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Charles Sturt University

Port Macquarie Campus

Vegetation Management Plan

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Port Macquarie Campus

Vegetation Management Plan

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1 INTRODUCTION

1.1 The Proposal

Charles Sturt University (CSU) is proposing the staged development of a site located off Major Innes Drive, Lake Macquarie for the purposes of a new Port Macquarie Campus (Figure 1). The CSU land comprises:

- Stage 1, which includes Lots 2 and 3 (in DP 1178043), to the north of an unmade Crown Road Reserve, with part of Lot 8 DP 1094444 (for a proposed stormwater detention pond); and
- Stage 2 including Lots 6, 7 and 8 to the south of the Crown Road Reserve.

As part of Stage 1, CSU have applied to Council to seek approval for the following activities:

- Site clearing;
- Bulk earthworks;
- Levelling/benching
- Stormwater drainage; and
- Water and sewer infrastructure

As part of the proposal, the majority of the vegetation within the Crown Road Reserve is to be retained and enhanced, with a stormwater detention basin to be constructed within the eastern parts of Lot 8 (within the Stage 2 lands), connected by a stormwater gravity pipe discharging from the Stage 1 area.

The development application (DA) has been approved by Port Macquarie Hasting Council (reference 2014/119), subject to conditions. Condition B7 requires the preparation of a vegetation management plan. Accordingly, Charles Sturt University has commissioned SLR Consulting Australia (SLR) to prepare a *Vegetation Management Plan* (VMP). The conditions of consent applicable to this VMP are listed in Appendix A.

1.2 Aims and Objectives

The objectives of this VMP are:

- to guide the clearing and protection measures associated with the proposed development of the subject site;
- to guide the management, protection and maintenance of vegetation to be retained on the subject site and maintain biodiversity conservation values; and
- to facilitate the maintenance and enhancement of habitat for native fauna.

The specific objectives of this VMP include:

- protection of vegetation during construction activities;
- reduce the foliage cover and diversity of weeds within the site;
- the promotion of native regeneration through suitable measures; and
- the establishment of native vegetation that has low maintenance costs in the long-term.

1.3 Scope

The *Vegetation Management Plan* (VMP) applies to the areas of land within the *Vegetation Management Area* (VMA), as shown in Figure 2, which include the following:

- residual areas of native vegetation located outside of the proposed works area but within the site boundary;

- native bushland within the Crown Road reserve, in the area to be affected by the proposed stormwater drainage works in this area; and
- proposed conservation or 'offset' lands identified in Lot 7 and Lot 8 (see Figure 2), which incorporates environmental lands identified in the (now superseded) draft Master Plan (King & Campbell, Feb 2013).

The area of land to which this plan applies is shown in Figure 2. The plan has been prepared with due consideration to Council's *Vegetation Management Plan Requirements*, a copy of which is attached in Appendix B. The plan is based on information provided in the following reports prepared for the DA:

- Flora & Fauna Assessment Report (Version 3.0; SLR 2014);
- Bushfire Protection Assessment (Australian Bushfire Protection Planners 2014);
- Landscape plans and Landscape Specification (JPW 2014);
- Engineering site works plans (including stormwater) and bulk earthworks plan (TTW 2014); and
- Architectural drawings (BVN Donovan Hill 2014).

This VMP addresses:

- weeding and noxious weed control;
- requirements for nesting boxes and 'recruitment trees';
- revegetation (planting) works;
- management of asset protection zones (APZs);
- the salvage and re-use of fauna habitat features from the portion of the site to be developed.

This VMP does not address:

- management of landscaped areas and street trees, which are to be managed and maintained according to the *Landscape Specification*;
- management and maintenance of stormwater infrastructure, including the proposed overland grassed swales and detention basin; and
- other residual areas of land identified in the draft Master Plan (King & Campbell 2013), which is now superseded and no longer relevant to the Stage 1 DA.

2 SITE DESCRIPTION

2.1 Overview

The Stage 1 Area is a small 3.4 ha portion of the site which has been largely cleared and modified, with the exception of a narrow band of vegetation in the road reserve. The northern lots (Lots 2 and 3) were cleared initially for their use as a caravan park and more recently in association with the development of the adjoining Lake Innes Shopping Village. In addition, the proposed location for the stormwater detention basin occupies a small portion of Lot 8 that had previously been cleared for agricultural pursuits.

The majority of the Stage 1 Area (occupied by Lots 2 and 3) appears to have been subject to substantial earthworks, with a mound in the northeastern corner and what would appear to be introduced fill across the site (possibly associated with stockpiling for the recent Lake Innes Shopping Village development). Consequently the vegetation across Stage 1 comprises a dense groundcover of exotic grasses and weeds, with native trees occurring in small patches or as individuals and no shrub layer.

The site is adjoined by:

- residential developments off Kingfisher Road to the north;
- a mostly vegetated undeveloped property (Lot 7 in DP 876001) to the east;
- cleared agricultural land which forms part of the Stage 2 Area along the southern boundary; and
- Lake Innes Shopping Village and Major Innes Road to the west.

2.2 Soils

According to broad scale soil mapping of NSW (OEH 2013), two soil types are mapped as occurring on the site: (i) ferrosols and (ii) kurosols (see Figure 3). Charman (1978) states that ferrosols (also known as kraznozems or euchrozems) are characterised by the lack of strong texture contrast between the A and B horizons, with high free iron oxide in the B2 horizon. In areas of high-rainfall, ferrosols are often deep and very permeable. Ferrosols are considered to have moderately high inherent fertility. Kurosols are characterised by strong texture contrast between the A and B horizons, with strongly acidic (pH less than 5.5) B horizons. Natric kurosols are also distinguished by their sodicity in the B2 horizon. Natric kurosols (also known as soloths) are considered to have moderately low inherent fertility.

Soils on the subject site appear to have been subject to disturbance, in the form of burial of foreign materials, and re-working of levels, in some places. Of note is the large mound in the northern part of Lot 3, which is covered in dense swards of Couch and common herbaceous weeds. Similarly, the area of dense weed infestation in the south of Lot 3 (see description below in Section 2.5) appears to be related to soil disturbance.

2.3 Topography

The land within the subject site is gently sloping with a southerly to south-westerly aspect. The land slopes downhill from around 18 m above sea level on the northern boundary of Lot 3 to around 6 to 7 m on its southern boundary. On the western side of the site (in Lot 2 and in the Crown Road), land slopes gently at less than five degrees toward the east. In the southern part of the subject site, the area of land proposed for the stormwater detention basin in Lot 8, is low lying and flat, with spot heights of around 4 m to 6 m.

2.4 Vegetation

The vegetation within the Stage 1 Area is a combination of cleared and modified grassland with scattered trees throughout. Part of the site is mapped by Council (Phillips *et al.* 2013) as Blackbutt Shrubby Moist Forest, including along the eastern boundary, in the southeastern corner and within the Crown Road Reserve to the south (see Figure 4).

