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# Biodiversity Management Plan

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Redevelopment of UNSW Cliffbrook Campus

45-51 Beach Street, Coogee

State Significant Development Application (SSD 8126)

Revision A

Date: 03/05/17





# NARLA

*environmental*

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Prepared for: University of New South Wales

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Prepared by: Narla Environmental Pty Ltd

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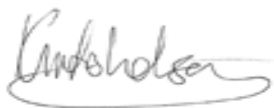
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As Principal of Narla Environmental Pty Ltd I, Kurtis Lindsay, certify that:

- This report has been prepared in accordance with the brief provided by the client.
- The information presented in this report is a true and accurate record of the study findings in the opinion of the authors.



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## Glossary and abbreviations

ACRONYM	DESCRIPTION
BAR	Biodiversity Assessment Report
BioMetric	Refers to the State Government devised methodology for vegetation assessment
BMP	Biodiversity Management Plan
BCC	Bio-banking Credit Calculator
DPE	NSW Department of Planning and Environment
Subject site	UNSW Cliffbrook Campus, 45-51 Beach Street, Coogee, 2034
EEC	Endangered Ecological Community
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
ESBS	Eastern Suburbs Banksia Scrub
FBA	Framework for Biodiversity Assessment
IBRA	Interim Bio-regionalisation of Australia
LGA	Local Government Area
LPI	Land and Property Information
OEH	NSW Office of Environment and Heritage
PCT	Plant Community Type
SEARs	Secretary's Environmental Assessment Requirements
SSD	State Significant Development
m	Metres
km	Kilometres
ha	Hectares
TSC Act	NSW <i>Threatened Species Conservation Act 1995</i>
UNSW	The University of New South Wales

# 1. Introduction

## 1.1 Background and Project Proposal

Narla Environmental Pty Ltd was engaged by The University of New South Wales (UNSW) Planning and Development Facilities Management, to prepare this Biodiversity Management Plan (BMP) for the Cliffbrook Campus, 45-51 Beach Street Clovelly (the 'subject site'). The BMP has been developed as a guide for the mitigation of impacts associated with the redevelopment of the campus and installation of a walkway within the subject site. This BMP provides site specific requirements and recommendations to maintain and enhance biodiversity on the Cliffbrook Campus and the surrounding locality.

The primary objective of this BMP is the restoration of native vegetation and habitat enhancement for native fauna. Works described in this report address the entire subject site; however, focus is given to the eastern half of the Campus, the 'bushland areas', which include existing native vegetation and surrounding exotic lawn that is proposed for revegetation. The BMP also provide recommendations for protecting and enhancing biodiversity values within the western half of the subject site (the 'built' areas) which prior to development encompassed ornamental gardens (The Ents 2016, FJMT 2016) .

This BMP is intended to operate in conjunction with and inform the Landscape Plan designed by FMJT Studio (2016).

## 1.2 Aims and Objectives

The primary objective of this BMP is to enhance the onsite biodiversity at the Cliffbrook Campus. Specific aims will be to mitigate the impact on native vegetation and its value as habitat for fauna associated with the proposed development. This is to be achieved through:

- Mitigating the impact associated with the construction of a walkway through native bushland.
- Enhancing or retaining the same habitat value for native wildlife across the entire subject site.
- Management and removal of exotic plants, including noxious and environmental weeds.
- Facilitating an increase in the extent of locally indigenous native vegetation on the Cliffbrook Campus.
- Restoring elements of Eastern Suburbs Banksia Scrub to areas where it is considered to have formerly occurred.



Figure 1. The Subject Site, demonstrating proposed development footprint and mapped vegetation distribution

## 2. Site Description

### 2.1 Existing Vegetation Communities

Site surveys by Narla Ecologists conducted on the 7<sup>th</sup> and 9<sup>th</sup> of February 2017 determined the vegetation which made up the bushland patch on the subject site was dominated by native flora, interspersed with weed infestations (Narla 2017). The flora assemblage was influenced by a history of disturbance, including clearing, urbanisation and introduction of exotic species. Bushcare groups had also influenced the site through historic and ongoing weed removal and revegetation works (RCC 2015).

The native vegetation in the subject site displayed floristic and structural variation across its extent. The variations in soil and local geology suggest the subject site may once have supported a transitional zone between the two closely related vegetation communities: Eastern suburbs Banksia Scrub (ESBS) and Coastal Headland Heath.

In the northern most portion of the bushland patch, the presence of taller vegetation layers containing Heath-leaved Banksia (*Banksia ericifolia*) and Sydney Red Gum (*Angophora costata*) growing on deep, podsolised, sandy soils, suggested that parts of the subject site may have once supported ESBS, listed as 'Eastern Suburbs banksia scrub in the Sydney Basin Bioregion', an Endangered Ecological Community under the NSW Threatened Species Conservation Act 1995 (TSC Act) and Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). Despite these biophysical influences assessment of four 20m x 20 m vegetation plots sampled across the vegetation patch were compared with current vegetation community descriptions (OEH 2013) and this revealed the area did not meet the formal criteria for classification as ESBS.

Further analysis of the vegetation plots revealed the vegetation of the subject site correlated more strongly with Coastal Headland Banksia Heath, a non-threatened vegetation community that shares floristic elements with ESBS. The Coastal Headland Banksia Heath vegetation supported low-lying maritime shrubs including Coastal Rosemary (*Westringia fruticosa*), White Correa (*Correa alba*) and Heath Myrtle (*Baeckea imbricata*), which are key distinguishing features between ESBS and coastal heathland communities (OEH 2013; OEH 2011). The presence of skeletal soils and exposed Hawkesbury sandstone provided further evidence to support the identification of this vegetation community.

Exotic vine and woody weed cover was found across the subject site in varying density. The extensive urban interface has promoted 'edge effects' on across the subject site. Garden escapees and herbaceous exotics were observed to have colonised both the ornamental gardens and of the native vegetation patch.

**Table 1. Nomenclature of the single vegetation community within the subject site**

Common Name	Total Extent on Subject Site	Sydney Metropolitan Vegetation Type	NSW Plant Community Type	BioMetric Vegetation Type
Coastal Headland Banksia Heath	0.40 ha	H_L06 Coastal Headland Banksia Scrub	PCT 1822: Heath-leaved Banksia - Scrub She-oak heath on sandstone headlands in the Sydney basin	ME101

## 2.2 Threatened Species

Targeted threatened flora searches were performed for species with likelihood to occur within the subject site:

- Magenta Lilly Pilly (*Syzygium paniculatum*)
- Sunshine Wattle (*Acacia terminalis* subsp. *terminalis*)
- Netted Bottle Brush (*Callistemon linearifolius*)

Each of these species is suited to the habitat conditions found within the subject site, however active targeted surveys were undertaken for each of these three species by an experienced Narla Ecologist (Emily Strautins) on 20<sup>th</sup> of June 2016 and 9<sup>th</sup> of February 2017.

Further survey for threatened flora were undertaken during the assessment of the four vegetation plots that were spread across the vegetation patch by both Emily Strautins and experienced local Restoration Ecologist Dean Sugden on the 7<sup>th</sup> and 9<sup>th</sup> of February 2017.

