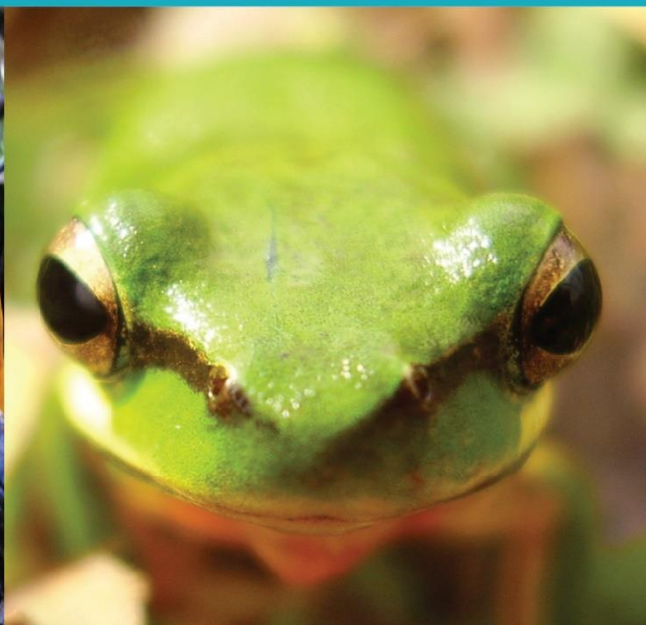




**TRAVERS
BUSHFIRE
& ECOLOGY**

A TBE ENVIRONMENTAL COMPANY



BIODIVERSITY MANAGEMENT PLAN

Proposed Development
70A Willandra Road, Narraweena

15 December 2021
(REF: 18ALT02.2)



BIODIVERSITY MANAGEMENT PLAN

70A Willandra Road, Narraween

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The mapping is indicative of available space and location of features which may prove critical in assessing the viability of the proposed works. Mapping has been produced on a map base with an inherent level of inaccuracy, the location of all mapped features is to be confirmed by a registered surveyor.

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EXECUTIVE SUMMARY

This biodiversity management plan (BMP) has been prepared by *Travers bushfire & ecology* to identify relevant biodiversity management measures specific to the proposed development for a residential dwelling with access, services and required APZs within the north-western portion of Lot 808, DP 752038 70A Willandra Road, Narraweena. This lot has frontage along Lady Penhryn Drive.

Biodiversity Management Works

Biodiversity management for the proposed dwelling focuses on the identification of the affected habitat features (such as hollow bearing trees, water courses, drainage lines and rock outcrops), minimising the removal of trees impacted by the works, loss and subsequent management of vegetation to create and maintain APZs, protection of high conservation value areas, and (if required) restoration of degraded areas. The dwelling and APZs have been located in an area of least conservation value and consequently the impacts have been minimised as much as possible.

The management of the residual bushland focuses on the protection of existing native flora and associated fauna habitat. A managed and/or landscape area has been identified which will be wholly situated within the bushfire APZ. All areas outside of the permanent protective fence located at the outer extent of the APZ. The residual bushland will remain wholly undeveloped with all rock outcrops, shelves, escarpments, native vegetation and the flora and fauna habitats that they contain protected and managed as a conservation area.

Schedule 1 – Vegetation Management Works illustrates the restoration strategy, trees to be retained and removed based on the proposed building envelope, driveway and required APZs.

The objectives are:

- To describe the vegetation communities and their condition;
- Identify affected threatened species, populations and ecological communities;
- Minimise ecological impacts on biodiversity and protect high conservation value lands;
- Installation of permanent protective fencing on the outer boundary of the required APZ in order to protect the residual bushland, restrict access, and ensure the retention of native bushland and the habitat it contains within the residual bushland;
- Provide guidelines for vegetation management within the residual bushland and APZ, and habitat tree removal within the APZ;
- Provide a weed management, works and restoration schedule;
- Protect potential Red Crowned Toadlet habitat;
- Protect potential Eastern Pygmy Possum habitat;
- Maintenance of all areas for three (3) years post development to ensure all managed areas are protected, maintained, weed free and in good condition;
- Auditing and certification of protection and management works by the appointed project ecologist at six (6) monthly intervals; and
- The Project Ecologist will undertake audits and issue Compliance Certificates at certain milestones.

The land not affected by the development and associated APZs is to be managed as residual bushland with access provided via the proposed access gates through the permanent

protective fence. Degraded areas (if any are found or created) are to be revegetated and protected to provide a well-defined conservation area and a separate managed landscape for residential purposes (Schedule 1).

A program of works, maintenance requirements and performance targets has been identified for the proposed dwelling and associated works, as well as the residual bushland within the allotment.

LIST OF ABBREVIATIONS

APZ	asset protection zone
BAM	Biodiversity Assessment Method
<i>BC Act</i>	<i>Biodiversity Conservation Act (2016)</i>
<i>BC Reg</i>	<i>Biodiversity Conservation Regulation (2017)</i>
BMP	Biodiversity Management Plan
BPA	bushfire protection assessment
BSSAR	Biodiversity Stewardship Site Assessment Report
CEEC	Critically endangered ecological community
<i>CM Act</i>	<i>Coastal Management Act 2016</i>
CUS	Coastal Upland Swamp
DCP	development control plan
DEC	NSW Department of Environment and Conservation (superseded by DECC from April 2007)
DECC	NSW Department of Environment and Climate Change (superseded by DECCW from October 2009)
DECCW	NSW Department of Environment, Climate Change and Water (superseded by OEHS from April 2011)
DEWHA	Commonwealth Department of Environment, Water, Heritage & the Arts (superseded by SEWPAC)
DOEE	Commonwealth Department of Environment & Energy
DPIE	NSW Department of Planning, Industry and Environment
EEC	endangered ecological community
EPA	Environment Protection Authority
<i>EP&A Act</i>	<i>Environmental Planning and Assessment Act (1979)</i>
<i>EPBC Act</i>	<i>Environment Protection and Biodiversity Conservation Act (1999)</i>
<i>FM Act</i>	<i>Fisheries Management Act</i>
IBRA	Interim Biogeographic Regionalisation for Australia
LEP	local environmental plan
LGA	local government area
<i>LLS Act</i>	<i>Local Land Services Act (2013)</i>
NES	national environmental significance
<i>NPW Act</i>	<i>National Parks and Wildlife Act (1974)</i>
NSW DPI	NSW Department of Industry and Investment
OEHS	Office of Environment and Heritage (superseded by DPIE from August 2019)
PCT	plant community type
PFC	projected foliage cover
RFS	NSW Rural Fire Service
ROTAP	rare or threatened Australian plants
SAII	Serious And Irreversible Impacts
SEPP	State Environmental Planning Policy
SEWPAC	Commonwealth Dept. of Sustainability, Environment, Water, Population & Communities (superseded by DOEE)
SIS	species impact statement
SULE	safe useful life expectancy
TEC	threatened ecological community
TPZ	tree preservation zone
<i>TSC Act</i>	<i>Threatened Species Conservation Act (1995) – Superseded by the Biodiversity Conservation Act (2016)</i>
VMP	vegetation management plan

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1 INTRODUCTION

This biodiversity management plan (BMP) has been prepared by *Travers bushfire & ecology* to identify relevant biodiversity management measures specific to the proposed dwelling and associated APZs within Lot 808, DP 752038, 70A Willandra Road, Narraweena.

1.1 Site identification

The subject site has frontage on Lady Penrhyn Drive, in the Northern Beaches (formerly Warringah City Council) local government area (LGA) of New South Wales.

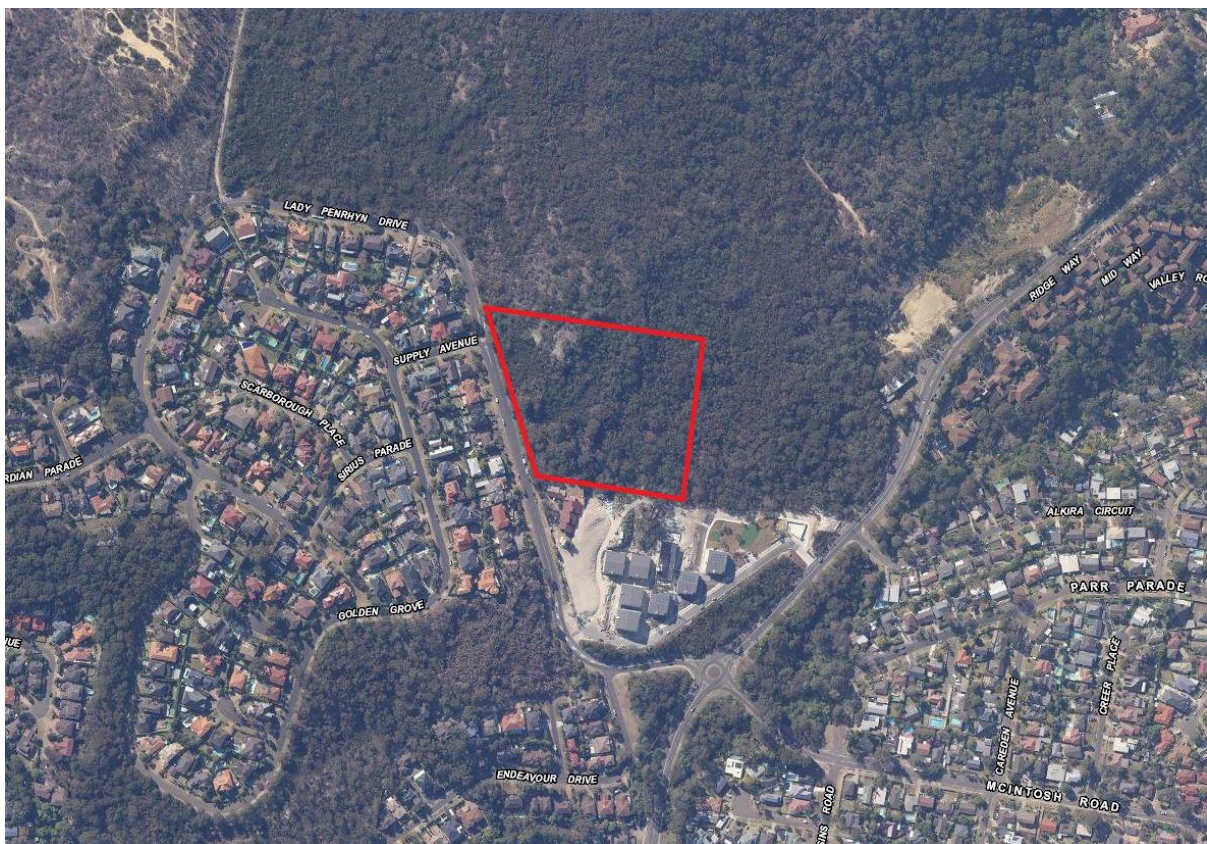


Figure 1-1 – Site location and boundary

1.2 Objectives of management plan

The purpose of this BMP is to detail the ongoing landscape management within 70A Willandra Road, Narraweena to manage the insitu biodiversity and to minimise the ecological impacts of the proposed development.

The objectives are:

- To describe the vegetation communities and their condition;
- Identify affected threatened species, populations and ecological communities;
- Minimise ecological impacts on biodiversity and protect high conservation value lands;

- Installation of permanent protective fencing on the outer boundary of the required APZ and ensure the retention of native bushland and the habitat.
- Provide guidelines for vegetation management within the APZ and residual lot;
- Provide a weed management, works and restoration schedule;
- Minimise and enhance habitat for Red Crowned Toadlet habitat and Eastern Pygmy Possum;
- Maintenance three (3) years post development to ensure all managed areas are protected, maintained, weed free and in good condition;
- Auditing and certification of protection and management works by the appointed project ecologist; and

1.3 Proposed development

The proposed development is for a detached residential dwelling with access, services and required APZs within the north-western portion of the lot adjacent to Lady Penrhyn Drive. The extent of the APZ will hereafter be referred to as the 'subject site', that is, the affected landscape.

