species (MZ1 &, MZ3)	Aquatic species (MZ3)	Great Meadow (MZ4)
	Opercularia diphylla	Stinkweed	X		
	Orthosanthus multiflorus	Morning Flag			X
	Patersonia glabrata	Leafy Purple-flag	X		
	Patersonia occidentalis	Purple Flag			X
	Poa labillardierei	Tussock Grass	X		
	Pelargonium rodneyanum	Magenta Stork's-Bill			X
	Podolepis jaceoides	Showy Podolepis			X
	Pycnosorus globosus	Drumsticks			X
	Poranthera microphylla	Small-leaved Poranthera	X		X
	Pteridium esculentum	Common Bracken	X		
	Rhodanthe anthemoides	Chamomile Sunray			X
	Rubis parvifolius	Native Raspberry	X		
	Rytidosperma pilosum	Smooth-flower Wallaby Grass	X		
	Rytidosperma racemosum var. *racemosum*		X		
	Scaevola aemula 'Aussie Salute'	Fan Flower			X
	Scaevola aemula 'Bombay Pink'	Fan Flower			X
	Scaevola aemula 'Zig Zag'	Fan Flower			X
	Schoenus melanostachys	Black Bog-rush	X		
	Senecio hispidulus	Hill Fireweed	X		
	Senecio minimus		X		
	Stackhousia monogyna	Creamy Stackhousia	X		X

Stratum	Scientific Name	Common Name	Southern Highlands Shale Woodland species (MZ1 &, MZ3)	Aquatic species (MZ3)	Great Meadow (MZ4)
	Stellaria pungens	Prickly Starwort			X
	Thelionema caespitosum	Tufted Blue Lily			X
	Themeda triandra	Kangaroo Grass	X		X
	Tetratheca thymifolia	Black-eyed Susan			X
	Thelionema caespitosum	Tufted Blue Lily			X
	Thysanotus tuberosus ssp. *tuberosus*	Common Fringe Lily			X
	Tricoryne elatior	Yellow Rush-Lily			X
	Tricoryne simplex	-	X		
	Veronica gracilis	Slender Speedwell			X
	Veronica plebeia	Trailing Speedwell	X		
	Viola betonicifolia	Showy Violet			
	Viola hederacea	Ivy-leaved Violet	X		
	Wahlenbergia communis	Tufted Bluebell			X
	Wurmbea dioica	Early Nancy			X
	Xerochrysum bracteatum	Golden Everlasting	X		
	Xerochrysum viscosum	Sticky Everlasting			X
Scramblers	*Clematis aristata*	Old Man's Beard	X		
Aquatic & semi-aquatic species	*Baumea articulata*	Jointed Twig-rush		X	
	Juncus usitatus	Common Rush		X	
	Bolboschoenus caldwellii	Marsh Club-rush		X	
	Bolboschoenus fluviatilis	Marsh Club-rush		X	

Stratum	Scientific Name	Common Name	Southern Highlands Shale Woodland species (MZ1 &, MZ3)	Aquatic species (MZ3)	Great Meadow (MZ4)
	Carex appressa	Tall Sedge		X	
	Carex fascicularis	Tassell Sedge		X	
	Carex gaudichaudiana			X	
	Carex inversa	Knob Sedge		X	
	Cyperus exaltatus			X	
	Cyperus trinervis			X	
	Cyperus vaginatus	Stiff Flat-sedge		X	
	Eleocharis sphacelata	Tall Spikerush		X	
	Ficinia nodosa	Knotted Club Rush		X	
	Isolepsis inundata	Swamp Club Rush		X	
	Juncus usitatus	Common Rush		X	
	Lepidosperma laterale	Variable Sword-sedge		X	
	Lepironia articulata	Grey rush		X	
	Philydrum lanuginosum	Frogsmouth		X	
	Potamogeton sulcatus	Floating Pondweed		X	
	Schoenoplectus mucronatus			X	
	Schoenoplectus validus	Lake Club Rush		X	
	Cycnogeton procerum	Water Ribbons		X	