Despite thorough in-field searches, no flora species of conservation significance listed under either "Rare or Threatened Australian Plants" (RoTAP) (Briggs and Leigh 1996), TSC Act or EPBC Act were confirmed on or immediately adjacent the subject site.

## 2.3 Environmental and Noxious Weeds

Field survey identified sixty-five environmental weeds and four noxious weeds within the Cliffbrook Campus (**Table 2**). Additionally seven species of these species were listed as undesirable within the LGA in the Randwick DCP.

Of particular concern were exotic vine infestations which were abundant and evidently posing a risk of smothering a number of native shrubs. Cape Ivy (*Delairea odorata*) was particularly dominant, though significant environmental weed species Turkey Rhubarb (*Acetosa sagittata*) and Madeira vine (*Anredera cordifolia*) were also prevalent.

Dense, though isolated patches of woody weed species were also observed, including noxious species Lantana (*Lantana camara*), Bitou Bush (*Chrysanthemoides monilifera rotundata*) and Green Cestrum (*Cestrum parqui*). Mirror Bush (*Coprosma repens*) was also present near the eastern boundary, associated with localised erosion issues.

Ground Asparagus (*Asparagus aethiopicus*) was the third noxious weed identified within the subject site. This species was rarely observed, with specimens mainly immature.

**Table 2. Noxious and environmental weeds identified within the subject site**

<b>Scientific Name</b>	<b>Common Name</b>	<b>Non-local natives</b>	<b>Exotic Species</b>	<b>WM Act Noxious</b>	<b>Randwick DCP</b>
<i>Acetosa sagittata</i>	Turkey Rhubarb		x		
<i>Ageratina adenophora</i>	Crofton Weed		x		
<i>Anagallis arvensis</i>	Scarlet Pimpernel		x		
<i>Anredera cordifolia</i>	Madeira Vine		x		
<i>Araucaria heterophylla</i>	Norfolk Island Pine	x			
<b>Asparagus aethiopicus</b>	<b>Ground Asparagus</b>		x	<b>4</b>	
<i>Asteraceae sp.</i>			x		
<i>Bidens pilosa</i>	Cobblers Pegs		x		
<i>Bromus catharticus</i>	Prairie Grass		x		
<i>Celtis occidentalis</i>	Hackberry		x		Undesirable
<b>Cestrum parqui</b>	<b>Green Cestrum</b>		x	<b>3</b>	
<i>Chlorophytum comosum</i>					
<b>Chrysanthemoides monilifera rotundata</b>	<b>Bitou Bush</b>			<b>3</b>	
<i>Cinnamomum camphora</i>	Camphor Laurel		x		Undesirable
<i>Conyza bonaerensis</i>	Conyza		x		
<i>Coprosma repens</i>	Mirror Bush		x		
<i>Crocasmia x crocosmiiflora</i>			x		
<i>Cynadon dactylon</i>	Common Couch	x			
<i>Cyperus eragrostis</i>	Umbrella Sedge		x		
<i>Cyperus involucratus</i>	Umbrella Sedge		x		
<i>Cyrtomium falcatum</i>	Holly Fern		x		
<i>Delairea odorata</i>	Cape Ivy		x		
<i>Digitaria sanguinalis</i>	Summer Grass				
<i>Dyopsis decaryi</i>	Triangle Palm		x		
<i>Ehrharta erecta</i>	Bird Seed Grass		x		
<i>Eleusine indica</i>	Crow's Foot Grass		x		
<i>Eragrostis curvula</i>	African Lovegrass		x		
<i>Euphorbia peplus</i>	Petty Spurge		x		
<i>Ficus lyrata</i>	Fiddle Leaf Fig		x		
<i>Fraxinus raywoodii</i>	Claret Ash		x		
<i>Galinsoga parviflora</i>	Potato Weed		x		
<i>Gamochaeta calviceps</i>	Cudweed		x		
<i>Howea forsteriana</i>	Kentia Palm	x			
<i>Hymenoporum flavum</i>	Native Frangipani	x			
<i>Hypochaeris glabra</i>	Cat's Ear		x		
<i>Lagunaria patersonii</i>	Norfolk Island Hibiscus	x			Undesirable
<b>Lantana camara</b>	<b>Lantana</b>		x	<b>4</b>	

Scientific Name	Common Name	Non-local natives	Exotic Species	WM Act Noxious	Randwick DCP
<i>Lonicera japonica</i>	Japanese Honeysuckle		x		
<i>Magnolia grandiflora</i>	Bull magnolia		x		Undesirable
<i>Modiola caroliniana</i>	Red Flowered Mallow		x		
<i>Morus sp.</i>	Mulberry		x		Undesirable
<i>Nephrolepis cordiflora</i>	Fishbone Fern	x	x		
<i>Nerium oleander</i>	Oleander		x		Undesirable
<i>Northoscordum borbonicum</i>	False Onion Weed		x		
<i>Ochna serrulata</i>	Mickey Mouse Plant		x		
<i>Olea europaea subsp. cuspidata</i>	African Olive		x		
<i>Parietaria judaica</i>	Asthma Weed		x		
<i>Phoenix canariensis</i>	Canary Island Date Palm	x			
<i>Phyllanthus tenellus</i>	Hen and chicken		x		
<i>Polygala myrtifolia</i>	Myrtle-leaf Milkwort		x		
<i>Portulaca oleracea</i>	Pigweed				
<i>Schefflera actinophylla</i>	Umbrella Tree	x	x		Undesirable
<i>Setaria parviflora</i>	Pigeon Grass		x		
<i>Sida rhombifolia</i>	Paddy's Lucerne		x		
<i>Solanum nigrum</i>	Black Nightshade		x		
<i>Solanum seaforthianum</i>	Brazilian Nightshade		x		
<i>Sonchus oleraceus</i>	Sonchus				
<i>Stenotaphrum secundatum</i>	St. Augustine Grass				
<i>Strelitzia nicolai</i>	Bird of Paradise		x		
<i>Syagrus romanzoffiana</i>	Cocos palm		x		
<i>Tradscantia flumensis</i>	Trad		x		
<i>Ulmus parvifolia</i>	Chinese Elm		x		
<i>Zantedeschia aethiopica</i>	Arum Lily		x		
<i>Zelkova serrata</i>	Japanese Elm		x		

## 2.4 Environmental Management Issues

- The shallow, sandy soils are easily subject to erosion from water and wind movement if exposed.
- Unauthorised thoroughfare through bushland (off track).
- Unauthorised poisoning, trimming and felling of trees and shrubs from the bushland patch.
- Unauthorised planting of garden plants within the Cliffbrook Campus.
- Unauthorised dumping of green waste, allowing the introduction of weed propagules and damage to native vegetation.
- Colonisation of 'escaped garden plants' in bushland patch.
- Phytophthora, Myrtle rust and Chytrid fungus are environmental pathogens which are not yet evident within the subject site. These pathogens have been listed as 'Key Threatening Processes' (KTP) under the TSC Act, and are easily spread through infected soil.