The design intent is to leave the surrounding bushland below the escarpment wholly intact and placing three linked pavilion-style modules that generally follow the existing contour of the land to minimise cut and fill.

This design approach reduces the visual bulk of the building form and the walkway link between each pavilion allows landscaping opportunity in between. The siting of the house is as close to Lady Penrhyn Drive as possible to reduce the length of the driveway while meeting the front setback requirement of 20 m.



1.4 Ecological constraints

Figures 3 & 4 provide threatened species and EEC observations within the site resulting ecological survey undertaken by *Travers bushfire & ecology* from Nov 2018 through to Aug 2019.

As part of the Biodiversity Development Assessment Report (BDAR) prepared by *Travers bushfire & ecology* (December 2021), all vegetation communities and relevant habitat features were located and mapped using a *Trimble* differential GPS accurate to less than a metre after post processing. The BDAR identifies two (2) significant habitat features within the site of conservation value that warrant protection and retention:

- Coastal Upland Swamp TEC
- Habitat for Red Crowned Toadlet

These habitat features occur to the south-east of the proposed APZ (see Figure 5). The proposal has been specifically located to avoid these features, and the implementation of a Biodiversity Conservation Area will provide adequate protection.

1.4.1 Flora results

One (1) state listed threatened flora species, *Tetratheca glandulosa*, and one (1) state listed threatened ecological community (TEC) *Coastal Upland Swamp* were observed during surveys undertaken.

In accordance with Section 7.2 of the *BC Act*, the Significance of Impact Test within the BDAR (*Travers bushfire and ecology*, December 2021, Ref: 18ALT02BDAR) concluded that the proposed development will not have a significant impact on any state listed threatened flora species, threatened flora populations or threatened ecological communities.

The proposed development was also considered to have no significant impact on threatened flora species, populations or threatened ecological communities listed as matters of national environmental significance (NES) under the *EPBC Act 1999*.

1.4.2 Fauna

Eight (8) threatened fauna species including Red-crowned Toadlet (*Pseudophryne australis*), Giant Burrowing Frog (*Heleioporus australiacus*), Rosenberg's Goanna (*Varanus rosenbergi*), Glossy Black-Cockatoo (*Calytorhynchus lathamii*), Powerful Owl (*Ninox strenua*), Eastern Pygmy Possum (*Cercartetus nanus*), Grey-headed Flying-fox (*Pteropus poliocephalus*) and Eastern Bentwing-bat (*Miniopterus orianae oceanensis*), have been recorded within the **study area**.

Giant Burrowing Frog (*Heleioporus australiacus*) list under the *BC Act* and the *EPBC Act* was observed outside of the subject site within the study area but was not recorded within the subject site and is not affected by the proposal.

1.5 Potential ecological impact on existing land

The BDAR identified the following potential direct, indirect and cumulative ecological impacts which are expected or considered as a result of the proposed development.

The direct impacts of the proposal within the subject site are considered as:

- Removal or modification of 0.39 ha of non-TEC vegetation,
- Subsequent removal of threatened fauna species habitat,
- Removal of seasonal flowering resources providing foraging habitat for the recorded Eastern Pygmy Possum and Grey-headed Flying-fox (foraging resources on site),
- Removal of seeding *Allocasuarina* spp. for the recorded Glossy Black-Cockatoo,
- Prey species habitat for recorded Powerful Owl, Giant Burrowing Frog Giant Burrowing Frog, Rosenberg's Goanna, Eastern Pygmy Possum and Eastern Bentwing-bat,
- Removal of hollows suitable for shelter and nesting by the recorded Eastern Pygmy Possum,
- Removal of foraging habitat close to winter burrowing areas for Rosenberg's Goanna,
- Removal of dead trees for perching use by some raptors and owls, and
- Removal of rocky habitat areas along a southern aspect hill side (less valuable for herpetofauna)

The potential indirect impacts of the proposal are considered as:

- Altered hydrology (specifically water quality and quantity) of the adjacent Coastal Upland Swamp which may support Red-crowned Toadlet breeding opportunity following high rainfall events,
- degradation of Red-crowned Toadlet foraging and shelter habitat close,
- Reduced width of habitat passage above the steep escarpment edge,
- Increased potential presence of pets and subsequent impacts on native wildlife and especially Eastern Pygmy Possum,
- Edge effects such as weed incursions caused from soil disturbance, repeated clearing and landscaping species becoming a nuisance in the adjacent remnant bushland,
- Increased spill-over from noise, activity, scent and lighting effects into the adjacent natural habitat areas,
- Increased soil nutrients from changes to runoff that may provide further opportunities for weed plumes, and
- Concentrated stormwater runoff from solid surfaces and subsequent increased flows.

The potential cumulative impacts (combined results of past, current and future activities) of the proposal are considered as:

- Increased risk of weed invasion and fungal mobilisation or infections,
- Cumulative loss of native vegetation within the locality supporting the abovementioned important habitat for local threatened species,
- Cumulative loss of rock-on-rock habitat,

- Increased varied human presence and activity within the remaining native vegetation, and
- Edge effects from inappropriate use of remaining native vegetation areas such as additional clearing, dumping of materials, dumping of faecal, food or general waste and building refuse.

1.6 Mitigation measures

The following recommended mitigation measures described within the biodiversity development assessment report (BDAR) produced by *Travers bushfire and ecology* (December 2021, Ref: 18ALT02BDAR) are made to avoid, minimise or ameliorate the above potential ecological impacts, address threatening processes and to guide a more positive ecological outcome for threatened species, populations, ecological communities, and their associated habitats.

- A 20 m buffer surrounding the CUS is to be established as a protected zone along with adjoining native bushland not affected by the proposed building and asset protection zone. This buffer is to provide for the retention and protection of the CUS.
- The boundary of the asset protection zone will be fenced for the entire extent of the APZ at the interface with the adjoining bushland. As Rosenberg Goanna is present, 'ring lock' style fencing will be required to restrict the access into habitat by household dogs. The APZ boundary is to be clearly marked out prior to vegetation clearance and allow installation of fencing as part of the landscaping works.
- After completion of vegetation clearance but prior to any cut and fill works the construction impact zone is to be fenced with 1.8m high construction proof fence or fencing panels to ensure that areas outside of the construction zone are not damaged during the construction phase.
- A drainage and sediment swale is to be built prior to commencement of the cut and fill associated with the building as a primary sediment control measure. This swale is to be stabilised with open weave jute mesh and or turfed to entrap any fine sediments from being delivered to the CUS. This measure is to be included into the approved sediment and erosion control plan and the stormwater treatment plan.
- Landscaping within the property is to use a minimum of 50% locally occurring native plants and species commensurate with the existing vegetation on site increasing in density at the APZ and bushland interface. Native groundcovers are to be retained and slashed within the APZ where there is no cut and fill works. With exception to the drainage swale, lawns are to be avoided on aspects draining to the CUS as fertilisers used in maintenance may cause excess nutrients, weed incursion and degradation of Red Crowned Toadlet (RCT) habitat in the adjacent CUS community.
- All stormwater and surface water quality and quantity is to be effectively managed within the subject site such that pre and post development stormwater quality and quantity remain unchanged within the CUS community. The target quality is to be set by undertaking a baseline sample from the CUS.

- External lighting is to be directed downwards and away from any natural habitat areas by use of baffles to prevent lighting spill-over into retained threatened species natural habitat areas.
- The BMP is to address the following actions to mitigate impacts. The BMP aims to retain and protect the CUS community and RCT habitat on site.
 - a) Targeted weed control is to be undertaken throughout the site and prioritised within the conservation zone.
 - b) Construction activities should be intermittently supervised on-site and monitored by a project ecologist to ensure that the recommendations of this report are implemented.
 - c) All staff involved with the development shall undergo an induction and training program to reinforce the ecological and environmental objectives of the development
 - d) Baseline environmental water quality samples (minimum of three samples) is to be undertaken by sampling from the CUS drainage as a reference target, water quality sampling is to be undertaken before, during and after development to ensure that groundwater seepage and surface water quality is maintained and to avoid eutrophication of the CUS on site. The BMP is to incorporate periodic water quality sampling for set periods post development. Parameters to measure include:
 - (i) pH
 - (ii) EC
 - (iii) DO
 - (iv) Temperature
 - (v) nutrients NO₂, NO₃, NH₃, NH₄, PO₄, TKN and TP
 - (vi) turbidity
 - (vii) hardness
 - (viii) salinity
 - e) Erosion control measures are to be in place to reduce temporary erosion and sedimentation risks to adjacent vegetation.
 - f) Hollow-bearing trees will be directly or indirectly impacted by the proposal. One of these (HT13) has recorded use by Eastern Pygmy Possum and two others (HT8 & HT12) are considered suitable for use by this species. The felling of hollow-bearing trees is to be conducted under the supervision of a fauna ecologist to ensure appropriate animal welfare procedures are taken, particularly if threatened species are present. Hollows of high quality or with fauna recorded residing within should be carefully dismantled and prepared for relocation into an appropriate retained tree within the site. All hollows removed should be inspected for occupation, signs of previous activity and potential for reuse. All hollow sections considered suitable for Eastern Pygmy Possum should where possible be recovered and prepared for placement into an appropriate retained tree.
 - g) Any hollow section that is not able to be relocated will be compensated by the placement of ten (10) nest boxes placed throughout the conserved habitat areas as guided by the project ecologist. These are to target the Eastern Pygmy Possum but also Powerful Owl prey species Common Ringtail Possum and Sugar Glider. Constructed nest boxes are to be constructed wholly of

weatherproof timber (marine ply), fasteners and two coats of external paint and then appropriately affixed to a recipient tree.

- h) The relocated hollow section and nest boxes should be well secured in the recipient tree in a manner that will not compromise the current or future health of that tree.
- i) Similarly, with hollows, rocky shelter habitat and quality terrestrial shelter logs are to be relocated from development areas into conserved habitat. This is to be done under the supervision of a fauna ecologist to ensure best habitat outcomes, such as high surface area rock on rock shelter outcomes.
- j) If any fauna species, a nest or roost is located during development works, then works should cease until safe relocation can be advised by a contract fauna ecologist.
- k) Pest species management is to be undertaken based on the recording of cat, fox and Black Rats during surveys.