The vegetation within the site (particularly along the eastern boundary and in the southeastern corner of Lot 3) is highly modified and the original mid and lower strata have been cleared. The vegetation within the road reserve contains more structured native vegetation, but is heavily impacted by weeds and other disturbances due to its linear shape and high perimeter to area ratio. None of the vegetation within the Stage 1 Area would constitute a 'threatened ecological community' listed on either the NSW *Threatened Species Conservation Act 1995* (TSC Act) or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (see SLR 2014).

A total of 173 plant species were recorded on the site, including 124 species which are indigenous to the Port Macquarie LGA and 49 exotic species (see Appendix C). No threatened plant species have been recorded on the subject site during any of the inspections undertaken to date and whilst parts of the subject site could provide some marginal habitat for some threatened species of flora, it is unlikely that the habitat on the site is appropriate for the presence and survival of individuals of any threatened plant species (see SLR 2014).

2.5 Weeds

2.5.1 Weed species on the site

A total of 49 species recorded on the site are exotic to Australia, a large proportion of which are listed as weeds (Appendix C).

There is substantial weed invasion and other disturbance within the site, including:

- exotic garden escapes, particularly along the northern fence line (abutting adjoining residents), such as Asparagus Fern, Climbing Asparagus, Senna and Passionfruit;
- thickets of dense woody weeds, particularly a patch of disturbed ground in the southern part of Lot 3, which contains a dense ground cover of Scotch Thistle, Stinking Roger and a shrub layer of Lantana and Wild Tobacco. The invasive Madeira Vine, was also recorded in this patch;
- exotic invasive perennial grasses (mainly Narrow-leaf Carpet Grass, Paspalum, Vasey Grass, Buffalo Grass), forming a dense groundcover throughout the site.

2.5.2 Noxious Weeds

A total of 10 plant species recorded on the site are listed as noxious weeds under the *NSW Noxious Weeds Act 1993* for Port Macquarie Hastings local government area (see Appendix C and **Table 1**). Most of these species are present as isolated individuals or patches, with the exception of Fireweed *Senecio madagascariensis* which is widespread throughout the grassland areas of the site, and Lantana, which occurs in small patches around the periphery of the site and in the adjoining bushland of the Crown Road reserve as well as further to the east.

Noteworthy is the patch of weeds in the southeastern corner of the site, in which Lantana and Wild Tobacco form a low dense shrub layer and Scotch Thistle forms a dense ground layer. Evidence of Madeira Vine (new shoots and aerial bulbs) was recorded in this area also.

Table 1 Noxious weed species recorded on the subject site

Common Name	Species Name	NW Act category	NW Act Control
Asparagus Fern; Ground Asparagus	*Asparagus aethiopicus* (syn. *Protasparagus aethiopicus*)	4	The plant must not be sold, propagated or knowingly distributed
Bitou Bush	*Chrysanthemoides monilifera* subsp. *rotundata*	4	The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread
Blackberry	*Rubus anglocandicans*	4	The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed This is an All of NSW declaration
Camphor Laurel	*Cinnamomum camphora*	4	The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed
Climbing Asparagus Fern	*Asparagus plumosus* (syn. *Protasparagus plumosus*)	4	The plant must not be sold, propagated or knowingly distributed
Fireweed	*Senecio madagascariensis*	4	The plant must not be sold, propagated or knowingly distributed
Giant Reed, Elephant Grass	*Arundo donax*	4	The plant must not be sold, propagated or knowingly distributed
Lantana	*Lantana camara*	4	The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread
Madeira Vine	*Anredera cordifolia*	4	The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread
Yellow Bignonia	*Tecoma stans*	3	The plant must be fully and continuously suppressed and destroyed

2.5.3 Weed density

Weed density has been mapped across the subject site using three broad categories:

- Low <20% foliage projective cover (FPC) of weeds or exotic species;
- Medium 20-70% FPC of weed species; and
- High >70% FPC

A weed density map is provided in Figure 5. Due to the presence of invasive perennial grasses in the ground layer, notably Narrow-leaf Carpet Grass, Buffalo Grass and Kikuyu, most of the site is mapped as medium density, with low density areas limited to the margins of the site, where native species dominate the ground layer. A few small patches of high density weed growth are present, including the patch of Lantana, Wild Tobacco and Scotch Thistle mentioned above, with a small patch of Giant Reed in the northeastern corner of the site and areas comprising almost entirely exotic grass.

2.6 Fauna

A total of 24 fauna species was recorded during the current investigation (see SLR 2014), including 21 bird species, two mammal species and one amphibian species. Given the nature and condition of the site, it is likely that a greater assemblage of common native fauna would utilise the subject site, on an occasional basis. However, the availability of habitats and resources on the subject site is limited, and it is unlikely that any native vertebrate fauna would be dependent on the subject site for their survival at this location.

Individuals of a number of threatened fauna species could potentially utilise resources on the subject site, particularly the forest habitat within the road reserve. An array of threatened microchiropteran bats could utilise the forest canopy for foraging purposes, and individuals may also utilise some of the hollow-bearing trees for at least temporary roost sites. Similarly, it is possible that individuals of the Koala, Grey-headed Flying Fox, Squirrel Glider, Powerful Owl and other threatened birds, could utilise the forest canopy for foraging on a temporary or transient basis.

3 MANAGEMENT APPROACH AND ACTIVITIES

3.1 Vegetation Management Approach

The activities identified in the Vegetation Management Plan (VMP) are to be initiated on release of the Construction Certificate by Council, and prior to any clearing or construction works within the approved development area.

Given the presence of native vegetation of moderately good condition, small-scale rehabilitation efforts, such as weeding and localised planting, are proposed. Conversely, the VMP will not involve major earthworks, soil remediation or large-scale planting. The works will predominantly involve low-intensity rehabilitation and maintenance activities, designed to minimise the potential for adverse impacts, and to reduce any indirect impacts associated with the proposed development.

The boundary between the Vegetation Management Area (VMA) and the development area is to be fenced at the initiation of the VMP activities using link-mesh fencing and silt fencing. In addition, appropriate signage will be provided around the site to inform people of the relevance of the bushland and of the rehabilitation program, and to encourage passive surveillance of the VMA.