### Matters not requiring Additional Attention

- No acid sulphate soils (ASS) were identified within the subject site or within any directly adjacent areas.
- The subject site is not mapped as bushfire prone land.
- The subject site does not contain any waterways or riparian zones.

## 2.5 Management Zones

Work zones to which this BMP applies can be broadly divided into three regions, each with distinct requirements and objectives, as summarised in **Table 3**. Vegetation areas referred to within this table are illustrated in Error! Reference source not found.

**Table 3. Biodiversity Management Zones across the subject site**

<b>Work Zone</b>	<b>Description</b>	<b>Objectives</b>	<b>Management Issues</b>
<u>Zone 1</u> Bushland	Intact bushland east of the dividing fence line which extends to lot boundaries to the east, north and south incl. adjacent lawn, ESBS and Coastal Headland Heath	Extend area of native of vegetation through revegetation works.  Enhance biodiversity incl. increasing species richness and fauna habitat potential	<ul style="list-style-type: none"> <li>▪ Weed infestation/ infiltration</li> <li>▪ Erosion and stormwater washout</li> <li>▪ Establishment of low impact walkway</li> </ul>
<u>Zone 2</u> Garden Bed and Recreational Lawn	Green space which contains a mix of native and exotic vegetation situated within 'built' areas	Maintain (or increase) existing potential for fauna habitat  Allow for redevelopment works	<ul style="list-style-type: none"> <li>▪ Located in close vicinity to redevelopment works</li> </ul>
<u>Zone 3</u> Coastal Banksia/ Tick Bush Patch	Isolated patch of indigenous vegetation, contiguous with Coastal Headland Banksia Heath, found on the northern boundary within the built region of the subject site	Protect and enhance native vegetation during and post construction works	<ul style="list-style-type: none"> <li>▪ Located in close vicinity to major elements of redevelopment works</li> <li>▪ Existing exotic vegetation</li> </ul>



Figure 2. Management zones

## 3. Recommended Management Actions

### 3.1 Pre-construction Phase

Any trees not scheduled for removal must be protected by suitable Tree Protection Zones (TPZ) established prior to the commencement of any other works (The Ents 2016). A guide for appropriate size of TPZ must be supplied by a qualified arborist.

Prior to any vegetation clearing or construction works it is recommended that best practice erosion and sedimentation mitigation measures are installed as per the provisions of 'The Blue Book' (Landcom 2004). Maintain erosion and sedimentation measures, and monitor for signs of any erosion/sedimentation throughout construction phase.

If topsoil stripping is required, ensure any topsoil stripped from bushland areas is stockpiled following best practice methodology to retain topsoil biota and seedbank. Areas of topsoil stripped from non-bushland areas will not require the same level of care when stockpiling.

Select storage, stockpiling and laydown sites away from native vegetation. Preferably locate these sites in areas that are cleared or paved.

#### Zone 1

A combined pre-clearing and micro-sighting survey is recommended to minimise ecological impact of the proposed walkway. This must be undertaken by a qualified Ecologist, no more than one week prior to any proposed vegetation clearing or removal works.

The pre-clearing assessment will allow identification of any habitat containing fauna which may be harmed during the clearing process, such as cavernous rock outcrops, soaks, culverts (possible microbat roosts) and birds' nests. Prevention of harm to native fauna is a requirement of the *Prevention of Cruelty to Animals Act 1979* and the *NSW National Parks and Wildlife Act 1974*. Avoidance of ecological features may involve shifting the walkway within the assessed corridor; however alterations should not exceed 1m. Where works are predicted to directly impact or occur within close vicinity of sandstone outcropping or native vegetation an Ecologist must be contacted and may be required to return to site to supervise works.

Micro-siting the finalised route of the pathway will further ensure that the integrity of the bushland is retained. Of specific importance is the need to retain mature stands of native trees, specifically Heath-leaved Banksia, Coastal Banksia, Sydney Red Gum, any *Eucalyptus* spp. and large specimens of Coastal Teatree. These trees take long time to mature and provide among the more significant fauna habitat values in the bushland patch. If deemed necessary during micro-siting the route of walkway may be altered by a maximum of 1m. The finalised location of walkway should be clearly delineated from surrounding vegetation with TPZ and erosion control measures established.

## Zone 2

Any trees not scheduled for removal must be protected by suitable Tree Protection Zones (TPZ) established prior to the commencement of any other works (The Ents 2016). A guide for appropriate size of TPZ must be supplied by a qualified arborist.

Fauna may inhabit tree hollows, buttresses, bark crevices and nests in the canopy of trees as well as culverts within the built region of the subject site. Therefore prior to the removal of any trees or demolition works a Qualified Ecologist is required to inspect potential habitat no more than one week prior to clearing for signs of inhabitant fauna. Any tree felling or lopping works must be undertaken by a qualified arborist with an Ecologist present to capture and relocate any displaced fauna. If any injured or sensitive fauna is found the Ecologist must be contacted to safely capture and transport the fauna to a registered wildlife carer.

## Zone 3

Vegetation within this zone has been scheduled for retention and protection. As such prior to commencement of development works, this region must be clearly delineated and TPZ erected. Protected areas should encompass sandstone retaining walls, to ensure subsidence of the supporting garden bed does not undermine the viability of the zone.

## **3.2 Construction Phase**

A basic hygiene protocol should be established to prevent the spread of weed propagules and environmental pathogens inadvertently to the site. Basic principles include avoiding transport of soil onto and off site by cleaning all work clothing, gloves, tools and machinery. In some cases, a solution of 70% ethanol or methylated spirits in 30% water may be sufficient to disinfect equipment prior to use.

The report, 'Arrive Clean, Leave Clean' (Commonwealth of Australia 2015) provides detailed information on best practice methods to reduce spread of these pathogens between work sites.

## Zone 1

A fence is proposed mid-way through the site and will provide a clear boundary between the campus and the revegetation / coastal foreshore zone. Fences must not impede fauna movement and no barbed wire or similar material is to be used. The Landscape Schematic Design provides detail of proposed fencing that is to be retained, replaced or established across the subject site (FJMT 2016a).

In some areas establishment of dense native plantings around the boundaries of lawn and bushland may also provide suitable barriers for human traffic to maintain the integrity of these areas. Suitable plantings for screens include, locally indigenous, dense fast growing, impenetrable shrubs such as *Lomandra longifolia* and *Hakea teretifolia*.

Any construction, machinery operation, excavation, vehicle movement and other works that occur within the bushland area of the subject site should (as much as practicable) avoid impact to sandstone outcropping.

Particular consideration of soil and site stability is recommended within bushland regions as the soil layer is shallow and highly prone to erosion. For this reason, it is advised that clearing should be undertaken by manual means only and no excavation equipment or other plant should be used on the slope. Furthermore, it is recommended that works is carried out progressively from the upper to lower slope. This will help to stabilise soil and will prevent reinfestation of exotics via downslope seed migration. In areas containing existing erosion problem areas, staging of works to manage high erosion areas should proceed as follows:

- primary removal of exotic weed species cover;
- installation of erosion-control coir-log terracing where required;
- thorough secondary control of remerging exotic weed species;
- installation of a deep mulch layer to prepared site;
- revegetation of prepared and mulched area with provenance native plant stock;
- establishment and maintenance of installed plants;
- ongoing weed maintenance.