Figure 1-3 – Flora survey results

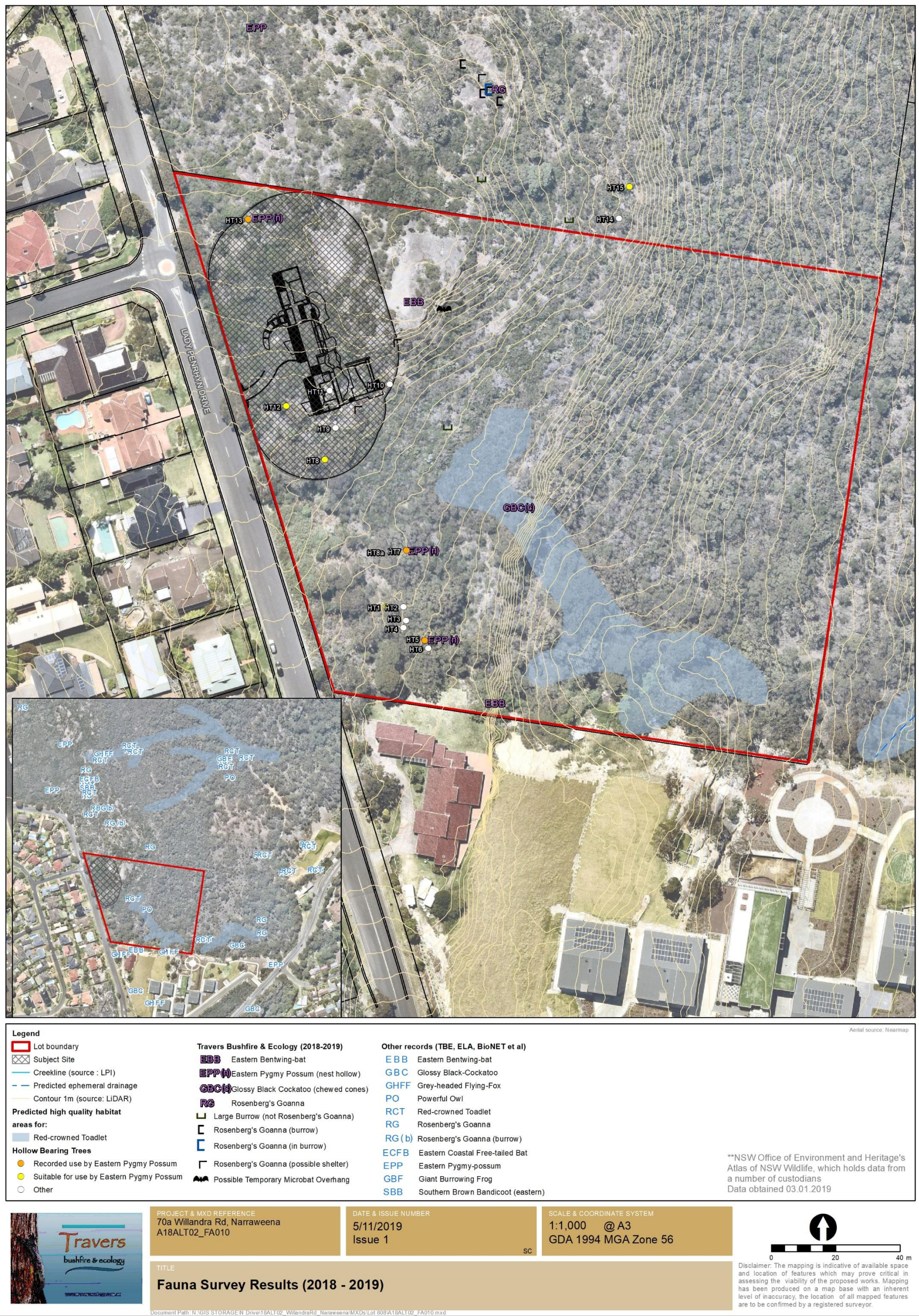


Figure 1-4 – Fauna survey results



Figure 1-5 – Threatened fauna habitat

2 ONSITE BIODIVERSITY

2.1 Site details and characteristics

Tables 2.1 and 2.2 provides a summary of the planning, cadastral, topographical, and disturbance details of the subject site

Table 2-1 – Site details

Location	Lot 808 DP 752038, 70A Willandra Road, Narraweena
Local government area	Northern Beaches (formerly Warringah)
Grid reference MGA-56	338900 E 6264730 S

Table 2-2 – Site characteristics

Elevation	120–131 m AMSL
Topography	The proposed development is situated at the base of a rock outcrop which occurs along the upper parts of a ridgeline. The land slopes towards the east, and south, away from the development area
Vegetation	Sandstone Gully Forest and Tall Heath vegetation communities
Geology / soils	Geology; Hawkesbury Sandstone Soils; Lambert – erosional soil landscape, usually shallow soils where vegetation is low; heath, woodland, low open forest
Catchment and drainage	South Creek into Narrabeen Lakes
Clearing	No clearing has occurred to date
Existing land use	Undeveloped bushland

2.2 Existing vegetation, threatened species and TECs

Vegetation communities

The following vegetation communities were identified within the subject site through ground truthing.

- Zone 1 – PCT 1825 – Coastal Sandstone Plateau Rock Plate Heath (0.11 ha)
- Zone 2 – PCT 1824 – Mallee - Banksia - Tea-tree - Hakea heath-woodland of the coastal sandstone plateaus of the Sydney basin (1.31 ha)
- Zone 3 – PCT 1083 – Red Bloodwood - scribbly gum heathy woodland on sandstone plateaus of the Sydney Basin Bioregion (1.28 ha)
- Zone 4 – PCT1803 – Banksia - Needlebush - Tea-tree damp heath swamps on coastal sandstone plateaus of the Sydney basin (0.08 ha) = TEC

PCT 1825 – Coastal Sandstone Plateau Rock Plate Heath

This is the vegetation community covers 0.11 ha of the lot where it is restricted to the exposed rock platforms in the north-western corner.



Photo 1 – PCT 1825 – Coastal Sandstone Plateau Rock Plate Heath

Canopy – Occasional emergent *Eucalyptus punctata* and *E. obstans* provide up to 4% projected foliage cover (PFC).

Mid - storey – Common species include *Allocasuarina distyla*, *Angophora hispida*, *Banksia ericifolia*, *Bossiaea scolopendria*, *Phebalium squamulosum*, *Darwinia fascicularis*, *Hakea sericea*, *Kunzea ambigua*, *Epacris longiflora*, *Boronia ledifolia* and *Leptospermum arachnoides* providing a PFC of c. 10%.

Groundcovers – *Lepidosperma concavum* s. str., *Actinotus minor*, *Platysace lineariifolia*, *Cyathochaeta diandra*, *Trachymene incisa*, *Lepyrodia* spp., *Xanthorrhoea minor* and *Empodisma minor* providing up to 5% PFC.

PCT 1824 – Mallee - Banksia - Tea-tree - Hakea heath-woodland of the coastal sandstone plateaus of the Sydney basin

This vegetation occurs within the north-eastern and north-western portions of the lot, occupying an area of 1.31 ha.



Photo 2 – PCT 1824 – Mallee - Banksia - Tea-tree - Hakea heath-woodland of the coastal sandstone plateaus of the Sydney basin

Canopy – *Eucalyptus punctata*, *E. haemastoma*, *Angophora hispida* and *E. sieberi* provide up to 50% PFC.

Mid-storey – Very dense in places. Common species include *Banksia ericifolia*, *Leptospermum trinervium*, *Allocasuarina distyla*, *Grevillea* spp., *Hakea teretifolia*, *Acacia suaveolens*, *Hibbertia linearis*, *Phebalium squamulosum*, *Kunzea ambigua* and *Darwinia fascicularis* providing a PFC of 60–80%.

Groundcovers – Common species include *Chordifex fastigiatus*, *Xanthosia pilosa*, *Schoenus ericetorum*, *Cyathochaeta diandra*, *Eurychorda complanata*, *Entolasia stricta*, *Anisopogon avenaceus*, *Dianella caerulea*, *Lepidosperma laterale*, *Lomandra glauca*, *Patersonia sericea*, *Imperata cylindrica*, and *Actinotus helianthus*.



Photo 3 – PCT 1824 – Mallee - Banksia - Tea-tree - Hakea heath-woodland of the coastal sandstone plateaus of the Sydney basin to the south-east of the main rock platform

PCT 1083 – Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux of the Sydney Basin Bioregion

This vegetation occurs predominantly within the southern and central parts of the lot and occupies 1.28 ha.

Canopy – Common species are *E. haemastoma*, *Corymbia gummifera*, *Eucalyptus globoidea* and *E. punctata* providing 20–30% PFC.

Mid-storey – Includes *Banksia ericifolia*, *B. serrata*, *Acacia longifolia*, *Angophora hispida*, *Pittosporum undulatum*, *Hakea* spp., *Leptospermum* spp., *Kunzea ambigua*, *Allocasuarina distyla*, *Persoonia pinifolia* and *Elaeocarpus reticulatus* providing 75–82% PFC. Occasional exotic species are present but provide less than 1% PFC, and include *Lantana camara*, *Passiflora edulis* and *Ochna serrulata*.

Groundcovers – Dominated by a mixture of sedges, restiads, ferns and grasses providing 46–80% PFC. Common species are *Anisopogon avenaceus*, *Xanthorrhoea media*, *Entolasia stricta*, *Lepyrodia scariosa*, *Dampiera stricta*, *Pteridium esculentum*, *Empodisma minus*, *Gleichenia dicarpa*, *Gahnia sieberiana*, *Cyathochaeta diandra*, *Chordifex fastigiatus*, and *Lepidosperma latens*.



Photo 4 – PCT 1083 – Red Bloodwood - scribbly gum heathy woodland

PCT 1803 – Banksia - Needlebush - Tea-tree damp heath swamps on coastal sandstone plateaus of the Sydney basin

This vegetation occurs in the centre of the site and occupies 0.08 ha.

Canopy – Occasional emergent *E. haemastoma* at the margins of this zone, providing up to 10% PFC.

Mid-storey – Includes *Leptospermum squarrosum*, *Banksia ericifolia*, *Hakea teretifolia*, *Baeckea imbricata*, *Epacris obtusifolia*, *Actinotus minor*, *Selaginella uliginosa* *Persoonia levis*, *Acacia suaveolens*, *Bossiaea scolopendria* and *Woollsia pungens* providing up to 90% PFC.

Groundcovers – Dominated by sedges and restiads including *Chordifex fastigiatus*, *Empodisma minus* and *Lepyrodia scariosa* which provide up to 80%. Other species include *Gleichenia dicarpa*, *Gleichenia rupestris*, *Actinotus minor*, *Selaginella uliginosa*, *Sporadanthus gracilis* and *Eurychorda complanata*.

Classification:

This vegetation is ecotonal and is likely to vary in composition depending on time since fire and fluctuations in soil saturation. PCT 1803 is recognised as wholly equivalent to *Coastal Upland Swamp in the Sydney Basin Bioregion* (CUS), which is listed as an endangered ecological community under the *BC Act* and *EPBC Act*. This vegetation on site was previously mapped by *Ecological Australia* (2011) as PCT 1804, which is also equivalent to CUS. Within PCT 1803, 19 species out of 32 recorded are listed in the final determinations for CUS. The structure of CUS is generally more open than that observed, however this TEC also includes tall closed scrubs and closed heaths. Aerial imagery shows that a large portion of the study area, including Zone 4, was burnt between 2005 and 2006 and that the vegetation remained quite open for several years before reaching the high shrub density currently seen. It is likely that the vegetation structure fluctuates depending on fire regime from open sedgeland to closed heath and scrubland.



Photo 5 – PCT1803 – Banksia - Needlebush - Tea-tree damp heath swamp



Photo 6 – PCT1803 – Banksia - Needlebush - Tea-tree damp heath swamp understory

Weed prevalence

In general, there is a very low weed prevalence throughout the site. Along the western boundary with Lady Penrhyn Drive there are some minor incursions of exotic species.

Threatened species

Eight (8) threatened fauna species including Giant Burrowing Frog (*Heleioporus australiacus*), Red-crowned Toadlet (*Pseudophryne australis*), Rosenberg's Goanna (*Varanus rosenbergi*), Glossy Black-Cockatoo (*Calyptorhynchus lathamii*), Powerful Owl (*Ninox strenua*), Eastern Pygmy Possum (*Cercartetus nanus*), Grey-headed Flying-fox (*Pteropus poliocephalus*) and Eastern Bentwing-bat (*Miniopterus orianae oceanensis*), one (1) threatened flora species, *Tetratheca glandulosa* were recorded within the study area.

Threatened Ecological Communities

One (1) threatened ecological community (TEC), *Coastal Upland Swamp in the Sydney Basin Bioregion*, was recorded within the study area.

3 RESTORATION STRATEGY

3.1 Biodiversity conservation area

The long-term conservation of TECs and threatened species and their habitats is considered to be a high priority for maintaining local biodiversity within the site. A 20 m buffer from the edge of the CUS has been retained and will define the perimeter of the conservation area.