Specific activities to be undertaken in the VMA include:

- *Rubbish removal* - in particular the fencing material, garden waste, and building waste in the Crown road reserve would need to be removed.
- *Excavation and soil remediation* - there may be some small areas of exotic grass requiring excavation (small scale soil turning by hand) and top-soil remediation, prior to planting.
- *Weed removal and maintenance* - a dedicated weed removal and monitoring programme is required (in particular to control the garden escapes and African Lovegrass) followed by an ongoing weed maintenance program. Weeds and edge effects must be monitored following the establishment period.
- *Revegetation* - planting of locally indigenous plant species is proposed within a designated area in Lot 8 to, in part, offset the loss of trees and vegetation associated with the clearing for Stage 1. Planting material will be derived from seeds and propagules sourced from the site or from a local nursery stocking local provenance plants;
- *Salvage* - the salvage of native fauna disturbed or injured during tree felling, and salvage of tree hollows and seeding branches during the clearing of the development areas is to be undertaken to minimise direct impacts on native fauna and habitat loss and to support revegetation and rehabilitation tasks.
- *Re-location* - the re-location of any captured fauna to adjoining areas of bushland or their transfer to wildlife carers or veterinarian.
- *Threatened species management* – measures to avoid or minimise adverse effects on arboreal threatened fauna, particularly the Koala, Squirrel Glider, and Grey–headed Flying Fox, including a *Hollow bearing Tree Protocol*, salvage of fauna habitat features, retention of recruitment trees and installation of nesting boxes.
- *Monitoring* - a monitoring program is to be implemented to monitor the ongoing condition of vegetation in bushland and revegetation areas, as well as the condition and status of nesting boxes, recruitment trees and relocated fauna habitats.
- *Access* – the VMA is to be fenced, with access through the Crown Road reserve restricted during construction.

The VMA can be divided into two distinct areas: (i) the Crown Road reserve, which adjoins the southern end of the Stage 1 site and (ii) the 'Southern Offset Area' (Figure 2). The works described in Chapter 4 of this VMP apply to the both areas (as applicable), however, the specific approach to the Southern Offset Area will involve a low intensity approach, whereby the natural resilience (plant seed diversity and seed bank) combined with proposed changes to land management practices will aim to allow natural regeneration of the native vegetation in this area. Key VMP activities for this area will be conducted by CSU, the appointed Bush Regeneration Contractor and the Project Ecologist, and will involve:

- Cessation of periodic slashing of the vegetation (CSU);
- Delineation of the area by survey (registered surveyor) and stakes and/or post markers (CSU);
- Monitoring of plant growth and recording the diversity of native and weed species across the area (Project Ecologist);
- Targeted weed removal only as required (Bush Regeneration Contractor);
- Monitoring evidence of herbivory (eg rabbit grazing, and macropod and deer browsing), with adaptive management to address any adverse effects; and
- Limited planting of koala feed trees to compliment the proposed planting of Tallowwood *Eucalyptus microcorys* (a SEPP 44 koala feed tree) as part of the *Landscape Plan* in the Stage 1 area (noting that 53 Tallowwoods are to be planted throughout the Stage 1 car parking areas).

The Southern Offset Area is designed to offset vegetation removal related to the Stage 1 DA and also for potential future offsets associated with later stages of the Port Macquarie campus development. As such, the Southern Offset Area is intended to provide environmental and educational benefits to future users of the campus associated with development of all parts of the CSU land holding.

3.2 Project Roles

The following parties would be required to fulfil the roles involved for the implementation of the VMP:

- a Project Ecologist - with suitable qualifications to monitor the success of the project;
- a Bush Regeneration Contractor - to implement the bush regeneration activities of the VMP; and
- a Construction Team - to erect protection fencing and erosion controls.

Further details on project roles are provided in Section 0.

The VMP is to be initiated on release of the *Construction Certificate* by Council and prior to any clearing or works within the development area. Implementation of the approved VMP, as a condition of consent, will guarantee the successful implementation of the VMP by the proponent.

4 PRE-CONSTRUCTION ACTIVITIES

4.1 Weed Control

4.1.1 Issue

A high number of weed species has been recorded from the subject site, including 10 noxious weed species. However, the majority of the weed growth on the site will be subject to the bulk earthworks programme and will be subject to cut and fill and (in many areas), buried beneath proposed hard stand areas (e.g. car parks, buildings and internal roads). Nonetheless, specific measures are necessary to ensure that weed propagules are not inadvertently distributed to adjoining bushland areas or offsite. Moreover, weed growth is present in the Crown Road reserve and other residual areas of the site that will require control and ongoing maintenance.

A variety of techniques will be used to remove and control weeds within the site including:

- cut-and-paint, stem scraping, stem injection, and frilling and chipping for woody weeds;
- hand removal and crowing for herbaceous weeds; and
- chemical control where appropriate.

As indicated above, a low intensity approach is to be employed, and the over-riding principles of the Bradley method of bush regeneration will be applied (Buchanan 2000). Weed removal techniques applicable to this VMP are provided in Appendix D.

4.1.2 Actions

- Bush regeneration works to occur across the VMA within six months of construction works commencing.
- Primary weeding – initial phase of intensive weed removal (typically over two week period), including cut-and-paint of woody weeds, scraping of vines with herbicide, hand removal of herbs. To commence after initial site preparation, delineation of the construction work zone and installation of fencing. Any soil containing vegetative matter within the area of Madeira Vine infestation (in the southern part of Lot 3) that is excavated as part of the bulk earthworks is not to be re-used as topsoil or mulch for landscaping or other purposes. Any soil left *in situ* in this area (to allow for tree retention or for landscaping purposes) or excavated and re-used as fill shall be monitored for weed growth by the Project Ecologist. Any weed growth is to be treated in accordance with the specific requirements of the weed species.
- Straw bales are not to be used for erosion control (to avoid dispersal of weed seed);
- Secondary weeding – follow up weeding 3 to 6 months after primary weeding (generally during warmer growing season) to remove or treat weeds that have germinated or grown since primary weeding. Involves hand removal of seedlings, spot spraying of grasses and herbs with diluted herbicide (glyphosate).
- Maintenance weeding – program of follow up visits during VMP monitoring phase to target noxious weeds, other problematic weeds, any new weed growth or new weed species that have appeared since secondary weeding.
- Any weed biomass that is excavated during bulk earthworks that is not to be buried as fill shall be removed from the site and disposed of at a licenced waste facility.
- Monitor weed growth as part of VMP monitoring programme (Section **5.2**).

4.2 Plant Propagation and Revegetation

4.2.1 Issue

Revegetation works are proposed to re-established native vegetation in areas where the original vegetation has been removed) in order to offset the loss of vegetation associated with the Stage 1 development. Revegetation is only appropriate for areas where natural resilience is low and natural self-recruitment is unlikely to occur. An area within eastern part of the Stage 2 lands has been identified for revegetation works, as shown in Figure 2.

Given the level of natural regeneration already present within the vegetated parts of the site and/or that is likely to occur once weeds are removed from some areas, it is unlikely that intensive replanting works would be required. Nevertheless, in the event that areas (particularly where exotic vegetation is removed and where rubbish and other materials are removed) do not display satisfactory natural self-recruitment within 12 months of initiation of the VMP, then replanting works should be undertaken.