### Zone 2 and 3

Work zones must be maintained away from vegetation or identified habitat features which have been scheduled for retention.

In the event that any injured or sensitive fauna is observed, the Ecologist must be immediately contacted for advice. When required the Ecologist will be also attend site to safely capture and transport wildlife to a registered wildlife carer.

### **3.3 Post-Construction**

This BMP identifies and details selected areas for native bush regeneration within Zone 1. Replacement plantings may also occur anywhere on campus, as determined within the Landscape Plans (FJMT 2016).

New plantings, particularly those located within close proximity to existing native vegetation are recommended to only contain locally indigenous species, sympathetic to the indigenous vegetation type the originally occurred at the location, either:

- Eastern Suburbs Banksia Scrub or
- Coastal Headland Banksia Heath

All plants must be sourced from known provenance stock collected from within a maximum distance of 20 kilometres from the subject site. This document contains detailed lists of appropriate species suggested for use within the subject site (**Table 8**). Planting of medium sized shrubs is recommended as an important element to provide soil stabilisation and privacy screening for adjoining houses. However, no trees or shrub species likely to exceed a height of 2.5m or above are to be used in 'screening zone' as tall plants may impede outlooks of residents and campus users.

Habitat may be further enhanced through the installation of nest boxes of sizes relevant for locally occurring, native fauna including microbats and Ring-tailed Possum.

## Zone 1

It is recommended that all noxious weeds on site are continually removed and suppressed, with the aim of eventual eradication across the subject site. This is a requirement of the landholder (UNSW) under the *Noxious Weeds Act 1993* (NW Act). All Noxious weeds and Randwick council declared 'undesirable' weeds on the subject site should be removed. Some weeds including Privet (*Ligustrum sp.*) may currently provide, prey, nectar, fruit or shelter for fauna such as birds and intermittently by Grey-headed Flying Fox.

Progressive weed removal should take place in tandem with replacement with an ecological equivalent indigenous native flora species. This is especially important since the vegetation patch at the subject site is believed to have low restoration resilience with minimal, natural seedbank. Revegetation works are recommended to focus along the northern boundary of Zone 1, to increase extent of native vegetation into areas previously occupied by exotic turf (FJMT 2016). The installation of native vegetation within this area will provide an opportunity to increase local biodiversity whilst mitigating the loss of vegetation from the footprint of the proposed walkway.

Qualified Bush Regeneration specialists should support natural regeneration of ESBS and other vegetation through scalping and direct seeding; reducing the cost of planting tube stock (DECC2009). If plantings are to take place within remnant vegetation, effort must be made to ensure species chosen are known to occur naturally within the respective vegetation community.

Council-funded / volunteer Bushcare teams should be encouraged to continue working in and around the Cliffbrook Campus bushland areas. The proponent and their contracted professional Qualified Bush Regeneration specialists may choose to assist with work by Council-funded / volunteer Bushcare teams.

## Zone 2

In order to maintain landscape amenity, shade, and fauna habitat value (nectar, fruit or shelter) on the campus, where possible it is recommended that any tree removed from the western portion of the campus (in association with campus re-construction) should be replaced with a locally indigenous, native tree that provide comparable habitat value elsewhere on the campus. Narla have compiled a list of suitable replacement trees (**Table 10**). These tree species are recommended as they are locally indigenous and provide fauna foraging habitat and aesthetic values.

Replacement trees can be planted anywhere on the campus where suitable space is available, this includes within the bushland area and adjoining space. This action will assist in achieving no long-term net loss of ecological values from the subject site.

Any tree hollows removed through lopping or felling should be replaced with at least two similarly sized, all-weather, fauna nest boxes. These should be attached to the same or proximal tree to provide fauna shelter values.

### 3.4 Ongoing Management Requirements

#### Erosion Management across All Zones

In the event erosion or sedimentation is observed, the Project Coordinator should be notified immediately and they will implement appropriate response.

Areas of isolated erosion are already present within the subject site. It is apparent that erosion and sedimentation controls may have been previously established in these areas, though measures have since deteriorated and more work is required to address this issue.

Erosion caused by high velocity stormwater flushing events within the gully associated with the stormwater outlet should also be continually monitored. Sections of sandstone have already been exposed here from past gully erosion. This has in part led to the heavy disturbance of local plant communities. These disturbed plant communities are more subject to future weed invasion, as can be seen currently with the intense vine infestation in the surrounding area. Dissemination of water outlets may be a simple solution to reduce impact.

An additional area with existing erosion issues should be addressed along the eastern boundary of the site. It is recommended that the proponent removes all Mirror Bush currently occurring in the area and installs the appropriate erosion mitigation measures such as jute matting, installation of coil logs or a similar method. This area should then be covered in a layer of topsoil and be planted with native ground covers to assist in stabilisation.

#### Zone 1

It is recommended that removal and control of existing vine and woody weeds is the primary focus for bushland management works in initial stages of the project. Control of re-emerging weeds has the potential to impose high ongoing maintenance costs if initial control effort or techniques are insufficient. To minimise ongoing weed maintenance costs from the control of re-emerging noxious and environmental weed species, well planned and executed weed control works will be critical. Specific issues may arise when dealing with exotic species which possess regenerative underground structures such as rhizomes (e.g. Cape Ivy) or stolons (e.g. Lantana). Wherever viable, weed control techniques that remove the capacity for weed species to re-emerge from underground rhizomes or stolons following removal of above-ground vegetation, without negatively impacting upon native vegetation outcomes at a site would be favoured.

Substantial efforts have been made by local volunteers and council-funded / volunteer Bushcare teams to aid bush regeneration through weed control and supplementary native plantings. These efforts should be encouraged to continue. It is important to note however that the control of vine infestations, which are a significant issue on the subject site, will require more regular and intensive management than can be offered by sporadic volunteer hours. Therefore, it is recommended that weed removal work is undertaken by professional bush regenerators to assist/supplement the work of local Bushcare groups in and immediately around the subject site.

In order to achieve best possible outcomes, where possible, UNSW and Randwick Council should undertake active weed management in their adjoining bushland patches, in a

coordinated manner. This will increase likelihood of controlling local noxious weed problems in the locality and in the long term will save resources spent on managing recurring weed infestations that spread from Cliffbrook Campus to council land and vice versa.

Environmental pathogens Phytophthora, Myrtle rust and Chytrid fungus which can be spread through infected soil will remain a risk to the viability of the subject site. Continued efforts must be maintained to avoid their introduction. Basic principles include avoiding transport of soil onto and off site by cleaning all work clothing, gloves, tools and machinery. In some cases, a solution of 70% ethanol or methylated spirits in 30% water may be sufficient to disinfect equipment prior to use.

### Zone 2

Continued maintenance of ornamental gardens, to be undertaken as prescribed by landscaping contractors.