The residual bushland is part of an extensive area of native vegetation and there are known threatened species and good quality fauna habitats and hollow-bearing trees. Effective weed control, natural regeneration and ongoing protection of the residual bushland will contribute to the long-term viability of the existing native vegetation communities as well as threatened flora and fauna species and their habitats.

3.2 Proposed biodiversity management works

Best practice delineation of the extent of the required asset protection zone (APZ) is required. This will take the form of a fence constructed with a minimum of steel pickets with four strand plain wire and 'ring lock' type netting to prevent dogs or other pets from escaping into the retained bushland within the residual bushland.

A 20 m target weed control zone (bushland/APZ interface) will be the focus of target weed control to ensure that weeds and garden escapes do not establish within the first three years of occupation

This BMP aims to conserve and enhance existing areas of remnant vegetation, including threatened flora species habitat in a post development landscape. A project ecologist is to be engaged to ensure the methods are being applied correctly to ensure a successful biodiversity conservation outcome.

3.2.1 Flora

All native flora outside of the APZ boundary is to be protected outside of the APZ. All building, construction, bushfire asset protection zones (APZ) and landscaping works will be excluded from this protected area. Exotic species with the potential to spread into areas of adjacent vegetation are to be removed from these areas in order to maintain the integrity of native vegetation. Enhancement will be in the form of weed control and natural regeneration.

3.2.2 Fauna

Fauna habitats will be protected outside of the APZ through the exclusion of building, construction, bushfire asset protection zones (APZ) and landscaping works. The function of the residual bushland will be to retain, maintain and enhance the protection of hollow bearing and foraging resources wherever possible and to monitor and maintain water volume and quality inputs into the CUS and RCT habitat.

Schedule 1 – Vegetation Management Works identifies the location and extent of the required works.

3.3 Weed control

Although the site in general contains few exotic or weed species, it is expected that the proposal will result in greater disturbance, nutrients and edge effects and thus provide a greater opportunity for weedy species to establish or invade the residual bushland. Continued weed management works are to be undertaken in perpetuity as part of the development.

For the purposes of this biodiversity management plan, a weed is defined as any plant species that does not occur naturally within the native bushland surrounding the impact area. The definition of a weed includes any exotic or cultivar species that are used in landscaping works or grasses commonly used to create lawns.

3.4 Management of biodiversity conservation area

In general, to maintain or improve the current condition of the retained vegetation within the biodiversity conservation area, the following restrictions within the protected residual bushland need to be enforced:

Weed management

- All invasive and environmental weeds need to be eradicated within residual bushland; and
- Garden or landscaping waste, weed propagules (seeds, tubers etc.), or lawn clippings, should not be dumped or spread on adjacent residual bushland or allowed to be washed downstream.

Nutrient management

- Lawn fertilizers and manure (horse or chicken) are not to be spread or stockpiled within 40 m of a drainage line, including for the purposes of vegetable gardens or landscaping; and
- Drainage from lawns, manure and chicken coops is to be allowed to filter through a grass-lined level spreader prior to discharge into local drainage lines.

Erosion control / sedimentation management

- All bare soils within the residual bushland and development area are to be stabilised especially within riparian vegetation, near creeks, overland flows, and drainage lines will be re-vegetated immediately with appropriate local native plants;
- Sediment and tree protection fences are to be installed around all construction works (including access tracks) prior to commencement of any earth or construction works.

- Sediment control infrastructure is to be installed in accordance with “*Managing Urban Stormwater Soils and Construction*” (Landcom 2004); and
- Sediment or stormwater infrastructure such as basins, dams (if necessary), or grassy swales are to be installed prior to commencement of construction works.

Bushland regeneration works

- Bushland regeneration within the residual bushland is to be achieved by low-impact weed control undertaken by qualified bushland regenerators (TAFE Certificate 2 in Bushland Regeneration and two (2) years demonstrated experience) as specified in Section 4.1.
- Weed control will create space for native propagules to germinate and establish, thereby replacing weed species with locally occurring native species from the existing soil seedbank.
- If natural regeneration does not occur, then restoration works (planting) by suitably qualified bushland regenerators will be required to create a fully structured vegetation community commensurate with the surrounding native vegetation.

3.5 Access

The residual bushland is to be maintained as an area of locally native vegetation protected from detrimental impacts of construction works, motor vehicles, rubbish or garden waste dumping and nutrient run off. Clearing, under scrubbing or the creation of foot or vehicle tracks is prohibited within the biodiversity conservation area.

A permanent protective fence with a minimum height of 1.3 m consisting of a minimum of steel posts with four strands of plain wire and ‘ring lock’ type mesh is to be installed along the outer extent of the bushfire asset protection zone (APZ) to define the boundary of the APZ and edge of the residual bushland. This protective fence is to have two (2) locked gates 90 cm wide installed as marked on Schedule 1 – Vegetation Management Works. These gates are to allow access only for authorised persons such as for bushland regenerator or weed control personnel to maintain the residual bushland.

Access within the residual bushland is to comply with the following:

- Movement within the residual bushland is to be avoided and the construction of any pathways or tracks is to be prohibited.
- Dogs are to be excluded from the residual bushland at all times. The use of barbed wire is prohibited and fencing is to consist of “ring lock” style fencing to allow Goannas and mammals to move to a safe location free from dog attack or harassment.
- The fence also needs to blend with and complement the landscape setting and create minimal disturbance during erection of the fence. It is suggested that erection of the fence

should be undertaken wholly from the inner side to avoid disturbance to vegetation within the residual bushland.

- All domestic animals or pets are to be housed and kept within the managed landscape area.

3.6 Management of hollow bearing trees

A complete assessment of the location of habitat trees above the escarpment edge and the size of hollows within each is found in the BDAR. Six (6) hollow-bearing trees were identified within the proposed APZ area, of which five (5) are nominated for removal in the Arboricultural Impact Assessment Report (*Travers bushfire and ecology*, December 2021, Ref: 18ALT02T).

Of the five (5) hollow-bearing trees to be removed, two (2) each contain a hollow of potential use by Eastern Pygmy Possum (HT8/T048 & HT12/T023).

Eastern Pygmy Possum have been demonstrated to take up artificially constructed housing for constructing their nests, as long as they provide the appropriate entry, internal chamber and thermal characteristics. Therefore, all hollows to be removed by the proposal may be prepared (or even improved) for reuse by the species in another part of the study area. Therefore, this process as well as construction of additional nesting boxes is recommended to compensate for the loss of hollows within the subject site habitat area.

HT13/T14 contains one (1) hollow of recorded use by Eastern Pygmy Possum within the subject site occurs at the outer northern extent of the APZ and will be retained. This tree is to be protected with standard tree protection fencing as recommended in the Arboricultural Impact Assessment Report. Vegetation is to be retained to provide connectivity with this tree to the vegetation outside the APZ to the north. This is to allow for continued use of the hollow by Eastern Pygmy Possum.

3.6.1 Guidelines for the removal of hollow bearing trees

If any identified hollow bearing trees are to be removed, it is recommended that the tree be inspected before removal by a suitably qualified fauna ecologist. If occupied by breeding native fauna the tree removal is to be postponed until young have matured and have left the nest. The fauna ecologist is to be present during tree removal to provide for the welfare of affected fauna.

If required, guidelines for ameliorating the loss of nesting hollows are as follows:

- Where possible and practical, hollow bearing trees identified for removal should have the hollow sections extracted, collected and re-erected in adjoining habitat areas within the biodiversity conservation area.

A fauna ecologist is to locate appropriate trees and locations for installing the re-erected hollows. All hollow sections considered suitable for Eastern Pygmy Possum should where possible be recovered and prepared for placement into an appropriate retained tree. If the hollows are in poor condition they are to be relocated as on-ground habitat in the biodiversity conservation area and artificial nesting hollows (nest boxes) erected in trees located in the biodiversity conservation area to replace the removed hollows.

Any hollow section that is not able to be relocated will be compensated by the placement of ten (10) nest boxes placed throughout the conserved habitat areas as guided by the project ecologist. These are to target the Eastern Pygmy Possum but also Powerful Owl prey species Common Ringtail Possum and Sugar Glider. Constructed nest boxes are to be constructed all of weatherproof timber (marine ply), fasteners and two coats of external paint and then appropriately affixed to a recipient tree.

The following guidelines are provided in the event of a hollow bearing tree requiring removal.
Pre-Clearing

At least one-week notice will be needed prior to the planned date for clearing of any trees. This is required so as to allow for suitable time for inspections of trees by a suitably qualified and licensed ecologist to determine any use by fauna and to plan for the safe felling of the tree / removal of fauna if present.

After notice is given of the planned removal of trees, a fauna ecologist will inspect the trees for use by fauna. This may include inspection of trees at sunset (stag watching) which allows for the detection of diurnal fauna returning to hollows or nocturnal fauna leaving for the night.

In some cases, physical inspections of hollows may be required. This will be carried out by suitably qualified arborists under the direction and supervision of the fauna ecologist.

During-Clearing

Where fauna is identified within a hollow and the risk of death or injury as a result of machine felling of the tree is high, the tree may need to be felled in sections. This will involve the removal of hollow limbs or sections by chainsaw with the hollow limb lowered to the ground for removal / relocation of fauna and the relocation of the hollow sections to suitable nearby trees that are to be retained. These works are to be carried out by a suitably qualified arborist under the direction of the fauna ecologist.

In those trees that contain hollows where no fauna has been observed, the tree will be machine felled. Where machinery is required to fell hollow trees, the blade or bucket of the machinery will be tapped against the trunk of the tree to disturb any fauna present and provide time for fauna to leave the hollow. This may require repeating several times. The tree will then be felled as gently as possible. All hollow limbs will be inspected by an ecologist after felling for occupation by fauna. Any fauna will be removed and relocated to adjoining bushland, or taken to a vet for treatment if required.

Where young fauna species are identified within a hollow and whose survival will be at risk as a result of the removal of the hollow or the felling of the tree, then clearing will not be carried out until those young are old enough to leave the hollow and the care of the parents. It is recommended that clearing of hollow bearing trees, if young fauna are identified, is not carried out during breeding times.

3.6.2 Guidelines for the replacement of removed hollows

Fifteen hollow bearing trees were observed and plotted within the western parts of the allotment as shown in the following table.

Table 3-1 – Habitat tree data

Tree no	Scientific name	Common name	DBH (cm)	Height (m)	Spread (m)	Vigour (%)	Hollows & other habitat features recorded
HT1 (T74)	Scribbly Gum	<i>Eucalyptus haemastoma</i>	26	7	9	35	1x 0-5cm trunk (suitable for EPP), 1x 0-5cm broken trunk (suitable for EPP)
HT2	Scribbly Gum	<i>Eucalyptus haemastoma</i>	45	7	9	75	2x 0-5cm shallow trunk
HT3 (T82)	Scribbly Gum	<i>Eucalyptus haemastoma</i>	7,9,7,7	7	5	75	1x 0-5cm trunk
HT4	stag		5	2.5	0	0	1x 5-10cm shallow trunk
HT5 (T64)	Scribbly Gum	<i>Eucalyptus umbra</i>	26,24	11	8	80	1x 0-5cm trunk spout (EPP bedding material)
HT6 (T63)	Stringybark	<i>Eucalyptus umbra</i>	33,5,1 6,35	17	15	70	1x 0-5cm shallow trunk, 1x 0-5cm shallow branch spout
HT7 (T87)	Scribbly Gum	<i>Eucalyptus haemastoma</i>	26	14	7	75	1x 0-5cm shallow trunk (EPP bedding material)
HT8a (T48)	Scribbly Gum	<i>Eucalyptus haemastoma</i>	27,20	17	8	70	1x 0-5cm shallow trunk (sap stain/fills with water)
HT8 (T38)	Scribbly Gum	<i>Eucalyptus haemastoma</i>	24,28, 16	17	12	80	1x 0-5cm trunk (suitable for EPP)
HT9 (T19)	stag		35,35	12	8	0	1x 0-5cm shallow trunk
HT10 (T23)	Scribbly Gum	<i>Eucalyptus racemosa</i>	15,23, 6,6	7	8	80	1x 0-5cm shallow trunk
HT11 (T17)	stag		24	8	6	0	1x 5-10cm trunk (Antechinus bedding)
HT12 (T16)	Scribbly Gum	<i>Eucalyptus racemosa</i>	22	7	9	70	1x 0-5cm trunk (suitable for EPP), 1x 0-5cm shallow trunk
HT13 (T14)		<i>Angophora hispida</i>	29	6	10	85	1x 0-5cm trunk (EPP bedding material)
HT14	Red Bloodwood	<i>Corymbia gummifera</i>	26,8	6	3	60	1x 0-5cm shallow trunk
HT15	Red Bloodwood	<i>Corymbia gummifera</i>	15,20	6	3	80	1x 0-5cm trunk (suitable for EPP)

Note – Hollow bearing trees shown in **Red text** are to be removed within the APZ

The proposed development will require the removal of five (5) 0-5cm sized hollows and one (1) 5-10cm hollow as shown in the table above.