Appendix E : Koala Sensitive Fencing Design

Table 1: Guide to Koala Sensitive Design - koala friendly fencing

Design specification	Additional supporting information
Use koala-friendly fencing material *Allow koalas to easily climb through or under a fence.* Build using minimal materials such as post and rail or other fencing material with a minimum gap of 300 mm between rails. Alternately use solid fencing material that cannot be climbed by koalas but has a minimum gap of 300 mm between the ground and the lowest rail to allow koalas to move underneath the fence.  *Allow koalas to easily climb over a fence.* Use rails or slats that have spaces of at least 10 mm between vertical slats and 20 mm between horizontal rails that koalas can climb. Alternately use materials such as timber posts or chain wire that a koala can easily grip and climb  	Koalas try to go through, under and then around a structure before attempting to climb over. Fencing raised off the ground is the best option for koalas. Koalas can become trapped in fencing as they try to squeeze through palings and rails. Fence design needs to ensure that gaps in the fence are: • large enough to allow easy access to pass through • of a size (less than 10 cm) to allow koalas to climb over, but prevent koalas climbing through and getting stuck in the fence.

Incorporate koala-friendly fencing additions

Build the fence to incorporate existing vegetation or trees.

Leave vegetation on either side of the fence with canopies or trunks extending beyond the height of the fence and where canopies are connected or tree trunks are less than 1 m apart.

Install a timber post or log (of at least 125 mm in width or diameter) leaning against the top of the fence but positioned at an angle to the fence so that the log is not flush with the fence (i.e. the space between the base of the log and the bottom of the fence is at least 400 mm (Figure7))

Install ladders of the following dimensions and design:

- Timber ladder rungs are at least 300 mm in width, 50-100mm in height and a minimum of 20mm in depth to provide grip for koalas.
- Rungs are spaced horizontally with a 150-300mm gap between rungs for ease of climbing.
- Webbed or latticed material is attached to provide additional footholds for koalas.

Incorporate structures or designs in association with fencing material that provide a means for koalas to climb over fences, retaining walls or other structures.

If installing koala-friendly fencing additions they should be used at the following frequencies:

- At least once within a backyard to allow animals to exit a property.
- At least once every 50 m where the length of the impassable barrier or fencing is greater than 200 m.

Ladder rungs need to be solid and firmly attached to the structure.

Install a simple koala bridge (particularly suited to security fences) using timber logs of at least 125 mm in diameter of the following design:

- Timber logs are positioned adjacent to and within 1 m of each other on either side of the fence and extend for at least 1m above the fence.
- A cross piece of similar diameter to the logs connects the two vertical timber posts that are within 1-4m of each other on either side of the fence.

Koala exclusion fencing

Install fencing material that is unclimbable such as:

- brick, metal sheeting, perspex or timber fencing without gaps between palings.

Koala exclusion fencing stops koalas moving between areas. It reduces permeability so should only be used where there is a direct threat to koala safety. The following situations are suitable for using koala exclusion fencing:

- Domestic dog enclosures in larger properties (greater than 800 m^2). Smaller properties should use other measures to reduce dog and koala interactions.
- High speed/volume roads or train lines - fencing funnels koalas to safe crossing structures (underpasses or overpasses).
- Swimming pools where pool design is unsafe for koalas.
- Areas where construction activities may cause harm to koalas such as pits or trenches. Temporary fencing that stops koala access would be appropriate.

• chain wire fencing material with a floppy top that falls in the direction that the koala will attempt to climb the fence or that has a smooth metal or perspex sheets of at least 600 mm wide on the top of the fence  	Additional requirements for koala exclusion fencing are: • Fence bracing or supports are on the side of the fence that's away from koala access. • The top of the unclimbable section of fencing is at least 1.5 m from the ground to prevent koalas jumping and gripping the top of the fencing. • Fencing should extend to ground level along uneven or undulating ground. • Vegetation beside the fence is regularly maintained to: o exclude trees and shrubs from within 3 m of the fence o keep canopies of trees trimmed to remove links to tree canopies on the other side of the fence o remove fallen branches and vines growing on the fence which koalas may use to climb over the fence.