### Zone 3

Removal and ongoing suppression of all exotic flora within this area is recommended to reduce competition for native species. To decrease the likelihood of reinfestation by exotic species, supplementary native plantings may be considered. In the case that revegetation is adopted, this should aim to increase the species diversity of the patch by introducing a range of Coastal Headland Banksia Heath ground cover species (**Table 8**).

## **3.5 Plant Supply and Revegetation**

Revegetation works will aim to establish a diverse native plant species assemblage and habitat mosaic across the subject site. This revegetation outcome is intended to create as wide a range of habitat and food resources for local native fauna as possible. Suitable species may be selected from the list provided in **Table 8**. This table identified species which are already present within the site and therefore recommended to be utilised sparingly within novel plantings.

All plant propagation is to be undertaken by a specialist native plant nursery which is qualified and experienced in provenance plant propagation. Any plants to be introduced to the subject site, especially into bushland areas must reflect appropriate provenance, preferably with plant stock collected from within a 20-kilometre distance of the subject site. It is understood this is not always possible, however local provenance is encouraged.

Upon supply, all plants will be in the following condition:

- appropriately hardened-off;
- fully developed root system;
- not root bound;
- in a healthy and robust condition;
- free of pests, disease and weed infestation;
- free of malformations and other defects.

Planting of all native revegetation areas will take place using locally indigenous tubestock planted to a density of:

- 4 groundcover plants 1 m<sup>2</sup>
- 2 shrub plants per 1 m<sup>2</sup>
- one tree/tall shrub per 20 m<sup>2</sup> (only in areas outside of 10m from a private residence)

### **3.6 Works Specifications**

Work stages in relation to management zones are outlined below in **Table 4**. The commencement of certain works will be dependent on the completion of other work actions.

**Table 4. Staging of biodiversity management works**

Action	Objectives	Specifications	Location	Activities/ Materials Involved	Responsibility	Frequency
<b>Pre-Construction Phase</b>						
<b>Zone 1 - Bushland</b>						
Micro-siting and pre-clearing ecological assessment	Minimise impacts on native fauna and flora (especially ESBS)	Mark ecological features to avoid and shift walkway within assessed corridor if required	Length of proposed walkway through bushland	Flagging tape, Global Positioning System (GPS)	Ecologist and Surveyor	Once prior to any vegetation clearing activity.
<b>Zone 2 – Garden and lawn</b>						
Pre-clearing ecological assessment	Minimise impacts on native fauna and flora	Mark ecological features to avoid	All areas of vegetation to be cleared within garden	Flagging tape, GPS	Ecologist	Once prior to each tree lopping/removal activity.
<b>All zones</b>						
Erosion and sedimentation mitigation	Prevent soil movement during vegetation clearing construction works	Install best practice erosion and sedimentation mitigation measures as per 'The Blue Book' (Landcom 2004)	Surrounding proposed vegetation clearing and construction areas	Sediment fences etc. as required	Construction Contractor	Prior to any soil disturbance, vegetation removal or construction works
	Prevent soil movement allowing native vegetation to take root	Address existing specific problem areas including on the eastern boundary of bushland area and associated with stormwater outlets	Length of eastern boundary and in the vicinity of stormwater outlets on southern boundary	Steps: 1.Installation of coir logs 2.Mulch 3.Installation of deep rooting native vegetation and extensive ground covers	Professional Bush Regenerators	
<b>Construction Phase</b>						

Action	Objectives	Specifications	Location	Activities/ Materials Involved	Responsibility	Frequency
<b>Zone 1 – Bushland</b>						
Construction of proposed walkway	Avoid disturbance to native vegetation	Maintain 'buffer zone' of vegetation that is intensively weed-controlled and infill-planted with locally indigenous plants.	Surrounding proposed vegetation clearing and construction areas	See Landscape Plan (FJMT 2016)	Landscaper/ Construction Contractor/ Professional Bush Regenerators	Maintain and manage buffer immediately post construction, then six-times per year for duration of VMP.
Installation of fencing	Avoid impacts on fauna	Fencing to allow movement of fauna within and between bushland and garden vegetation	According to FJMT fencing strategy	See Landscape Plan (FJMT 2016)	Construction Contractor/ Landscape	Once during construction phase
<b>All zones</b>						
Ecological clearing supervision	Avoid impacts on fauna through disturbance to fauna habitat including protected vegetation, sandstone cropping, and culverts	Check vegetation to be cleared for any active fauna nests to be avoided or relocated. Check culverts/crevices for presence of sheltering fauna, especially threatened microbats. Supervise the clearing and felling of vegetation to capture and relocate any displaced native fauna.	All areas where trees or shrubs are to be removed or where works adjoin native vegetation or of sandstone cropping and culverts	Ecologist to be present on site prior to any tree or vegetation removal or works around outcropping or culverts. Ecologist to inform vegetation clearing or construction contractors of appropriate techniques for minimising impact to fauna and habitat. Ecologist will have fauna capture and handling	Ecologist	During any tree/shrub removal, vegetation clearing works or construction, excavation or demolition around culverts or rock outcrops

Action	Objectives	Specifications	Location	Activities/ Materials Involved	Responsibility	Frequency
Mature tree removal	Minimise impacts on fauna	Limit the removal of large, mature native trees, particular nectar and fruit bearing species (e.g. Coastal Banksia)	All vegetation clearing areas	See Arborist Report for removal techniques. equipment on hand.	Construction Contractors/ Arborist/	
		Supervise any felling or lopping of mature trees	All locations where trees or shrubs are lopped, felled or cleared across the subject site	Ecologist will advise tree loppers of best method to minimise impacts to fauna and habitat. Ecologist will have fauna capture and handling equipment on hand.	Ecologist	During any tree/shrub removal, vegetation clearing works
Storage and stockpiling	Minimise impacts on native vegetation and soils	Locate stockpile sites in historically cleared areas	Storage sites		Construction Contractor	Prior to any construction, demolition or landscaping works
		Stockpile topsoil from bushland areas using best practice methodology to retain topsoil biota and seedbank	Proposed walkway through bushland		Construction Contractor	Prior to any construction, demolition or landscaping works

Action	Objectives	Specifications	Location	Activities/ Materials Involved	Responsibility	Frequency
<b>Post-Construction Phase</b>						
<b>Zone 1 – Bushland</b>						
Weed management and bush regeneration	Encourage regeneration of native vegetation by removing problematic weeds.  Control and suppress Noxious Weeds	Focus on suppression of Cape Ivy ( <i>Delawarea odorata</i> ), Mirror Bush ( <i>Coprosma repens</i> ), and Noxious weeds and to allow expansion of native flora	Focus on high weed infestations, moving progressively to lower level infestations	To be achieved through a combination of manual removal, cut/scrape and paint, and careful spot spraying as appropriate. Planting of native tubestock to replace weeds removed and increase soil stability.	Professional Bush Regenerators	<u>Year 1 and 2:</u> One site visit per month for a team of four qualified, professional Bush Regenerators including a supervisor. This equates to 24 site visits over 24 months.  <u>Years 3-5:</u> Six visits (every two months) per year by a team of four qualified, professional Bush Regenerators including a supervisor. This equates to 18 site visits over 36 months.
Revegetation	Expansion of bushland areas	Installing and establishing of propagated plants (e.g. tubestock) with species that reflect indigenous vegetation communities	Grassed areas to north of ESBS and east of Coastal Heathland	Refer to <b>Section 3.8</b>	Professional Bush Regenerators	To be conducted as required during the weed control site visits.
	Restoration of understorey below	Installing and establishment of propagated plants (e.g. tubestock) with species that	Patch of trees to south of campus buildings	Refer to <b>Section 3.8</b>	Professional Bush Regenerators	To be conducted as required during the