In preparation for any potential planting works, local provenance seeds and plant propagules should be collected from within the site by the Bush Regeneration Contractor, and/or licensed local nursery. The timing and quantity of seed collected will depend on seasonal seeding events within the bushland surrounding the site.

Native species selected for planting should be sourced from the list in **Table 3**, based on availability of local provenance stock. The species in **Table 3** are characteristic of Swamp Sclerophyll Forest and Blackbutt Shrubby Moist Forest (PMVC 23), both of which occur within and adjacent to the site, limited to those species that are commercially available. Other sources of propagules for the planting program would include commercial nurseries that maintain local provenance stock and/or bush regenerators that also maintain local provenance stock for this locality.

4.2.2 Koala Offset Plantings

- Koala feed tree species are to be planted in the area depicted in **Figure 2**, to offset the removal of koala trees in the Stage 1 construction, and to supplement the planting of 53 Tallowwoods through the Stage 1 area as prescribed in the *Landscape Plan*;
- Koala plantings are to be advanced stock in 300 mm (75 litre) pots (around 3 m high), with each plant protected by installation of shade cloth and 2 m high stakes;
- Plantings are to have a minimum separation distance of 10 m (ie 10 m centres);
- Plantings are to occur within six months of works commencing;
- Failed plantings are to be replaced to maintain original numbers and replacement is to occur within three months of failure;
- Plant species for revegetation are to include species recorded on the site that are recognised as feed trees for the koala, namely *Eucalyptus robusta*, *E. microcorys* and *E. signata*; and
- Follow up maintenance of plantings, including watering, checking and replacing stakes and protective bags and weeding (see Section **5.1**).

4.2.3 Actions

- Seed collection. Seed of locally indigenous plant species to be undertaken prior to construction (or during tree felling), on an opportunistic basis, by licenced nursery operator or bush regeneration contractor (under direction of Project Ecologist);
- Propagation of collected seed by licenced nursery operator or bush regeneration contractor to produce tubestock for later planting (depending on outcomes of seed collection);
- Purchase supply of tubestock (to allow for limitations in seed collection and propagation) for early planting works (noting that local Landcare nursery can supply local native stock);

- Plantings are to occur within six months of works commencing;
- Planting of tubestock in the proposed offset revegetation area, according to the planting densities listed in **Table 2** and schedule of species in **Table 3**;
- Planted trees and shrubs are to be protected using plastic 'grow tubes' - to protect the plants from the elements during their establishment period, and to prevent grazing from herbivores (esp. rabbits, kangaroos, wallabies and deer). Tall (800 mm) grow tubes and 1.2 m bamboo stakes are recommended for all plantings to prevent deer browsing (Note foliar sprays are not reportedly successful in prevent deer browsing).
- Follow up maintenance of plantings, including watering, checking and replacing stakes and protective bags and weeding (see **Section 5.1**).

Target densities for native plants in the various strata are indicated below (**Table 2**). These targets are to be used:

- for monitoring revegetation performance; and
- to determine planting densities in areas where active plantings are required.

Table 2 Target (average) plant density and diversity in each stratum

Layer	Target Density	Target Diversity
Canopy	One large tree/25 m^2	3 species
	One canopy tree/16m^2	4 species
Mid-storey (small trees)	One small tree /4m^2	4 species
Shrub layer	One plant/m^2	4 species
Groundcover (forbs, sedges and climbers)	Four plants/m^2	8 species

Table 3 Plant species recommended for revegetation works

Species	Common name	Spacing	Number in group
Trees			
Glochidion ferdinandi var. *ferdinandi*	Smooth Cheese-tree	1 per 4m²	3-7
Banksia integrifolia subsp. *integrifolia*	Coast Banksia	1 per 4m²	3-7
Callistemon salignus	Pink Tips	1 per 4m²	3-5
Corymbia intermedia	Pink Bloodwood	1 per 16m²	5
Eucalyptus propinqua	Grey Gum	1 per 16m²	3
Eucalyptus robusta	Swamp Mahogany	1 per 16m²	5
Eucalyptus signata	Northern Scribbly Gum	1 per 16m²	5
Allocasuarina littoralis	Black Oak	1 per 4m²	3-7
Ficus rubiginosa	Port Jackson Fig	1 per 25m²	1
Ficus obliqua	Small-leaved fig	1 per 25m²	1
Livistona australis	Cabbage Palm	1 per 25m²	1
Archontophoenix cunninghamiana	Bangalow Palm	1 per 25m²	1
Alphitonia excelsa	Red Ash	1 per 4m²	3-7
Acmena smithii	Lilly Pilly	1 per 4m²	3-7
Shrubs and small trees			
Synoum glandulosum subsp. *glandulosum*	Bastard Rosewood	1 per m²	5
Cryptocarya glaucescens	Jackwood	1 per m²	5
Cryptocarya microneura	Murrogun	1 per m²	5
Pittosporum revolutum	Rough-fruited Pittosporum	1 per m²	5
Guioa semiglauca	Guioa	1 per m²	5
Homalanthus populifolius	Bleeding Heart	1 per m²	5
Polyscias elegans	Celery Wood	1 per m²	3
Cordyline stricta	Palm Lily	2 per m²	3
Acacia melanoxylon	Blackwood	1 per m²	5
Acacia floribunda	Sallow Wattle	1 per m²	5
Acacia maidenii	Maiden's Wattle	1 per m²	5
Indigofera australis	Austral Indigo	2 per m²	5
Forbs, sedges and climbers			
Hardenbergia violacea	Purple Twining-pea	4 per m²	10
Kennedia rubicunda	Running Postman	4 per m²	10
Viola hederacea	Ivy-leaved Violet	4 per m²	10
Lomandra longifolia	Mat-rush	4 per m²	10
Gahnia melanocarpa	Black-fruited saw-sedge	4 per m²	5
Commelina cyanea	Scurvy Weed	4 per m²	10
Dichondra repens	Kidney Weed	4 per m²	10
Glycine clandestina	Twining Glycine	4 per m²	10

4.3 Fencing and Protection Measures

4.3.1 Issue

Temporary and permanent fencing will be required during construction to exclude plant and machinery from retained trees (including their protection zones) and to avoid the accidental damage of vegetation and fauna habitat by heavy machinery and other plant.