These hollows may be suitable to recover and re-use by attaching them to trees in nearby bushland located outside of the APZ area. Six (6) nest boxes of similar size and suitable for use by the Eastern Pygmy Possum are also to be installed into trees outside of the APZ. If removed or recovered hollows are not suitable for re-use then they are to be replaced by a similar sized nest box.

Re used and replacement nest boxes are to be installed under the direction of a fauna ecologist. The loss of six (6) nest boxes is to be offset through the replacement of ten (10) nest boxes/re-used hollows.

3.7 Construction impact mitigation

The mitigation of potential adverse impacts of construction on the adjoining residual bushland will be implemented through the following procedures:

Prior to commencement of vegetation clearance

- Temporary protection fence (star pickets and Hi-vis bunting or plastic mesh) is to be installed around all trees and bush rock areas to be retained (e.g. along the interface required APZ and residual bushland).
- Identification and marking of the APZ through the use of appropriate signage at regular intervals along the outer protective fence.
- Installation of suitably sized nest boxes (to replace hollows to be removed) a minimum of two (2) weeks prior to vegetation clearance.
- Habitat tree removal (if required) is to be done under the supervision of a fauna ecologist so that any residing fauna, particularly threatened species, can be effectively recovered and relocated. If fauna is recorded utilising the hollows that are removed, or if these hollows are considered of high quality, then these hollows are to be reinstalled into tree(s) within the residual bushland.
- Certification to be submitted to Council for satisfactory completion is to be provided for habitat protection and fauna relocation works and implementation of contingency measures as required by Project Ecologist.

During vegetation clearance

- A forest mulcher is to be used to remove shrubbery and small trees within the APZ and excavators only used to grub out tree roots within the driveway and building footprint. Mulch is to be left on ground to provide erosion protection and sediment control.
- Project Ecologist to have contractors tool box talk prior to clearing to manage and direct clearing operations.
- Certification to be submitted to Council for satisfactory completion is to be provided for vegetation clearance and fencing works and implementation of contingency measures as required by the Project Ecologist.

Prior to commencement of excavations, cut and fill works

- Installation of temporary construction fence at the extent of the construction / landscape area excluding the managed outer APZ not affected by cut and fill works. 1.8 m high chain link fence panels are appropriate.
- Installation of tree protection measures as per the arborist report.

- Implementation of erosion and sediment control measures during construction including installation of sediment fences adjacent to biodiversity conservation areas, overland flows, drainage lines and creeks;
- Retention of natural sandstone bush rock as part of landscaping within the APZ where present.
- Protection of any retained habitat trees during clearing operations;
- Regular inspections and compliance certificates regarding protection of biodiversity conservation areas, erosion control, habitat trees and vegetation management measures by project ecologist;
- Application of low impact weed control methods by suitably qualified bushland regenerators;
- Retention of natural logs and rocks;
- Certification to be submitted to Council for satisfactory completion is to be provided for above works during construction and implementation of contingency measures as required by Project Ecologist.

Landscaping works

- Installation of protective fence 1.5 m tall constructed from a minimum of steel posts with four (4) strands of plain wire and 'ring lock' style mesh along the edge of the APZ / residual bushland interface.
- Turf to be limited to cut and fill areas allowing slashed native grasses to dominant the outer APZ.
- Appropriate signage notifying of the Biodiversity Conservation Area placed at regular intervals along the permanent outer protective fence
- All bare or disturbed areas are to be fully stabilised to minimise erosion into adjoining conserved bushland areas or drainage lines.
- All protective fencing to be maintained and secured.
- Certification to be submitted to Council for satisfactory completion of all bushland protection and restoration works in accordance with this BMP, the conditions of consent and implementation of contingency measures as required by the appointed Project Ecologist.

3.8 Proposed weeding activities

Only selective exotic vegetation removal (weed control) is permitted within the residual bushland. Weeds are to be progressively removed within the construction and APZ areas as well as the residual bushland in accordance with techniques recommended by the National

Trust, NSW Department of Environment and Conservation (National Parks & Wildlife Service) and the Australian Association of Bush Regenerators.

It is recommended that natural recruitment of the tree, shrub and groundcover layers within the biodiversity conservation area be facilitated by a combination of removal of weed species, natural regeneration, and if necessary, re-vegetation (planting) works. No livestock are to be used for weed control or suppression. Exotic flora species specifically targeted for removal are listed in Table A2.1. This list is not exhaustive but includes all non-native species which were observed in surveys and additional non-native species which are known to occur in the locality.

Monitoring of the progress of weed removal, plant growth and natural regeneration is to be undertaken by a qualified ecologist on a six (6) monthly interval with a report produced on an annual basis for three (3) years. This will include the issuing of compliance certificates before construction and post construction by the project ecologist.

Weed control works are expected to be undertaken in perpetuity within the residual bushland, however this will likely be scaled back to a maintenance level as the 3-year weed control program is expected to result in few weeds within the residual bushland and only minor incursions of weeds into the future.

Weeds that commonly occur within Warringah LGA are to be targeted if found on site in accordance with their respective responsibilities under the NSW *Biosecurity Act* (2015) and the 'best practice' removal methods identified for each weed.

3.9 Proposed re-vegetation works

Natural recruitment of native species (natural regeneration) within the residual bushland is to be promoted by a combination of protective fencing along the APZ / residual bushland boundary, targeted weed control, baiting for rabbits and natural regeneration of the flora. It is not anticipated that supplementary planting will be required as the current quality of the vegetation is quite high and there are no disturbed areas which require restoration.

3.10 Management of asset protection zones (APZs)

The RFS advises that when living in a bushfire prone environment, APZs are required on bushfire prone lands to provide a defensible space between hazardous vegetation and a dwelling.

The RFS provides basic advice in respect of managing APZs in several documents namely *Planning for bush fire protection 2006 (PBP)* and *Standards for Asset Protection Zones* (NSW RFS, undated but circa 2006).

APZs provide a level of defensible space between the hazard (bushland) and a habitable dwelling or similar structure. These zones are usually shown on plans adjacent to either cultural or natural assets (e.g. dwelling). They act to significantly lessen the impact of intense fire. The major mitigating factor that limits the effects of wildfire is the amount of fuel available to burn. By reducing the amount of fuel there will be a reduction in the intensity of the fire.

When considering bushfire fuel, it is important to understand that it occurs in our native bushland in three vertical layers – see Table 3.2.

Table 3-2– Fuel layers

Fuel layer name	Location of layer in vertical column	Type of fuel
Ground fuels	Below ground level	Peatmoss (always below the surface)
Surface fuels	0-200 mm	Litter layer (leaves & twigs)
Aerial fuels	200 – 3000 mm	Shrubs and grasses
Canopy fuels	> 3000 mm	Tree canopy

The APZ can be further classified into two sub-zones with each having a specific role. These sub-zone areas are called the inner protection area (IPA) and the outer protection area (OPA), although in this case, the subject site only has an IPA.

Inner Protection Area (IPA) - fuel load standard between 0 – 4 t/ha.

This zone is intended to stop the transmission of flame and reduce the transmission of radiant heat by the elimination of available fuel. This area also allows airborne embers to fall safely without igniting further outbreaks.

- Grasses may occur within an IPA if they are generally no higher than 50-75mm (high cut);
- Shrubs may occur within an IPA in the form of clumping amidst open grassy areas with a spatial coverage of 15–20%. The design of the clumping will be dependent on species selection and spatial density. For example, the larger the shrubs the less clumping may occur in a given area; and
- Trees are allowed within an IPA but only where those trees are at least 5m away from a dwelling.

Trees within the IPA are to be managed as follows:

- A tree may not form a potential fire link with shrubs;
- Trees with low hanging branches are to be undercut with a minimum of ground to branch separation of 3 m and the crown lifted. Note: Forest Oaks (*Allocasuarina* species) are usually removed from an IPA; and
- Trees are allowed within an IPA where the density of retained trees is commensurate with Table 3.3 below and located on slopes up to 20% with a westerly aspect.

In respect of trees that can be located in an IPA Table 3.3 provides guidelines.

Table 3-3 – Tree density in an inner protection area (IPA)

Distance from dwelling wall (metres)	Trees permitted on the exposed side of a dwelling	Trees permitted on the non exposed side of a dwelling
Within 5m	No trees	No trees
Between 5-10m	One tree per 100m ²	2 trees per 100m ²
Between 10-20 metres	<10 trees per 400m ² .	<10 trees per 400m ²

Outer Protection Area (OPA)

An OPA is not required for this site. This information is provided to distinguish between IPA and OPA management and in the event that a modified APZ design is required in the future through a Section 96 or similar development application.

The OPA is designed to stop the development of ‘intense’ fires and the transmission of ‘severe’ radiated heat.

The OPA assumes all trees will remain but with a modified shrub / grass layer or regular removal of the litter layer. In some sparse vegetation communities, the shrub layer may not require modification.

The firefighting advantage of an OPA will manifest in reduced fire intensity as a fire approaches the IPA. It achieves this by denying fire a significant proportion of the fuel to feed upon. Understorey vegetation containing small (or fine) leaves such as Forest Oaks (or similar) may be removed if they have the capacity to burn and feed fire up into adjacent trees.

In most cases, the removal of 85% of the litter layer will achieve a satisfactory OPA. A recommended performance standard for the fuel load of an OPA is between 4-6 t/ha.

3.11 Monitoring and maintenance

Maintenance activities are aimed at providing a framework for the upkeep of biodiversity conservation areas. Maintenance of revegetation areas should continue for a minimum period of three (3) years after revegetation. After completion of three (3) years maintenance, the biodiversity conservation area is expected to be a fully structured endemic native vegetation community commensurate with the locally occurring vegetation communities, which is reasonably stable and resilient to changes caused by the proposed development.

Maintenance activities include:

- Weed control;
- Waste control;
- Watering and vegetation maintenance - if required for revegetation (planting) works;
- Pest control of rabbit infestations; and
- Repairs to the protective fencing, seedling protection (if bushland planting is undertaken), and sedimentation fencing.

Maintenance activities will occur on a regular basis during the construction and post-construction phase for a minimum of 3 years post-construction. It is the responsibility of the landowner to ensure all maintenance is conducted.

It is recommended that regular monitoring inspections be undertaken by the project ecologist on a six (6) monthly basis for the 3-year duration of the BMP. This will allow the determination of the condition of the vegetation and may include identification of any areas suffering from disturbance or in need of further rehabilitation, weed control, soil stabilisation, erosion control, fencing or other maintenance.