Action	Objectives	Specifications	Location	Activities/ Materials Involved	Responsibility	Frequency
	trees to improve fauna habitat	reflecting indigenous existing vegetation communities				weed control site visits.
	Increase the likelihood and number of plants that survive to maturity	Close monitoring of new plantings and weather conditions to ensure appropriate care is taken	All revegetation areas	Watering and fine detail weeding, twice weekly during first weeks after installation and decreasing as required	Ecologist	Undertaken four times per year by Ecologist and as required by Professional Bush Regenerators.
Tree replacement	Replacement of some of the trees removed in association with campus re-construction	Planting of replacement trees from species list anywhere on campus where suitable space is available	Western portion of campus		Landscapers	As required
<b>All zones</b>						
Sewerage and stormwater	Prevent nutrient enrichment of bushland	Monitor site for signs of seepage from stormwater or sewerage	Throughout the site		Landscapers / Professional Bush Regenerators	As required

### 3.7 Appointment of Bushland Restoration Contractors

All bushland management works within bushland areas are to be implemented by a qualified and experienced Bushland Restoration Company.

To ensure no unnecessary legal ramifications or suboptimal quality of work, the Bush Regeneration Company selected to complete the project works must:

- Provide a statutory declaration stating their compliance with provisions of the National Gardening & Landscaping Services Award 2010;
- Provide completed and signed Subcontractor Statement regarding payment of worker's compensations, payroll tax and remuneration;
- Provide established Workplace Health & Safety and Environmental Management Systems. Preferably the company has third-party accredited systems in place;
- Demonstrate implementation of safe workplace and appropriate environmental management practices and procedures (e.g. appropriate transport and management of herbicides);
- Provide Public Liability (min \$10M) and Workers Compensation Insurance;
- Have previous experience undertaking bushland restoration works within Western Sydney. Contractor references are to be contacted;
- Provide supervisor with minimum qualifications and experience including Certificate III Conservation & Land Management and two years full-time equivalent experience as a trained bush regenerator;
- Provide a minimum of one trained bush regenerator per team of four (minimum qualifications and experience including Certificate III Conservation & Land Management and one year full -time equivalent experience as a bush regenerator.
- Provide a minimum of two trained bush regenerators per team with minimum qualifications and experience including Certificate III Conservation & Land Management and one year full – time equivalent experience as a trained bush regenerator
- Schedule appropriately resourced regular site visits for the duration of the contract period;
- All herbicide usage, including storage and transport, to be in accordance with the *NSW Pesticides Act 1999*, *WorkCover NSW (2006)* and all other relevant legislation;
- All bush regeneration crew members undertaking herbicide spray applications must hold a current chemicals application training certificate to AQF level III.

### 3.8 Appointment of Project Ecologist

A Project Ecologist must be appointed prior to any tree/shrub removal or construction works taking place.

The Project Ecologist must (as a minimum) have:

- Five years' experience as an Ecologist Consultant
- Experience in bushland restoration practices in coastal environments
- Experience supervising the clearing of trees and vegetation

- A full and current NSW Scientific License under Section 132c of the National parks and Wildlife Act 1974
- A current Animal Ethics Permit from the NSW Department of Primary Industries

### **3.9 Construction Environmental Management Plan**

Prior to any construction works, a detailed Construction Environmental Management Plan (CEMP) should be produced the details the implementation of all recommendations in the Landscape Plan (FJMT 2016) Arborist Report (reference) and this BMP.

This must detail precise erosion control and mitigation measures and procedures for when to call Arborist or Ecologist to supervise works.

The CEMP and this BMP must be available on hand during all construction works.

## 4. Monitoring

In order to ensure the proposed landscape management works are meeting their aims, it is recommended that the Project Ecologist is appointed to monitor the works over the five year lifespan of this BMP. Monitoring of the management actions undertaken within each zone should be carried-out on an annual basis. Each monitoring visit should be followed by an annual biodiversity monitoring report.

Annual independent monitoring will ensure that the project objectives are being fulfilled. These included reducing impacts associated with the proposed development and noxious weed issues on the subject site, and working towards achieving a net gain in biodiversity for the subject property.

The Project Ecologist will undertake quarterly vegetation monitoring (4 times per year) and produce a concise summary report detailing the findings of each monitoring bout.

At the end of each year an annual monitoring report will be produced. This report will detail all the biodiversity management works that have been undertaken on the site to date. This report must assess adherence to the following key performance criteria.

### 4.1 Key Performance Criteria

#### Year 0 – Prior to Construction

- The Ecologist must establish four, permanent 20m x 20m across the bushland patch (outside of the proposed track construction)
- Each plot must be surveyed of all native and exotic flora species with a percentage cover applied to each species.
- A photo must be taken from each end of the plot, looking in
- Two pickets must be erected to indicate the northern and southern edges of the plot. Each picket will be positioned at 10m (the centre) of each plot edge.
- Photograph areas of erosion that require soil stabilisation and planting

#### Year 1 – One year Post VMP Implementation

- Reduction in total weed cover by 30% from baseline across the Subject Site
- Reduction in Noxious Weed cover by 50% from baseline across the Subject Site
- Ensure all revegetation areas (refer to Landscape Plan by FJMT 2016) solely contain locally indigenous plants to a density of :
  - 4 groundcover 1 m<sup>2</sup>
  - 2 shrub plants per 1 m<sup>2</sup>
  - 1 tree/tall shrub per 10 m<sup>2</sup>

Or other density as determined by the Landscape Plan.

- Erosion remediation areas are not continuing to erode and soil stabilisation measures are still in place

#### Year 2 – Two years Post VMP Implementation

- Reduction in total weed cover by 70% from baseline across the Subject Site
- Reduction in Noxious Weed cover by 80% from baseline across the Subject Site
- Ensure all revegetation areas (refer to Landscape Plan by FJMT 2016) solely contain locally indigenous plants to a density of :
  - 4 groundcover 1 m<sup>2</sup>
  - 2 shrub plants per 1 m<sup>2</sup>
  - 1 tree/tall shrub per 10 m<sup>2</sup>

Or other density as determined by the Landscape Plan.

- Erosion remediation areas are not continuing to erode and soil stabilisation measures are still in place

#### Year 3 – Three years Post VMP Implementation

- Reduction in total weed cover by 85% from baseline across the Subject Site
- Reduction in Noxious Weed cover by 95% from baseline across the Subject Site
- Ensure all revegetation areas (refer to Landscape Plan by FJMT 2016) solely contain locally indigenous plants to a density of :
  - 4 groundcover 1 m<sup>2</sup>
  - 2 shrub plants per 1 m<sup>2</sup>
  - 1 tree/tall shrub per 10 m<sup>2</sup>

or other density as determined by the Landscape Plan.