4.3.2 Actions

- Temporary fencing to be installed along the northern boundary of the Crown Road Management Area (**Figure 2**), to exclude construction vehicles and plant from this area. Temporary signage identifying native bushland for conservation in the Crown Road reserve and temporary sediment-capturing mesh will be attached to fencing at suitable locations.
- Temporary sediment fences are to be removed at the completion of construction activities;
- Permanent fencing will be installed around the perimeter of the Crown Road Management Area, including alongside proposed pedestrian access ways (and roads) to be constructed through road reserve. Fencing design and type to allow movement of ground and arboreal mammals (including koalas and macropods) and hence should not be chain mesh. Fencing position and design to encourage visibility (of the bushland) and thereby discourage antisocial behaviour and rubbish dumping, and protect the bushland from trampling and weeds by controlling access.
- Boundary of Southern Offset Area to be surveyed (by registered surveyor) and marked with pegs (or equivalent). Temporary exclusion fencing (star pickets with geotextile fabric, or suitable equivalent) to be installed along western boundary of Offset Area. Vegetation slashing to be excluded from fenced Offset area. No chain mesh (or equivalent) fencing to be installed.
- All koala feed tree plantings proposed for Southern Offset Area to be protected with 1.8 m high guards using shade cloth and three (minimum) star pickets.

4.4 Hollow-bearing Trees

4.4.1 Issue

The proposal will require the removal of several hollow bearing trees (HBTs), with the final number to be removed depending on the outcomes of construction and the advice of the Project Arborist.

In relation to Council's DCP 2013 (Hollow bearing Tree Protocol), the *Flora and Fauna Assessment* (SLR 2014) estimates that 11 HBTs would be removed during construction, comprising :

- four trees that score 8-12 (922, 925, 950 and 919); and
- seven trees that score over 12.

Clause 2.3.3.9 of DCP 2013 requires the removal of HBTs to be offset by:

- the retention of 'recruitment trees[1]', with two such trees retained for every HBT scoring 8-12;
- the installation of nesting boxes, of a 'similar number and size' to those removed. Nesting box provisions are outlined in Section 4.5; and

[1] A compensatory recruitment tree us defined under Clause 2.3.3.9 of DCP 2013 as any tree that:
- does not have any major structural defects or is suffering from disease that would lead to premature death; and
- grows in same vegetation community and is of the same genus (as HBT to be removed); and
- is located within environmental lands and managed in accordance with a VMP; and
- has a DBH of 50cm or greater and does not possess hollows. For Blackbutt *Eucalyptus pilularis* a DBH of 100cm or greater applies.

- formal strategy for tree removal that minimises impacts on native wildlife. This requirement is addressed in the Hollow bearing Tree Protocol in Section 4.4.2.

According to Clause 2.3.3.9 of DCP 2013, 22 recruitment trees would be required to offset the loss of HBTs. A number of potential compensatory recruitment trees are located along the eastern margin of the site and within the Crown Road reserve, as shown in Figure 2. A number of native trees are identified for retention around the margins of the site, with further trees that can potentially be retained, subject to assessment by the Project Arborist during clearing works. Several additional recruitment trees are located in the Crown Road reserve and will be available to offset HBT loss as required.

4.4.2 Actions

Recruitment Trees

- Ensure identification of sufficient recruitment trees within the subject site and Crown Road reserve to offset loss of HBTs. The locations of potential recruitment trees are shown in Figure 2. The final number of recruitment trees is to be determined by the Project Ecologist based on the final count of felled HBTs (see below);
- Conduct audit of number of HBTs felled during construction and record number and size of hollows.
- Identify suitable number and type of recruitment trees (in the ratio to two recruitment trees for every one HBT felled); potential recruitment trees to be flagged, numbered and location recorded with GPS for later mapping;
- Recruitment trees to be assessed for health and longevity by Project Arborist to confirm suitability;
- Map of recruitment tree locations to be submitted to Council as part of VMP monitoring program (refer Section **5.2**);
- Planting of suitable 'recruitment trees' within the revegetation area (shown in **Figure 2**), to complement retention of recruitment trees.

Hollow bearing tree protocol

The *Hollow-bearing Tree Protocol* listed in **Table 4** will be implemented prior to and during any tree felling works.

Table 4 Hollow bearing Tree Protocol

Step	Action	Timing	Responsibility
1	Pre-clearing survey to flag HBTs and survey for arboreal fauna	Pre-construction	Project Ecologist
2	Clearing of non-HBTs and shrub layer	Pre-construction Day 1	Construction contractor
3	Salvage any seeding branches; set aside and stockpile for brush-matting in rehab areas; transfer to rehab areas	Day 1	Bush regeneration contractor
3	Clearing of HBTs	Day 2	Construction contractor
3a	Tap HBT three times with bucket of excavator and wait	Day 2	Construction contractor
3b	Observe canopy for escaping fauna	Day 2	Project Ecologist
3c	Fell HBT carefully using arm of excavator to brake fall of main trunk	Day 2	Construction contractor
3d	Inspect all hollows for fauna	Day 2	Project Ecologist
3e	Capture and handle any injured or juvenile fauna according to animal ethics requirements; transfer to local wildlife carer or veterinarian	Day 2	Project Ecologist or wildlife handler
4	Conduct audit of number of HBTs and number and size of tree hollows felled during clearing activities	Day 2	Project Ecologist
5	Hollow-bearing segments of felled HBTs are to, where feasible, be placed within retained bushland within the Crown Road Reserve or the Stage 2 area to provide hollow logs for ground dwelling fauna	Day 2 - 5	Construction contractor, under direction of Project Ecologist
6	Any tree-hollows that cannot be salvaged and re-used will be replaced with nesting boxes with the number of nest boxes to match the number and dimensions of tree-hollows lost.	See Section 4.5	Project Ecologist

All tasks involving wildlife handling may be performed by the Project Ecologist and/or a licenced wildlife handler. In the event that native wildlife are injured during construction, the local organisation For Australian Wildlife Needing Aid (FAWNA) fauna should be contacted (Ph. 02 6581 4141).

4.5 Nest Boxes

4.5.1 Issue

HBTs are predicted to be removed during construction. Clause 2.3.3.9 of DCP 2013 requires the removal of HBTs to be offset by:

- the retention of recruitment trees, as noted in Section 4.4;
- the installation of nesting boxes, of a ‘similar number and size’ to those removed.

Nesting boxes will be constructed using the appropriate dimensions for native fauna species expected to be utilising these boxes, including threatened species. Generally, nest boxes will be used to augment habitat for hollow dependent birds, microchiropteran bats, owls, possums and gliders within areas proposed for habitat restoration, particularly within the corridor of the Crown Road reserve. Target threatened species for arboreal habitat augmentation will include, but not be limited to:

- Forest owls (e.g. Powerful Owl, Masked Owl, Sooty Owl);
- Squirrel Glider; and

- Microchiropteran bat species.

The dimensions should be such that pest species cannot establish within the nest boxes. Nest boxes are to be supplied according to the aperture of the external hollow on any HBTs (not the internal diameter of the hollow once the tree has been felled). Nest box design and dimensions are to be consistent with those provided in the attached spreadsheet (Appendix E).

Nest boxes will be constructed from non-toxic, weather durable treated timber (e.g. alkaline copper quaternary - ACQ) or plywood painted with weather resistant paint (external surfaces only).