3.12 Compliance and review

An audit inspection will be undertaken by the project ecologist at a minimum once every six (6) months for the duration of the BMP following a baseline monitoring inspection. A compliance certificate will be issued at the completion of each stage of restoration works detailing the actual performance of the restoration tasks undertaken.

Compliance certificates are to be provided on the following basis:

Prior to commencement of vegetation clearance

- Certification to be submitted to Council for satisfactory completion is to be provided for habitat protection, delineation of the APZ boundary and fauna relocation works (as listed in Section 3.7) and implementation of contingency measures as required by Project Ecologist and Council.

During vegetation clearance

- Certification to be submitted to Council for satisfactory completion is to be provided for vegetation clearance and fencing works (as listed in Section 3.7) and implementation of contingency measures as required by the Project Ecologist and Council.

Prior to commencement of excavations, cut and fill works

- Certification to be submitted to Council for satisfactory completion is to be provided for above works during construction (as listed in Section 3.7) and implementation of contingency measures as required by Project Ecologist and Council.

Landscaping works

- Certification to be submitted to Council for satisfactory completion of all bushland protection and (if required) restoration works (as listed in Section 3.7) in accordance with this Biodiversity Management Plan, the conditions of consent and implementation of contingency measures as required by Project Ecologist and Council.

The project ecologist is to advise whether conditions of consent or targets are being met and if additional works or alternative methods are required to achieve various regeneration and protection targets.

3.13 Ecological fire regime

Fuel reduction burning is not permitted within the biodiversity conservation area as the provided APZs provide adequate protection for the proposed dwelling. Ecological burns are permissible in accordance with the type of vegetation communities present, however ecological burns are prescribed by NSW Department of Planning, Industry and Environment (DPIE) and such burns are under their control. Spot pile burns within the APZ area are generally discouraged, but may be undertaken under a permit. The advice of Warringah Council and the RFS is to be sought prior to undertaking any burns within the APZ area and is only permissible with an approved fire permit and appropriate fire operations supervision.

3.14 Soil erosion and drainage

Erosion and sediment control measures are to be implemented during all phases of the proposed development to minimise adverse effects as a result of increased erosion and sediment loading. These include:

- Sediment control infrastructure is to be installed in accordance with “*Managing Urban Stormwater Soils and Construction*” (Landcom 2004)
- Coordinated work practices aimed at minimising land disturbance and laying down of soil treatments to prevent erosion on disturbed soil or embankments (such as temporary seeding, erosion control matting, turfing and bitumen / hay sprays);
- Identification of potential erosion areas;
- Control of nutrients through construction of grassed swales and nutrient retention basin/s where necessary (as shown in Schedule 1);
- The prevention of disturbance, management and maintenance (weed control) of vegetation within biodiversity conservation areas;
- Installation and maintenance of flow, erosion, sediment and nutrient control structures;
- Routine site inspections of drains, channels and sediment control structures;
- The safe disposal of all waste products; and
- The disposal of 'clean' water off site.

The minimisation of soil erosion will be achieved through soil stabilisation measures which may include but is not limited to spray seeding, sediment fencing, water control techniques or structures, revegetation of cleared surfaces via seeding, planting of native species, mulching and the installation of biodegradable erosion control blankets.

3.15 Program of works

The *Proposed works program* (Table 3.4) is aimed at providing a framework for enacting relevant rehabilitation, maintenance, monitoring and review activities relevant to the

conservation of flora and fauna values within the site. The implementation is the responsibility of the landholder under the direction of the project ecologist.

Table 3-4- Proposed works program

Action	Responsibility
Pre-construction <ul style="list-style-type: none"> Erection of erosion control fencing Installation of signs, temporary protective fencing around the biodiversity conservation area. Delineation of construction area Vs. No-Go areas. Install monitoring quadrats and undertake baseline monitoring works Clearly mark all ecologically significant trees within APZ, supervise dismantling of affected hollow bearing trees and relocate important hollows into the biodiversity conservation area Install tree protection fencing around trees to be retained within the APZ If required, identify and mark out revegetation areas Written release from appointed project ecologist to commence construction works. Issue of compliance certificate for preconstruction works. 	<ul style="list-style-type: none"> Building contractor under direction of project manager Developer contractor under direction of project ecologist Project ecologist Project ecologist Contractor under direction of project ecologist Project ecologist Project ecologist Project ecologist
Construction <ul style="list-style-type: none"> Install permanent protective fencing, gates and signage along the outer boundary of the APZ Install replacement nest boxes Monitor erosion control infrastructure (monthly – especially after heavy rain) and replace/maintain as required. Monitor vegetation, protection fencing and signs, replace if required. 	<ul style="list-style-type: none"> Fencing contractor under direction of project ecologist Contractor under direction of project ecologist Contractor under direction of project ecologist Contractor under direction of project ecologist

Table 3-4- Proposed works program

Action	Responsibility
<ul style="list-style-type: none"> • Weed control within the APZ and in the 5m wide weed control zone within residual bushland • If required, revegetation works in all restoration areas • Written release from appointed project ecologist for occupation certificate. • Issue of compliance certificate for construction phase works. 	<ul style="list-style-type: none"> • Suitably qualified bushland regenerator • Suitably qualified bushland regenerator • Project ecologist • Project ecologist
<p>Post construction</p> <ul style="list-style-type: none"> • Removal of the temporary tree protection fencing. • Continuation of bushland regeneration (if required), targeted weed control and maintenance within the biodiversity conservation area and APZ areas. • Monitoring of retained vegetation at 6 months, 12 months and annually for three (3) years post construction. • Issue post construction compliance certificate for maintenance period. 	<ul style="list-style-type: none"> • Developer contractor under direction of project ecologist • Developer contractor under direction of project ecologist • Project ecologist • Project ecologist

4 IMPLEMENTATION & ADMINISTRATION

4.1 Administration

The proponent is responsible for implementation of this BMP with the assistance of an appointed project ecologist and contract teams as required. The proponent is to ensure that all primary restoration works are completed in accordance with this BMP and that a maintenance weed control program has continued unabated for a minimum of three (3) years.

In the event that the performance targets are not achieved, the program will be extended to enable contingency works to be undertaken to achieve the stipulated performance targets.

Bush regeneration contractors with the following minimum qualifications are to be engaged to undertake weed control works within the residual bushland:

- Bush regeneration contractor / Supervisor - TAFE Certificate 2 in Bushland Regeneration and two (2) years demonstrated experience.

These bush regeneration contractors are to be under the direct control of the project ecologist for the completion of the targeted and maintenance weed control, as well as any required restoration or regeneration works.

Contracts will be issued to the contract team specifying all works required and the performance standard/s of those works.

All contractors' invoices are to be certified by the project ecologist as being completed to the satisfaction of the project ecologist and in accordance with the stipulated performance targets on Schedule 1 – Vegetation Management Works.

Other contractors as required, such as for the installation of signage or any other ancillary works, are to be engaged in consultation with the project ecologist.

4.2 Timing

The actual timetable of works is assumed to commence after approval of the BMP but may be influenced by the commencement of works on site and any relevant preconstruction conditions of consent. The estimated typical timing of works is within Table 3.4 and the Gantt chart (Appendix 6).

Maintenance works shall continue for a period of three (3) years. This period will be extended if performance targets have not been met. All works associated with the action plan are to be confirmed upon engagement and consultation with contractors for the proposed works.

4.3 Funding

The required vegetation management works are to be fully funded and implemented by the proponent or subsequent landowners for the purposes of approved works as well as the protection and maintenance of the residual bushland.

5 MONITORING & AUDITING

A 'project ecologist' is to be engaged to ensure that the Program of Works (Table 3.4) is being undertaken in accordance with this BMP and the conditions of consent, efficiently, in order of priority, methodically and utilising ecologically sensitive approaches.

The project ecologist will provide a monitoring and auditing role to ensure the implementation of the proposed restoration works and protection of the natural landscape within the residual bushland. The project ecologist will also be responsible for monitoring and reporting to Council.

5.1 Minimum monitoring and inspection requirements

Vegetation within the APZ and residual bushland will be monitored in terms of vegetation condition, weed coverage, plant survival and achievement of restoration outcomes. Annual monitoring activities will include:

1. A minimum of four (4) nested flora quadrats (each marked by a steel picket) are to be undertaken within the weed control zones to assess the achievement of the performance targets. The quadrats are to be placed in representative locations and are to be a minimum outer dimension of 5x5m with a 1m² internal nested quadrat;
2. Photographic records within the nested flora quadrats are to be taken on an annual basis from the same location / picket, with the same view; and
3. An overall vegetation condition map based on standard bush regeneration vegetation condition assessment methodology.

Monitoring of the site is required to be set up at the commencement of vegetation management works within the biodiversity conservation area, preferably just after the removal of vegetation for the APZ, or prior to the installation of the permanent protection fencing. This will provide baseline data and will allow the determination of pre and post condition of the vegetation and its habitat, and may include identification of any areas suffering from disturbance, erosion, sedimentation or in need of contingency rehabilitation, weed control, stabilisation or maintenance of rehabilitated or regenerating areas.

The monitoring and review process will focus on the presence / absence of exotic species, floristic diversity of the bushland, structural integrity of the bushland, restoration progress and success, monitoring of any sediment fencing or protective fencing, installation of ten (10) replacement hollows or nest boxes, and monitoring of pest fauna.

Inspections of the site by the project ecologist is to be undertaken prior to, during and post operations to ensure that vegetated areas designated for retention and exclusion zones are adequately marked and that other appropriate protection procedures are being maintained.

Inspections and any monitoring tasks being undertaken by the project ecologist are to be undertaken at regular intervals for up to three (3) years.

An annual audit report is to be submitted and appropriate compliance certificates issued at the completion of each major phase of work. These reports will be undertaken and submitted to Council. The completion of all tasks will be progressively recorded as the works are completed on site.

The project ecologist is to determine whether any additional contingency works are required to satisfactorily achieve the performance targets. These works are to be implemented and controlled by the site manager or under the supervision of the project ecologist.

5.2 Compliance certification

Compliance certificates will be issued by the project ecologist for the following items:

- Engagement of a bush regeneration company and project ecologist;
- Installation of all protective fencing, sediment and erosion control measures and baseline monitoring works;
- Completion of staged targeted weed control works;
- Completion of works as stated in Table 3.4;
- Installation of any required habitat enrichment measures (nest boxes, hollow logs, rocks); and
- Completion of all required restoration maintenance tasks and (if required) contingency planting works.

5.3 Performance targets

Performance targets apply to the residual bushland during the three (3) year program of works. Site audits are to assess the achievement of the following performance targets:

1. Subject to the staging of works, the presence, abundance and cover of noxious and environmental weed species within the residual bushland is not to exceed 15% weed coverage at the end of Year 1, progressively reduced to less than 10% at the end of Year 2 and 3% at the end of Year 3.
2. Installation of sediment and erosion controls. Stabilised soils in all localities using turf strips, sediment traps and bitumen spray seed mix.
3. Installation and stabilisation of closed ends grassy stormwater drainage trench / soak pit.
4. Achievement of a natural vegetation composition within regenerated areas using low impact weed control methods to allow native species to naturally regenerate.