- Erosion remediation areas are not continuing to erode and soil stabilisation measures are still in place

#### Year 4 – Four years Post BMP Implementation

- Reduction in total weed cover by 85% from baseline across the Subject Site
- Reduction in Noxious Weed cover by 95% from baseline across the Subject Site
- Ensure all revegetation areas (refer to Landscape Plan by FJMT 2016) solely contain locally indigenous plants to a density of :
  - 4 groundcover 1 m<sup>2</sup>
  - 2 shrub plants per 1 m<sup>2</sup>
  - 1 tree/tall shrub per 10 m<sup>2</sup>

or other density as determined by the Landscape Plan.

- Erosion remediation areas are not continuing to erode and soil stabilisation measures are still in place

## **4.2 Review of Vegetation Management Plan**

After five years from initial implementation of this BMP, this entire document should be reviewed by a qualified Ecologist to ensure that it remains relevant and appropriate for the on-going biodiversity management of the subject site.

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# Appendix

- Table 5. Locally relevant species suitable for use in revegetation works (selected from Coastal Headland Banksia Heath and ESBS community descriptions)
- Table 6. Native flora species recorded in the subject site by Narla Environmental
- Table 7. Tree replacement guide for use within the 'built' region of the subject site

**Table 8. Locally relevant species suitable for use in revegetation works (selected from Coastal Headland Banksia Heath and ESBS community descriptions)**

Species	Common Name	Abundant on Site	Height	Habit	Niche	Notes
<u>Understorey</u>						
<i>Actinotus helianthi</i>	Flannel Flower		<0.5m	slender / upright	dry	flowering herb
<i>Actinotus minor</i>	Lesser Flannel Flower		<0.5m	low / spreading	dry	flowering herb
<i>Cyathochaeta diandra</i>	Sheath Rush		<1m	tufted	dry	sedge
<i>Dampiera stricta</i>			<0.5m	slender / decumbent	dry	flowering herb
<i>Dianella caerulea</i>	Blue Flax-lily		<1m	tufted	dry	flowering herb
<i>Entolasia marginata</i>	Bordered Panic	x	<0.5m	slender +/- upright	dry/damp	grass
<i>Entolasia stricta</i>	Wiry Panic		<0.5m	slender	dry	grass
<i>Gonocarpus teucroides</i>	Raspwort		<0.5m	low / spreading	dry	herb
<i>Hypolaena fastigiata</i>	Tassel Rope-rush		<1m	upright / creeping	damp	sedge
<i>Lepyrodia scariosa</i>			<1m	tufted	damp/ wet	sedge
<i>Lomandra glauca</i>	Pale Mat-rush		<0.5m	tufted	dry	flowering sedge
<i>Lomandra longifolia</i>	Spiny-headed Mat-rush	x	<1m	tufted	dry/damp	flowering sedge
<i>Xanthosia pilosa</i>	Woolly Xanthosia		<0.5m	low / scrambler	dry	herb
<i>Xanthosia pilosa</i>	Woolly Xanthosia		<0.5m	low / scrambler	dry	herb
<u>Vine</u>						
<i>Billardiera scandens</i>	Hairy Apple Berry		-	climber / creeper	dry	diversity enhancement
<i>Cassytha pubescens</i>	Bindweed		-	climber / twining	dry	diversity enhancement
<u>Sub-Shrub</u>						
<i>Epacris longiflora</i>	Fuchsia Heath		<1m	+/- slender	dry	flowering / diversity
<i>Lasiopetalum ferrugineum</i>	Rusty Velvet-bush		<1m	+/- slender		diversity
<i>Leucopogon ericoides</i>	Pink Beard-heath		<1m	dense	dry	flowering / diversity
<i>Philotheca buxifolia</i>	Box-leaf Waxflower		<0.5m	low +/- slender	dry	flowering / diversity
<i>Pimelea linifolia</i>	Slender Rice Flower		<1m	slender +/- upright	dry	flowering / diversity
<i>Xanthorrhoea resinosa</i>	Grass Tree		<1m	low / spreading	dry	diversity enhancement
<u>Shrub</u>						

Species	Common Name	Abundant on Site	Height	Habit	Niche	Notes
<i>Acacia suaveolens</i>	Sweet Scented Wattle		1-2m	upright / slender	dry	structural/ fragrant
<i>Darwinia fascicularis</i>			1-2m	dense	dry	primary structural species
<i>Kunzea ambigua</i>	Tick Bush		1-2m	+/- dense	dry	primary structural species
<i>Lambertia formosa</i>	Mountain Devil		1-2m	upright +/- dense	dry	nectar producing
<i>Persoonia lanceolata</i>	Lance Leaf Geebung		1-2m	upright +/- dense	dry	fruit producing
<i>Philotheca salsolifolia</i>			0.5-2m	upright +/- dense	dry	structural/ flowering
<i>Woolfsia pungens</i>	Snow Wreath		0.5-2m	upright +/- dense	dry	flowering/ fragrant
<i>Ricinocarpos pinifolius</i>	Wedding Bush		1-3	upright +/- dense		abundantly flowering
<u>Medium Shrub</u>						
<i>Acacia longifolia</i>	Sydney Golden Wattle	x	<3m	+/- dense	dry	primary structural species
<i>Allocasuarina distyla</i>	Scrub She-oak		<3m	upright	dry	primary structural species
<i>Banksia ericifolia</i> subsp. <i>ericifolia</i>	Heath-leaved Banksia		<3m	dense	dry/damp	structural/ nectar producing
<i>Dillwynia retorta</i>	Egg and Bacon Pea		<3m	+/- dense	dry	flowering / diversity
<i>Hakea dactyloides</i>	Needlebush		<3m	upright/slender	damp	primary structural species
<i>Hakea teretifolia</i>	Needlebush	x	<3m	upright/slender	damp	primary structural species
<i>Melaleuca nodosa</i>	Prickly-leaved Paperbark	x	<3m	dense	dry	structural/ flowering
<i>Monotoca elliptica</i>	Tree Broom-heath		<3m	+/- dense	dry	primary structural species
<u>Small Tree</u>						
<i>Leptospermum laevigatum</i>	Coast Tea-tree	x	3m	dense	dry	primary structural species
<i>Melaleuca armillaris</i> subsp. <i>armillaris</i>	Cream Paperbark	x	3m	dense	dry	structural/ flowering
<i>Banksia aemula</i>	Wallum Banksia		3m	dense	dry	nectar producing
<i>Kunzea ambigua</i>	Tickbush		3m	dense	dry	primary structural species