The exact number and location of nesting boxes to be installed will be dependent upon the number of hollows felled during site clearing, and will be limited by the availability of suitable trees in which to mount them. Nest boxes will be spaced at a minimum of one per hectare targeting threatened species previously recorded or considered highly likely to occur, using dimensions appropriate for the target species.

Potential locations for nest boxes within the subject site include:

- Along the eastern margins of the site (i.e. Lot 3);
- Within the Crown Road reserve; and
- Within bushland to be retained in the Stage 2 lands to the south of the subject site.

In addition, Council have advised that, should density of installed nest boxes exceed 10 per hectare, they will consent to additional nest boxes being installed in the Kingfisher Waste Transfer station land, to the east of the site.

The erection of nest boxes within revegetated areas will be delayed until such time that the trees are large enough to support the nest boxes, which will be determined during the monitoring of revegetation.

4.5.2 Actions

The requirement for nesting boxes will be determined by the Project Ecologist at the completion of vegetation clearing and will involve the following actions:

- Conduct audit of number of HBTs and number and size of tree hollows felled during clearing activities, noting the diameter of the aperture opening;
- Calculate number and type of nest boxes required (based on audit of felled trees) and order from preferred supplier. Dimensions of nest boxes to follow guideline in Appendix E;
- Assemble and install in suitable recruitment trees (or other trees deemed suitable), at suitable height and aspect;
- Obtain consent from Crown Land Road Reserve Manager prior to any installation of nest boxes within the Crown Road reserve;
- Next boxes to be installed within one month of vegetation removal;
- Number and record each nest box, record photo (for monitoring baseline) and register location using hand held GPS (or identify on survey plan if already surveyed); and
- Map of nest box locations to be submitted to Council as part of VMP monitoring program (refer Section **5.2**);
- Conduct monitoring of nest box activity as part of VMP monitoring program (see Section **5.2**), including removal of feral species or modification of boxes if feral populations persist. Monitoring and maintenance of boxes will be over a 20 year period.

4.6 Asset Protection Zones

4.6.1 Issue

A *Bushfire Protection Assessment* (Australian Bushfire Protection Planners 2014) has been prepared for the DA which stipulates requirements for bush fire protection for the development. Asset protection zones of 40 m width are required on the eastern and southern sides of the buildings, as shown in **Figure 2**.

The proposed APZs will comprise built up areas (car parking, internal roads), landscaped areas (within the courtyard and planted street trees) and bushland (small patch of retained trees on southern boundary of Lot 3.

4.6.2 Actions

In accordance with the *Bushfire Protection Assessment*, the management of APZs will involve the following actions:

- maintenance of landscaped gardens shall comply with prescriptions of an Inner Protection Area (see Appendix 5 of Planning for Bushfire Protection 2006 and Specifications for Asset Protection Zones)
- ensure species selection for landscaped areas minimises accumulation of fire fuels and is consistent with the requirements of an Inner Protection Area;
- Pruning and selective thinning of trees and shrubs as required in landscaped or bushland areas, to avoid contiguity of vegetation (horizontally and vertically);
- ongoing maintenance to remove flammable fuels;
- Regular mowing of lawns; and
- Manual removal of combustible materials, particularly within the landscaped areas.

5 POST-CONSTRUCTION ACTIVITIES AND MONITORING

5.1 Maintenance

Activities to maintain the vegetation within the Vegetation Management Area are to be undertaken by the Bush Regeneration Contractor (Bush Regeneration Contractor). These activities will involve:

- Watering and weeding around plantings in the revegetation area during the initial period following planting.
- Replacement of failed plantings to maintain 80% of initial planting rates.
- Bush regeneration works within all VMP areas, excluding the stormwater basin.
- Nest box maintenance to occur over 20 years (including inspections and removal of pest species).
- Replacement of failed Koala feed trees to maintain original planting stocks (i.e. 100% of original planting numbers), with replacement of failed plantings within three months of failure.
- Maintenance (tertiary) weed control, involving targeted weeding (eg spot praying with herbicide and/or hand removal, as required) on an annual basis in perpetuity.
- Determination of a supplementary planting regime (as required depending on monitoring results) in consultation with the Project Ecologist.

The proposed VMP performance criteria are listed in Section **5.2.3**.

Condition A8 of the final Conditions of Consent states “Ongoing maintenance works detailed in the approved Vegetation Management Plan are to be carried out in perpetuity”. Accordingly, maintenance works outlined in this VMP are assumed to be for the operational life of the project (ie effectively in perpetuity). One exception is the watering of plantings, which will only be for the initial establishment period after planting. Maintenance activities are outlined in Section **5.1**.

The Project Ecologist is to monitor the success of the bush regeneration works over the initial three year period, and provide recommendations to the Bush Regeneration Contractor when and if required. The Project Ecologist will also provide relevant monitoring reports to Council for the initial three year period, as detailed in Chapter **5.2.2** of this VMP.

5.2 Monitoring

5.2.1 Requirements

The Project Ecologist (Project Ecologist) is to monitor the success of the bush regeneration works and revegetation works in accordance with Council’s *VMP Audit and Monitoring Proforma*, a copy of which is attached in **Appendix B**.

Monitoring activities would involve:

- establishing permanent baseline monitoring stations, from which data on floral diversity and vegetation condition, using quadrat and photo-points, will be collected;
- inspection of site preparation activities prior to the construction works;
- biannual (6-monthly) updating of the photo point and quadrat monitoring data;
- monitoring of nesting boxes (over 20 year period), including removal of feral species (especially European honey bee and Indian Myna), or modification of boxes if feral animals persist;
- monitoring health of recruitment trees (in consultation with the Project Arborist);

- monitoring of success rates of plantings in revegetation area, as well as weed growth and mulch condition; and
- submission of monitoring reports to Council every 6 months for up to three years following initiation of the VMP works.

Monitoring within the revegetated areas will specifically focus on:

- germination rates where direct seeding has been used;
- survival rates of tube stock;
- the apparent health of plants (comparing within species and between species); and
- the need for maintenance activities including watering, weed control, repair of damaged plant bags, or removing plant bags from trees that have grown too large.

Poor germination rates or seedling survival will be investigated to determine the likely cause and will be addressed appropriately, whether by changing planting method or species, the application of additional topsoil or organic matter, or altering fertiliser or water application.

Where monitoring results identify a requirement for maintenance, remedial works may include:

- repair of erosion (i.e. re-grading of eroded areas);
- repair of drainage paths and de-silting of sediment control structures;
- re-seeding or re-planting;
- application of fertiliser;
- application of lime to improve pH and gypsum to improve soil structure;
- bushfire management activities; and
- implementation of weed and feral animal control measures.

Monitoring and maintenance results will be assessed and utilised to determine whether the VMP implementation requires adjustments or amendments to achieve the performance criteria (see Section 5.2.3).