Table 3: Guide to Koala Sensitive Design - koala safe pools

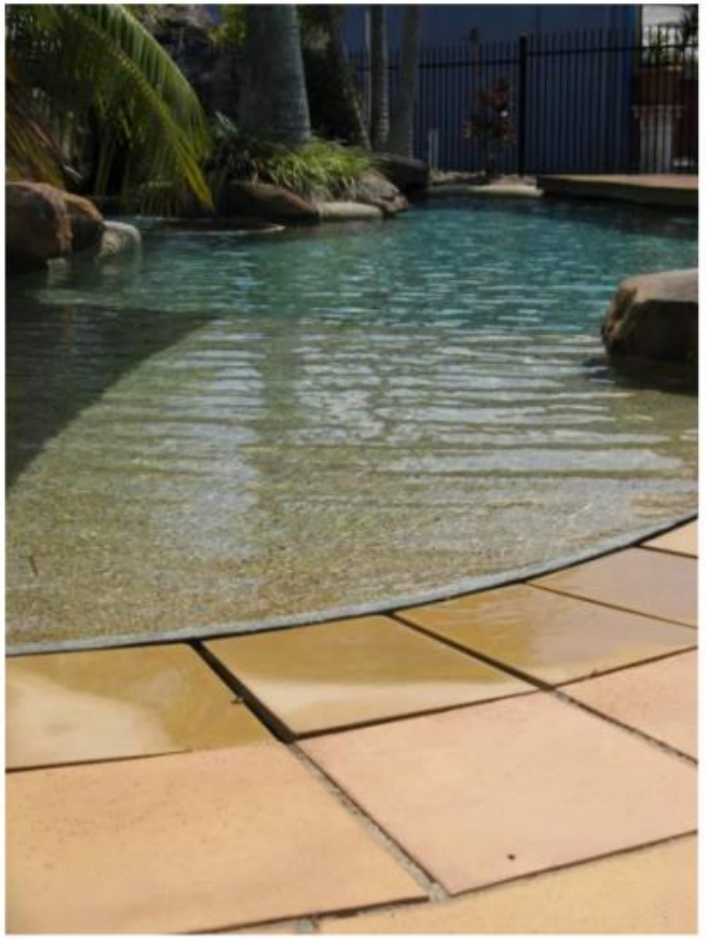
Design specification		Additional supporting information
Koala-friendly pool design Design pools with a shallow lagoon-style entry where the pool water is level with part of the surrounding pavement Incorporate a rope with a floatation device on the end in the pool (Figure 22). The rope should be: • a minimum diameter of 10 cm • anchored securely to a point beyond the pool and close to the ground • long enough to float at least 2 m into the pool. **Koala exclusion pool design** Use koala exclusion fencing around the pool, for example, glass or perspex that has negligible gaps at the bottom and between panels and the gate. Use appropriate landscaping that prohibits koalas entering the pool area on properties where exclusion fencing is used.		Floatation devices on lengths of rope allow koalas to better find the rope in the pool, while the rope's diameter and its position on the ground allows the koala to easily grip the rope and climb out of the pool.  Koalas drowning in pools can be avoided by preventing them from accessing the pool area. Pool fencing must also comply with Australian Standards and relevant state and local government requirements. If exclusion fencing is used without other koala-friendly design features, landscaping and garden maintenance should ensure that plants and structures do not allow koalas to enter the pool area. (See Koala exclusion fencing – additional requirements).

Table 5: Guide to Koala Sensitive Design - community awareness

Design specification		Additional supporting information
Education Install signs to inform residents and the community that koalas are present in an area and of actions that can be taken to protect koalas. Establish and promote programs that raise community awareness on koala presence, protection and safety. Publish easy to read information on websites.		Measures should be incorporated to educate residents about what things they can do to support koala populations in their area. This may include establishing local area committees to assist with the implementation and monitoring of koala sensitive design objectives.

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