**Table 9. Native flora species recorded in the subject site by Narla Environmental**

Scientific Name	Common Name	Coastal Headland Banksia Heath	Eastern Suburbs Banksia Scrub
<i>Acacia longifolia sophorae</i>	Coastal Wattle	Diagnostic	Diagnostic
<i>Acacia myrtifolia</i>	Red-stemmed Wattle		Associated
<i>Acmena smithii</i>	Common Lilly Pilly		
<i>Adiantum aethiopicum</i>	Maidenhair Fern		
<i>Allocasuarina distyla</i>	Black She-oak	Diagnostic	Diagnostic
<i>Angophora costata</i>	Smooth Barked Apple		
<i>Asplenium australasicum</i>	Birds Nest Fern		
<i>Baeckea imbricata</i>	Heath Myrtle	Diagnostic	
<i>Banksia ericifolia</i>	Heath-leaved Banksia	Diagnostic	Diagnostic
<i>Banksia integrifolia</i>	Coastal Banksia	Associated	Associated
<i>Bauera rubioides</i>	Dog Rose		
<i>Breynia oblongifolia</i>	Coffee Bush		
<i>Callistemon citrinus</i>	Crimson Bottlebrush	Associated	
<i>Calochlaena dubia</i>	Common Ground Fern		
<i>Carpobrotus glaucescens</i>	Pigface		
<i>Casuarina glauca</i>	Swamp She-Oak		
<i>Christella dentata</i>	Binung Fern		
<i>Commelina cyanea</i>	Scurvy Weed		
<i>Correa alba</i>	White Correa		
<i>Crinum pendeculatum</i>	Swamp Lily		
<i>Cupaniopsis anacardioides</i>	Tuckeroo		
<i>Cyperus brevifolius</i>	Globe Kyllinga		
<i>Cyrtomium falcatum</i>	Holly Fern		
<i>Dianella caerulea</i>	Blue Flax Lily	Diagnostic	
<i>Dianella revoluta</i>	Blue Flax Lily		Associated
<i>Dichelachne crinita</i>	Longhair Plume Grass		
<i>Dicksonia antarctica</i>	Soft Tree Fern		
<i>Dodonaea triquetra</i>	Common Hopbush	Associated	
<i>Eleocharis reticulatus</i>	Blueberry Ash	Associated	Associated
<i>Eragrostis brownii</i>	Browns Love Grass		Associated
<i>Eucalyptus botryoideis</i>	Southern Mahogany		
<i>Ficinia nodosa</i>	Knotted Club-rush	Associated	
<i>Ficus rubiginosa</i>	Port Jackson Fig		
<i>Gahnia sp</i>			
<i>Glochidion ferdinandi</i>	Cheese Tree		
<i>Grevillea hookeriana</i>	Hookers Grevillea		
<i>Hakea gibbosa</i>	Needlebush	Associated	Associated

Scientific Name	Common Name	Coastal Headland Banksia Heath	Eastern Suburbs Banksia Scrub
<i>Hakea teretifolia</i>	Dagger Hakea	Diagnostic	
<i>Hardenbergia violacea</i>	Purple Coral Pea		Associated
<i>Hibbertia scandens</i>	Snake Vine		
<i>Histiopteris incisa</i>	Bats Wing Fern		
<i>Hymenosporum flavum</i>	Native Frangipani		
<i>Imperata cylindrica</i>	Blady Grass	Associated	Associated
<i>Juncus continuus</i>	Juncus		
<i>Kunzea ambigua</i>	Tick Bush	Diagnostic	Associated
<i>Leptospermum laevigatum</i>	Coastal Teatree	Diagnostic	Diagnostic
<i>Livistona australis</i>	Cabbage Palm		
<i>Lobelia ancepslata</i>	Angled lobelia		
<i>Lomandra longifolia</i>	Spiny Mat Rush	Diagnostic	
<i>Melaleuca armillaris</i>	Bracelet Honey-myrtle	Diagnostic	Associated
<i>Melaleuca nodosa</i>	Ball Honey myrtle	Diagnostic	Diagnostic
<i>Microlaena stipoides</i>	Weeping Grass		
<i>Opercularia aspera</i>	Course Stinkweed	Associated	Associated
<i>Oplismenus imbecillis</i>	Basket Grass		
<i>Oxalis rubens</i>	Coastal Oxalis		
<i>Pittosporum undulatum</i>	Sweet Pittosporum	Diagnostic	Associated
<i>Portulaca oleracea</i>	Pigweed		
<i>Pteridium esculentum</i>	Bracken Fern		Diagnostic
<i>Sigesbeckia orientalis</i>	Common St. Paul's Wort		
<i>Stephania japonica</i>	Tape Vine		
<i>Tetragonia tetragonoides</i>	New Zealand Spinach		
<i>Viola hederacea</i>	Native Violet		
<i>Westringia fruticosa</i>	Coastal Rosemary		

**Table 10. Tree replacement guide for use within the ‘built’ region of the subject site**

Tree Habitat Features	Status	Species within ornamental gardens	Replacement Suggestions
Fruit-bearing	Local native	<i>Pittosporum undulatum</i> <i>Ficus rubiginosa</i> <i>Elaeocarpus reticulatus</i> <i>Cupaniopsis anacardioides</i> <i>Livistonia australis</i> <i>Olea europea subsp. cuspidata</i> <i>Cinnamomum camphora</i> <i>Nerium oleander</i> <i>Howea forsteriana</i>	<i>Syzigium paniculatum</i> <i>Ficus rubiginosa</i> <i>Elaeocarpus reticulatus</i> <i>Acmena smithii</i> <i>Personia lanceolata</i>
	Noxious/Undesirable Weed	<i>Dypsis decaryi</i> <i>Murraya paniculata</i> <i>Phoenix canariensis</i> <i>Cinnamomum camphora</i>	
	Ornamental	<i>Ficus lyrata</i> <i>Celtis occidentalis</i> <i>Syagrus romanzoffiana</i> <i>Morus sp.</i> <i>Phoenix dactylifera</i>	
Nectar-bearing	Local native	<i>Banksia integrifolia</i> <i>Banksia ericifolia</i>	<i>Angophora costata</i> <i>Corymbia gummifera</i> <i>Banksia aemula</i> <i>Banksia ericifolia</i> <i>Banksia integrifolia</i> <i>Banksia serrata</i> <i>Melaleuca nodosa</i> <i>Melaleuca squamea</i> <i>Kunzea ambigua</i>
	Ornamental	<i>Corymbia citriodora</i> <i>Corymbia citriodora</i> <i>Corymbia ficifolia</i> <i>Corymbia ficifolia</i> <i>Eucalyptus botryoides</i> <i>Eucalyptus botryoides</i> <i>Eucalyptus saligna</i> <i>Eucalyptus saligna</i> <i>Grevillea hookeriana</i> <i>Grevillea hookeriana</i> <i>Lagunaria pattersonii</i> <i>Lagunaria pattersonii</i> <i>Melaleuca quinquinervia</i> <i>Melaleuca quinquinervia</i>	
Ornamental	Ornamental	<i>Ulmus parvifolia</i> <i>Araucaria heterophylla</i> <i>Zelkova serrata</i> <i>Magnolia gandiflora</i> <i>Hymenosporum flavum</i> <i>Fraxinus raywoodi</i>	<i>Angophora costata</i> <i>Corymbia gummifera</i> <i>Syzigium paniculatum</i> <i>Ficus rubiginosa</i> <i>Elaeocarpus reticulatus</i> <i>Banksia integrifolia</i>



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