Assessment of site stability and erosion and sediment control issues will be assessed as part of the monitoring inspections. Temporary erosion and sediment controls, such as silt screens (but not hay bales) may be required in these areas for a longer period until vegetation cover is sufficient to bind and protect the soil from excessive runoff.

Fixed photo monitoring points will be established at each monitoring location in order to obtain visual evidence of the progression of bush regeneration activities and revegetation works. Photos will be compared to those of previous years in order to demonstrate the progression of the revegetation activities over time.

5.2.2 Reporting

A baseline monitoring report will be prepared and submitted to Council after completion of baseline monitoring surveys. Following this, 6-monthly monitoring reports will be prepared and submitted for a period of three years from commencement of the VMP works.

Monitoring reports will document:

- the works which have been undertaken during the previous survey period;
- the changes in weed densities and diversity at each monitoring station;

- success rates of revegetation works and recommendations for remedial measures as required;
- map and status of recruitment trees;
- map and status of nest boxes;
- recommendations for additional works or activities which may be required during the ensuing survey period.

5.2.3 VMP performance indicators

Implementation of the VMP is intended to achieve several goals. The following performance indicators have been nominated for each of the key VMP actions. The aim of these indicators is to provide a quantitative measures against which monitoring results can be compared to determine the progress and success of the VMP actions. The indicators are to apply for the full life of the project, and are listed as follows:

- a 90% reduction in the foliage projective cover (FPC) of weeds across the site (as measured from monitoring quadrats), with weeding activities timed to prevent setting of seed or propagules of weed species;
- 100% survival rate for Koala feed trees, with replacement of any failed plantings with three months of failure;
- next boxes continue to function as surrogate hollows, ie: no feral animal invasions (eg feral bees, Indian Mynas, etc.);
- the survival (or replacement) of any supplementary plantings (as identified in the management activities for the site);
- achievement of the native plant densities (averaged across each management area):
  - 1 canopy tree species per 16m^2;
  - 1 shrub species per 4m^2; and
  - 4 groundcover species per 1m^2.
- 90% of plant species (by species numbers, as measured in monitoring quadrats) to be local native species; and
- an ongoing monitoring and maintenance programme to identify areas of new weed infestation and to provide a mechanism for their control.

6 IMPLEMENTATION OF THE VMP

6.1 Initiation of the VMP

The following activities are to be implemented on the release of the construction certificate by Council.

The Project Ecologist is to:

- conduct pre-clearing surveys and identify and map HBTs and any resident arboreal fauna (including koalas, possums, gliders, microchiropteran bats);
- be on-site during vegetation clearing to ensure implementation of *Hollow bearing Tree Protocol*;
- conduct wildlife rescue and handling during tree felling works (in conjunction with local wildlife handler, if possible);
- audit number of tree hollows removed during site clearing and determine number of recruitment trees and nesting boxes required;
- identify and map suitable recruitment trees and/or host trees for nesting boxes;
- collect baseline monitoring data, involving photo-monitoring points and vegetation quadrats, within the *Vegetation Management Area* on the subject site;
- undertake monitoring inspections of the site to ensure activities have been satisfactorily completed; and
- prepare monitoring reports detailing the progress of VMP works and monitoring results for the initial three year period.

The Project Ecologist will also perform a site induction (in consultation with the Project Manager) for site workers, prior to commencement of works, including informing workers of the protected vegetation, retained trees, threatened species and their responsibilities.

The Bush Regeneration Contractor is to:

- collect seeds and other propagules, grow native seedlings, and obtain tube stock from local Landcare nursery for revegetation works;
- identify appropriate commercial nurseries from which to obtain local provenance seedlings, if necessary; and
- provide a detailed costing for implementation of the VMP.

The Construction Team is to:

- fence the Vegetation Management Area as detailed in Section 4.3 and **Figure 2**;
- ensure felling of HBTs in accordance with the *Hollow bearing Tree Protocol*;
- transfer of hollow sections from felled trees to areas of retained bushland under guidance of Project Ecologist; and
- erect permanent signage (e.g. “Conservation Area - Keep Out”) at intervals along the fencing of the Crown Road reserve.

6.2 After initiation of the VMP works

The Bush Regeneration Contractor is to:

- implement an intensive weed removal programme, involving removal of large woody weeds, exotic herbs and vines and exotic perennial grasses within the Vegetation Management Area;

- prepare areas of bare soil, exotic lawn and highly disturbed portions of the site for replanting, where deemed necessary; and
- plant prepared areas with stored propagules collected from the development area or other local provenance specimens, as necessary.

The Project Ecologist is to:

- monitor the regeneration activities and weed removal during the initial phase of the project - to ensure that the VMP is being implemented satisfactorily; and
- ensure that fencing and silt fences are being maintained.

6.3 Ongoing VMP works

On completion of the initial phase of the VMP (ie three years from commencement), the VMP implementation will enter a phase of 'in perpetuity' works that will be ongoing for the life of the project.

The following activities will be required during the maintenance phase:

The Bush Regeneration Contractor is to:

- maintain the management and control of any weed species in the Vegetation Management Area;
- undertake supplementary plantings, as necessary, to achieve the goals set out in this VMP; and
- maintain new plantings until self-sustainable.

The Project Ecologist is to:

- repeat monitoring surveys at the fixed photo and survey points;
- monitor ongoing activities;
- provide advice where necessary regarding the VMP activities; and
- prepare and submit monitoring reports to Council.

The following ongoing maintenance activities will be completed:

- weed control (spot spraying and hand removal) in the Vegetation Management Area;
- checking and clearing nest boxes of feral pest species; and
- replacing plantings of koala feed trees as required.

6.4 Costings for implementation of the VMP

The Bush Regeneration Contractor will provide a detailed costing estimate for implementation of the VMP after inspection of the subject site, in consultation with the Project Ecologist. An approximate costing of the VMP works (over three years) is provided in Table 5. However, the Bush Regeneration Contractor will provide a more accurate costing for the project as part of the tendering for the works and will not be held to this estimate (in part because the quantum of ongoing weed control and supplementary plantings required to achieve the goals of the VMP cannot be pre-determined). Hence, this cost estimate is preliminary only and should only be used as a guide.