5. If required, restoration (planting) is to use species commensurate with the appropriate adjoining plant community type (PCT), (see Appendix 1, Table A1.1 within this document), the height of vegetation is to be commensurate with expected native regrowth rates for each plant community type (PCT) at the end of Year 3 i.e. approximately 2-5m in height.
6. Confirmed effectiveness and appropriateness of weed control methods. No greater than 3% weed coverage or non-native exotic species to be present after the end of Year 3.
7. The effective control and removal of waste and litter.
8. Effective control of pest species, such as rabbits, cats, dogs and foxes.
9. Installation of a permanent 4 strand plain wire fence with 'ring lock' style mesh or an acceptable alternative is to be installed on the boundary of the residual bushland that faces the proposed residential development.
10. Sediment fencing is to be placed at the base of the permanent protection fencing on the lower side of the development works to prevent sediment deposition into the adjoining bushland or watercourse.
11. Species composition and general biodiversity is to be maintained or improved within residual bushland areas.
12. The site and the effectiveness of the proposed measures are to be monitored for a period of three (3) years after the completion of the construction phase by a project ecologist. The site will be inspected six (6) monthly for auditing and certification purposes.

APPENDIX 1. RECOMMENDED PLANTING LISTS

The plant species to be used for native landscaping that are known within the adjoining areas of the residual bushland are provided below.

Table A 1-1– Species to be used for native landscaping

PCT 1083 – Red Bloodwood – scribbly gum heathy woodland on sandstone plateaux of the Sydney Basin Bioregion	
Scientific name	Common name
Trees	
<i>Angophora costata</i>	Smooth-barked Apple
<i>Corymbia gummifera</i>	Red Bloodwood
<i>Eucalyptus globoidea</i>	White Stringybark
<i>Eucalyptus haemastoma</i>	Broad-leaved Scribbly Gum
<i>Eucalyptus punctata</i>	Grey Gum
<i>Eucalyptus sieberi</i>	Silvertop Ash
Shrubs	
<i>Acacia longifolia</i>	Sydney Golden Wattle
<i>Allocasuarina distyla</i>	-
<i>Angophora hispida</i>	Dwarf Apple
<i>Banksia ericifolia</i>	Heath-leaved Banksia
<i>Banksia serrata</i>	Old Man Banksia
<i>Elaeocarpus reticulatus</i>	Blueberry Ash
<i>Hakea sericea</i>	Needlebush
<i>Kunzea ambigua</i>	Tick Bush
<i>Leptospermum squarrosum</i>	-
<i>Leptospermum trinervium</i>	Slender Tea-tree
<i>Persoonia pinifolia</i>	Pine-leaved Geebung
<i>Pittosporum undulatum</i>	Sweet Pittosporum
Groundcovers	
<i>Anisopogon avenaceus</i>	Oat Speargrass
<i>Cyathochaeta diandra</i>	-
<i>Dampiera stricta</i>	Blue Dampiera
<i>Empodisma minus</i>	-
<i>Entolasia stricta</i>	Wiry Panic
<i>Gahnia sieberiana</i>	Red-fruited Saw-sedge
<i>Gleichenia dicarpa</i>	Pouched Coral Fern
<i>Lepyrodia scariosa</i>	Scale Rush
<i>Pteridium esculentum</i>	Bracken
<i>Xanthorrhoea media</i>	Forest Grass Tree

Table A1.2 – Species to be used for native landscaping

PCT 1824 – Mallee –Banksia – Tea-tree – Hakea heath-woodland of the coastal sandstone plateaus of the Sydney Basin

Scientific name	Common name
Trees	
<i>Eucalyptus punctata</i>	Grey Gum
<i>Eucalyptus haemastoma</i>	Broad-leaved Scribbly Gum
<i>Angophora hispida</i>	Dwarf Apple
<i>Eucalyptus sieberi</i>	Silvertop Ash
Shrubs	
<i>Banksia ericifolia</i>	Heath-leaved Banksia
<i>Leptospermum trinervium</i>	Slender Tea-tree
<i>Allocasuarina distyla</i>	-
<i>Grevillea speciosa</i>	Red Spider Flower
<i>Grevillea buxifolia</i> subsp. <i>buxifolia</i>	Grey Spider Flower
<i>Hakea teretifolia</i>	Dagger Hakea
<i>Acacia suaveolens</i>	Sweet Scented Wattle
<i>Hibbertia linearis</i>	-
<i>Phebalium squamulosum</i>	Scaly Phebalium
<i>Kunzea ambigua</i>	Tick Bush
<i>Darwinia fascicularis</i>	-
Groundcovers	
<i>Xanthosia pilosa</i>	Woolly Xanthosia
<i>Cyathochaeta diandra</i>	-
<i>Entolasia stricta</i>	Wiry Panic
<i>Anisopogon avenaceus</i>	Oat Speargrass
<i>Dianella caerulea</i>	Blue Flax-lily
<i>Lepidosperma laterale</i>	Variable Sword-sedge
<i>Lomandra glauca</i>	Pale Mat-rush
<i>Patersonia sericea</i>	Wild Iris
<i>Imperata cylindrica</i>	Blady Grass
<i>Actinotus minor</i>	Lesser Flannel flower

Table A1.3 – Species to be used for native landscaping

PCT 1825 – Coastal Sandstone Plateau Rock Plate Heath	
Scientific name	Common name
Trees (very Sparse)	
<i>Eucalyptus punctata</i>	Grey Gum
<i>Eucalyptus sieberi</i>	Silvertop Ash
Shrubs	
<i>Allocasuarina distyla</i>	-
<i>Angophora hispida</i>	Dwarf Apple
<i>Banksia ericifolia</i>	Heath-leaved Banksia
<i>Bossiaea scolopendria</i>	-
<i>Phebalium squamulosum</i>	Scaly Phebalium
<i>Darwinia fascicularis</i>	-
<i>Hakea sericea</i>	Needlebush
<i>Kunzea ambigua</i>	Tick Bush
<i>Epacris longiflora</i>	Fuchsia Heath
<i>Boronia ledifolia</i>	Sydney Boronia
<i>Leptospermum arachnoides</i>	-
Groundcovers	
<i>Lepidosperma concavum</i>	-
<i>Actinotus minor</i>	Lesser Flannel Flower
<i>Platysace lineariifolia</i>	Narrow-leaved Platysace
<i>Cyathochaeta diandra</i>	-
<i>Trachymene incisa</i>	Trachymene
<i>Lepyrodia scariosa</i>	Scale Rush
<i>Xanthorrhoea minor</i>	-
<i>Empodisma minus</i>	-

APPENDIX 2.TARGETED WEED SPECIES

The following Table lists exotic / weed species that have been observed within Lot 808 during flora surveys. Also listed are species known to occur within the locality, and which have potential to invade the Lot.

Table A2.1- Exotic species targeted for removal

Common Name	Scientific Name	Weed Control Priority
Exotic / Weed species observed within Lot 808		
Camphor Laurel	<i>Cinnamomum camphora</i>	Very High
Japanese Sacred Bamboo	<i>Nandina domestica</i>	Very High
Blackberry	<i>Rubus fruticosus</i> sp. agg.	Very High
Fishpole Bamboo	<i>Phyllostachys aurea</i>	Very High
Lantana	<i>Lantana camara</i>	High
Mickey Mouse Plant	<i>Ochna serrulata</i>	High
Cotoneaster	<i>Cotoneaster pannosus</i> or <i>C. glaucophylla</i>	Medium
Senna	<i>Senna pendula</i> var. <i>glabrata</i>	Medium
Crofton Weed	<i>Ageratina adenophora</i>	Medium
Coreopsis	<i>Coreopsis lanceolata</i>	Medium
Buffalo Grass	<i>Stenotaphrum secundatum</i>	Medium
Kikuyu Grass	<i>Pennisetum clandestinum</i>	Medium
Flatweed	<i>Hypochaeris radicata</i>	Low
Common Passionfruit vine	<i>Passiflora edulis</i>	Low
Exotic / weed species known to occur within the locality		
Bitou Bush	<i>Chrysanthemoides monilifera</i> subsp. <i>rotundata</i>	Very High
Boneseed	<i>Chrysanthemoides monilifera</i> subsp. <i>monilifera</i>	Very High
Jasmine	<i>Jasminum polyanthum</i>	Very High
African Boxthorn	<i>Lycium ferocissimum</i>	High
African Olive	<i>Olea europaea</i> subsp. <i>cuspidata</i>	High
Bridal Veil Creeper	<i>Asparagus declinatus</i>	High
Cape Broom	<i>Genista monspessulana</i>	High
Asparagus ferns	<i>Asparagus</i> or <i>Protasparagus</i> species	High
Madeira Vine	<i>Anredera cordifolia</i>	High
Pampas Grasses	<i>Cortaderia</i> spp.	High
Fireweed	<i>Senecio madagascariensis</i>	Medium
Green Cestrum	<i>Cestrum parqui</i>	Medium
Scotch Broom	<i>Cytisus scoparius</i> subsp. <i>scoparius</i>	Medium

APPENDIX 3. WEED MANAGEMENT SPECIFICATIONS

Weeds are to be progressively removed in accordance with the following techniques recommended by the National Trust and Australian Association of Bush Regenerators.

A3.1 Woody weeds – removal techniques

Cut and paint (woody weeds to 10cm basal diameter)

- Make a horizontal cut close to the ground using secateurs, loppers or a bush saw; and
- Immediately apply herbicide to the exposed flat stump surface.

Considerations:

- Cuts should be horizontal to prevent herbicide from running off the stump, sharp angle cuts are hazardous;
- Herbicide must be applied immediately before the plant cells close (within 30 seconds) and translocation of herbicide ceases;
- If plants re-sprout cut and paint the shoots after sufficient regrowth has occurred; and
- Stem scraping can be more effective on some woody weeds.

Stem injection

- At the base of the tree drill holes at a 45-degree angle into the sapwood;
- Fill each hole with herbicide immediately; and
- Repeat the process at 5cm intervals around the tree.

Frilling or chipping

- At the base of the tree make a cut into the sapwood with a chisel or axe;
- Fill each cut with herbicide immediately; and
- Repeat the process at 5m intervals around the tree.

Considerations:

- Plants should be actively growing and in good health;
- Deciduous plants should be treated in spring and autumn when leaves are fully formed;
- For multi-stemmed plants, inject or chip below the lowest branch or treat each stem individually; and

- Herbicides must be injected immediately before plant cells close (within 30 seconds) and translocation of herbicide ceases.

A3.2 Small hand pullable plants – removal techniques

Hand removal

- Remove any seeds or fruits and carefully place into a bag;
- Grasp stem at ground level, rock plant backwards and forwards to loosen roots and pull out; and
- Tap the roots to dislodge any soil, replace disturbed soil and pat down.

Considerations:

- Leave weeds so roots are not in contact with the soil e.g. hang in a tree, remove from site or leave on a rock.

A3.3 Vine and scramblers – removal techniques

Hand removal

- Take hold of one runner and pull towards yourself;
- Check points of resistance where fibrous roots grow from the nodes;
- Cut roots with a knife or dig out with a trowel and continue to follow the runner;
- The major root systems need to be removed or scrape/cut and painted with herbicide; and
- Any reproductive parts need to be bagged.

Stem scraping

- Scrape 15–30 cm of the stem with a knife to reach the layer below the bark / outer layer; and
- Immediately apply herbicide along the length of the scrape.

Considerations:

- A maximum of half the stem diameter should be scraped. Do not ring bark;
- Larger stems should have two scrapes opposite each other; and
- Vines can be left hanging in trees after treatment.

A3.4 Weeds with underground reproductive structures – removal techniques

Hand removal of plants with a taproot

- Remove and bag seeds or fruits;

- Push a narrow trowel or knife into the ground beside the tap root, carefully loosen the soil and repeat this step around the taproot;
- Grasp the stem at ground level, rock plant backwards and forwards and gently pull, removing the plant; and
- Tap the roots to dislodge soil, replace disturbed soil and pat down.

Crowning

- Remove and bag stems with seed or fruit;
- Grasp the leaves or stems together so the base of the plant is visible;
- Insert the knife or lever at an angle close to the crown;
- Cut through all the roots around the crown; and
- Remove and bag the crown.

Herbicide treatment – stem swiping

- Remove any seed or fruit and bag; and
- Using an herbicide applicator, swipe the stems/leaves.

Considerations:

- Further digging may be required for plants with more than one tuber;
- Some bulbs may have small bulbils attached or present in the soil around them which need to be removed;
- It may be quicker and more effective to dig out the weed;
- Protect native plants and seedlings; and
- For bulb and corm species the most effective time to apply herbicide is after flowering and before fruit is set.

Exotic vegetation is to be removed and stockpiled in a clear area away from adjoining bushland. This stockpile is to be removed from the site at a convenient time. As part of the regular maintenance of the restored area any regrowth of the exotic plant species is to be removed and disposed of appropriately.

A3.5 Use of herbicides

Herbicides should not be applied prior to rain occurring. This reduces the herbicides effectiveness as well as being transported in runoff to creek lines and waterways.

An advantage of herbicide use is the low time taken to spray weeds as compared to physically removing them, particularly for large infestations of weeds.

Travers bushfire & ecology recommends that the use of herbicides should be considered when there are:

- small areas of dense weeds with few or no native plants to protect;

- large areas of weeds; and
- weeds growing too rapidly for physical removal.

The spraying of weeds must only be undertaken by experienced persons with *Chemcert* or equivalent qualifications. The success of each treatment must be evaluated by the operator after a set period of time and reapplied (if necessary) according to the labeled effectiveness for each herbicide. Care must be taken when applying herbicides near drainage lines to avoid contamination of aquatic habitats.

APPENDIX 4. BUSH REGENERATION SPECIFICATION

A4.1 General description of work

This document outlines the general principles to be used in a bush regeneration and rehabilitation program. The term bush regeneration includes both weed control and revegetation (planting) in bushland and semi bushland areas.

A4.2 Definitions

Bush regeneration is defined as *"the practice of restoring bushland by focusing on reinforcing and reinstating the ecosystem's on-going natural regenerative processes"* (Australian Association of Bush Regenerators).

A4.3 Aims of bush regeneration

- To create an environment where native plants are able to re-colonise degraded / cleared areas;
- To restore degraded areas far as possible, to viable, manageable natural ecosystems;
- To protect the bushland from further external disturbance events;
- To preserve and enhance local and regional biodiversity;
- To enhance and extend habitat for native fauna; and
- To protect the site's special features (natural, geological, landscape and cultural).

A4.4 Process

The bush regeneration process involves:

- *Primary weeding* - initial weed clearance, through hand weeding and / or the very careful or judicious use of herbicides;
- *Secondary or follow up weeding* - maintenance of sites which have already received primary weeding;
- *Maintenance weeding* - monitoring/removal of weed regrowth and care of native plant seedlings (naturally occurring and/or planted); and
- *Revegetation* - the use of locally indigenous species to restore an area via tubestock planting, direct seeding, transplanting and / or brush matting.

In areas where degradation has been serious enough to severely deplete or extinguish the regenerative capacity of native vegetation, it may be necessary to reconstruct or fabricate a

plant community as close as possible to the original. This will involve a variety of techniques, including weeding, soil remediation, planting and ongoing site maintenance.

A4.5 Weed control

Weed removal shall include any species likely to significantly invade bushland, prevent natural regeneration, or impede native seedling growth. Priority shall be given to species listed as invasive or ecological weeds in the Northern Beaches (formerly Warringah) LGA in the Schedules of the *NSW Noxious Weeds Act 1993*. Note – the NSW Noxious Weeds Act (1993) has recently been repealed and since 1 July 2017 weeds are now managed in accordance with the *NSW Biosecurity Act* (2015). The old terminology of a 'noxious' weed is now no longer used in the same (legal) sense.

A4.5.1 Weeding Techniques

Within the bush regeneration context, weed control is described as the removal or control of weeds using hand removal and/or the careful selective application of selected herbicides. In specific circumstances, the use of machinery is used when the extent of the infestation is very large and where it will not cause significant erosion or soil surface destabilisation. Weeding techniques should be appropriate to the weed type, growth form and to the existing site conditions.

Wherever possible, weed removal should be carried out prior to annual seed set. Herbicide application via stem injection or foliar spray must not be applied to plants bearing ripe or semi-ripe fruit. It is important to plan herbicide control of target species according to a weeding calendar that recognises the weed's life form and seasonality (i.e. flowering, fruiting and seed set).

The techniques and methodologies used for bush regeneration shall conform to those identified in the National Trust Bush Regenerators Handbook (1991) and currently taught through the NSW TAFE Bushland Regeneration Certificate Course.

A4.6 Labour

Bush regeneration work shall be carried out in a competent manner by experienced and qualified bush regenerators. A minimum 50% of the workforce must have completed a TAFE Bushland Regeneration Certificate Course or equivalent, and have suitable field experience (e.g. minimum 200 hours prior employment as a bush regenerator).

The Bush regeneration contractor / Supervisor shall hold a TAFE Certificate 2 in Bushland Regeneration and two (2) years demonstrated experience.

In assessing tenders, preference will be given to bush regeneration contractors with prior experience in the rehabilitation of sandstone ridgetop bushland in the Sydney Basin Bioregion.

A4.7 Use of herbicides

The herbicide of choice for bush regeneration work is glyphosate (*Roundup*). *Roundup Biactive* shall be used in wet areas (e.g. drainage lines, sediment basin).

The contractor shall not use any other herbicide or chemical without the written consent of the project ecologist, project superintendent or their appointed representative.

Unless otherwise agreed with the project superintendent, herbicide application shall be limited to the following techniques:

- Cut-stump and poison (cut and dab);
- Stem injection;
- Stem-scrape and poison;
- Basal bark painting; and
- Selective spot-spraying.

A4.8 Mulch and cut brush

Any mulch imported onto the site shall be weed-free eucalyptus leaf mulch or woodchip. Mulch from Privet, Camphor Laurel, Coral Tree, Poplar, Willow, aquatic or declared invasive or environmental weeds are not to be used. The contractor shall ensure that any mulch used is properly composted before use.

Brush cut for erosion control and / or revegetation purposes shall be used only when cut branches are seed laden. Branches shall be spread as quickly as possible to reduce seed loss during stockpiling. The collection of cut brush shall be limited to species occurring naturally in the bushland area. Collection sites are to be agreed between the land owner and the project ecologist prior to any collection of brush.

A4.9 Weed debris and rubbish

Disposal of weed debris and other rubbish generated as a result of the work shall be the responsibility of the contractor. Costs for disposal of rubbish (collection and tipping fees) shall be clearly stated in the tender proposal.

Disposal of weed material via burn piles is permitted only after approval has been obtained from the project superintendent. Any burning must be carried out as advised by the Environment Protection Authority and NSW Fire Brigades.

A4.10 Soil erosion

Where bush regeneration works have the potential to destabilise slopes or embankments, action such as the use of fibre matting and / or the placing of logs or coir battens across the slope and fixing them in place shall be employed to minimise the problem. Erosion matting and / or silt fencing may be required in a number of sites. These sites are to be identified in the tender document and allowance made for the purchase and placement of erosion control matting or battens.

A4.11 Reconstruction of bushland (planting)

It is expected that the proposed development will require a minimal amount of replanting as the natural recruitment of native species is expected to occur within areas that have been subject to weed control measures.

The contractor may be required to supply a set number of locally occurring native plants to be used in the bushland reconstruction or other landscaped areas. All plant material used on site shall be grown from seed or cuttings collected in local bushland.

Plant material may be supplied as tubestock, hikos (forestry tubes) or virocells depending on the species, growth form and planting conditions. The method of delivery should be clearly stated in the tender documents.

APPENDIX 5. REVEGETATION SPECIFICATION

A5.1 Timetable of work

The contractor shall provide a preliminary planting schedule which incorporates a draft timetable of works for the planting activities. This shall be submitted at the time of tendering. A final planting schedule shall be prepared in consultation with the project manager, and approved by the project manager within 14 days of award of the contract. This schedule is to be designed to minimise the time the sites are exposed and take into account seasonal factors, availability of tubestock plants, and timing of construction works.

A5.2 Site preparation

Preparation activities for all planting sites will include preliminary weed control, rubbish removal and (only if necessary) minor earthworks (levelling, ripping). It is expected that any bare soil areas will be sown with a nurse crop to provide temporary soil stabilisation, and (where applicable) soil erosion control measures installed.

A5.3 Plant material

Plant material used to revegetation within the project area shall be sourced only from local bushland areas. Contractors are responsible for obtaining all necessary permits and licenses for the collection and propagation of local native plant material.

All plants are to be provided in a healthy condition. They must have good root development and a sturdy shoot system. Plants with an elongated or yellowed shoot system shall not be accepted.

Planting shall be undertaken immediately after delivery. If this is not possible, the contractor shall be required to provide appropriate storage to keep the plants in good condition on the site, regularly watered, adequately protected from frost, wind, sun and vermin, and secured from vandals.

A5.4 Planting guidelines

A5.4.1 *Planting densities and niche species*

Refer to Appendix 1 for species lists suitable for each Plant Community Type (PCT). The recommended 100% planting densities (if required for contingency restoration works) are 1 tree per 30m², 1 shrub per 10m² and 3 groundcovers per 1m².

A5.4.2 *Planting methods*

Planting holes shall be excavated to a depth of 150mm and a diameter of 200mm. Slow-release native plant fertiliser (low phosphorous formulated native plant fertiliser tablets / granules) shall be placed into the planting hole. In poorly structured soils, approximately 200cc

of native plant soil mix is to be placed and incorporated into the planting hole with fertiliser and water storing granules.

Plants must be placed into moistened soil preferably by soaking 1-2 litres of water into each hole. After planting, the soil shall be replaced and carefully firmed, leaving a slight depression around each plant to allow for water collection. Soil is to be replaced in the hole so that the base of the stem is level with the soil surface, not set below the soil, or sitting above.

All plants are to be thoroughly watered before planting and again after planting. If the weather is hot, a third watering shall be carried out within two (2) days or a t-tape or drip irrigation system set up to water plants on a weekly basis.

A5.4.3 Plant protection

The contractor shall be responsible for adequately protecting plant material from frost, wind, sun, vermin and animals. Two (2) litre cardboard guards (including 2 stakes) shall be placed around each plant and maintained. The use of jute mats (mulch mats) is recommended where annual or grass regrowth is expected.

Plant protection shall be discussed in the initial stages of work and identified whether or not required, dependent upon the season of planting and level of rabbit protection required.

A5.4.4 Mulching

Mulching will only be installed in high profile locations. Mulching will be limited in area within regeneration zones so as to maximise regeneration of native species from the soil seed bank. However, if used, the mulch is to be low nutrient mulch such as chipped eucalyptus. A depth of approximately 75mm and a diameter of 400mm around each plant are recommended. Mulch containing exotic plant material is not to be used. Pine bark is not considered to be a suitable mulch material. The provenance and weed free status of all mulch material must be known and approved by the project manager.

A5.4.5 Maintenance and weed control

Tubestock must be suitably maintained (watering and weeding) over a three (3) year period on the following basis:

- 1-3 months post planting – weekly watering and maintenance
- 4-12 months post planting – monthly watering and maintenance
- 13-24 months post planting – quarterly watering and maintenance
- 25-36 months – monitoring and maintenance

During the maintenance phase any plant losses in excess of 15% of the total number planted must be replaced at the expense of the contractor.

Site maintenance shall consist of the following tasks:

- Weeding throughout the planting area
- Watering tubestock
- Replacing lost plants (as required)
- Removing wind-blown or other rubbish from the planting area

The contractor shall provide a preliminary maintenance schedule which incorporates a timetable of works for each of the activities listed above.

APPENDIX 6.TIMETABLE OF WORKS

SCHEDULE 1. VEGETATION SPECIFICATION