Table 5 Activities and approximate costings for the VMP

Activity	Role	Costing
Pre-construction (induction, inspection, baseline)	Project Ecologist	$5000
Fencing and erosion controls	Construction Team	$0
Pre-clearing surveys and HBT protocol	Project Ecologist	$10,000
Recruitment trees, nesting boxes	Project Ecologist	$5000
Seed collection, propagation	Bush Regeneration Contractor	$5,000
Primary and secondary weeding	Bush Regeneration Contractor	$20,000
Revegetation (materials and labour)	Bush Regeneration Contractor	$20,000
Revegetation Maintenance (in perpetuity)	Bush Regeneration Contractor	$2,000 pa
Nest box monitoring and maintenance (over 20 yrs)	Project Ecologist	$2,000 pa
Monitoring Surveys and Reports (over 3 yrs)	Project Ecologist	$20,000
Final Assessment	Project Ecologist	$5,000

7 VMP ACTION PLAN

Table 6 VMP Action Plan

Activity	Timing	Role
Pre-construction		
Perform a site induction for construction site workers to identify VMA and VMP works	Prior to any construction works	Project Ecologist
Install sediment fences around areas of earthworks, where relevant, to protect areas of retained vegetation	Prior to any construction works	Bush Regeneration Contractor
Inspection of pre-construction works	Prior to any construction works	Project Ecologist
Collect baseline monitoring data (establish fixed monitoring stations, collect photo-points quadrat data)	Pre-construction (baseline monitoring report)	Project Ecologist
Fencing		
Temporary fencing to be installed along northern boundary of Crown Road Management Area. Temporary signage identifying native bushland for conservation in the Crown Road reserve and temporary sediment-capturing mesh to be attached to fencing at suitable locations.	Initial site clearing and establishment	Construction Team
Permanent fencing to be installed around perimeter of Crown Road Management Area, including alongside proposed pedestrian access ways (and roads). Fencing design and type to allow movement of ground and arboreal mammals (including koalas and macropods); should not be chain mesh. Fencing position and design to encourage visibility (of the bushland) and protect bushland from trampling and weeds by controlling access.	Initial site clearing and establishment	Construction Team and Project Ecologist
Boundary of Southern Offset Area to be surveyed (by registered surveyor) and marked with pegs (or equivalent). Temporary exclusion fencing (star pickets with geotextile fabric, or suitable equivalent) to be installed along western boundary of Offset Area. Vegetation slashing to be excluded from fenced Offset area. No chain mesh (or equivalent) fencing to be installed.	Initial site clearing and establishment	Construction Team
All koala feed tree plantings proposed for Southern Offset Area (Figure 2) to be protected with 1.8 m high guards using shade cloth and three star pickets; tree guards to be removed from each tree once tree established and safe from deer browsing (as deemed by Project Ecologist)	Post-construction	Bush Regeneration Contractor and Project Ecologist

Activity	Timing	Role
Temporary sediment fences are to be removed at the completion of construction activities	Post-construction	Construction Team
Recruitment trees		
Ensure identification of suitable recruitment trees within the subject site and Crown Road reserve. Final number of required recruitment trees to be determined by Project Ecologist based on final count of felled HBTs	Initial site clearing and establishment	Project Ecologist
Conduct audit of number of HBTs felled during construction and record number and size of hollows.	Initial site clearing and establishment	Project Ecologist
Identify suitable number and type of recruitment trees (in the ratio to two recruitment trees for every one HBT felled); potential recruitment trees to be flagged, numbered and location recorded with GPS for later mapping	Initial site clearing and establishment	Project Ecologist
Recruitment trees to be assessed for health and longevity by Project Arborist to confirm suitability	Initial site clearing and establishment	Project Arborist
Map of recruitment tree locations to be submitted to Council as part of VMP monitoring program	Initial site clearing and establishment	Project Ecologist
Hollow bearing tree protocol		
The Hollow-bearing Tree Protocol (Table 4) to be implemented prior to and during any tree felling works	Initial site clearing and establishment	Project Ecologist
Nesting boxes		
Conduct audit of HBTs and tree hollows felled during clearing	Initial site clearing and establishment	Project Ecologist
Relocate cut sections of hollow trees to ground layer in Vegetation Management Area, where feasible; record location (GPS waypoint) of any relocated hollow sections	Initial site clearing and establishment	Construction Team and Project Ecologist
Calculate number and type of nest boxes required and order from preferred supplier. Nest box dimensions to be according to those listed in Appendix E for target species listed in Section 4.5.	Initial site clearing and establishment	Project Ecologist
Nest boxes will be constructed from non-toxic, weather durable treated timber (e.g. alkaline copper quaternary - ACQ) or plywood painted with weather resistant paint (external surfaces only)	Initial site clearing and establishment	Project Ecologist

Activity	Timing	Role
Assemble and install nest boxes in suitable recruitment trees (or other trees deemed suitable), at suitable height and aspect (to avoid rainfall, cold winds and direct midday sun)	Within one month of clearing	Project Ecologist
Number and record each nest box, record photo and register location using hand held GPS (or identify on survey plan if already surveyed)	Initial site clearing and establishment	Project Ecologist
Map of nest box locations to be submitted to Council as part of VMP monitoring program	Pre-construction (baseline monitoring report)	Project Ecologist
Conduct monitoring and maintenance of nest box activity as part of VMP monitoring program	Post-construction for 20 years	Project Ecologist
Baseline Monitoring		
Collect baseline monitoring data (photo-points, quadrats, APZs, nesting box locations, recruitment tree locations)	Pre-construction (baseline monitoring report)	Project Ecologist
Weed control		
Weed removal program within the VMA (inc. all offset areas defined in the VMP)	Within six months of construction commencing	Bush Regeneration Contractor
Primary weeding	After fencing installed and construction zone delineated	Bush Regeneration Contractor
Secondary weeding	3 – 6 months after primary weeding	Bush Regeneration Contractor
Any soil or vegetative matter within the area of Madeira Vine infestation (in the southern part of Lot 3) that is excavated as part of the bulk earthworks is not to be re-used as topsoil or mulch for landscaping or other purposes. Any soil left in situ in this area (to allow for tree retention or for landscaping purposes) or excavated and re-used as fill shall be monitored for weed growth by the Project Ecologist. Any weed growth is to be treated in accordance with the specific requirements of the weed species.	Initial site clearing and establishment	Construction Team and Project Ecologist
Any weed biomass that is excavated during bulk earthworks that is not to be buried as fill shall be removed from the site and disposed of at a licenced waste facility	Initial site clearing and establishment	Construction Team and Project Ecologist

Activity	Timing	Role
Seed collection, propagation and revegetation		
Seed collection. Seed of locally indigenous plant species to be collected prior to construction by licenced nursery operator or bush regeneration contractor (under direction of Project Ecologist) and opportunistically during seeding events during the construction programme	Pre-construction throughout works program – timing dependant on seasonal seeding events	Bush Regeneration Contractor
Propagation of collected seed by licenced nursery operator or bush regeneration contractor to produce tubestock for later planting	3-6 months from collection	Bush Regeneration Contractor
Purchase supply of tubestock (to allow for limitations in seed collection and propagation) for early planting works	Initial site clearing and establishment	Bush Regeneration Contractor
Planting of tubestock in the proposed offset revegetation area, according to the schedule of species and planting densities listed in Table 3	Within 6 months of works commencing	Bush Regeneration Contractor
Planted trees and shrubs are to be protected using plastic 'grow tubes' - to protect the plants from the elements during their establishment period, and to prevent grazing from herbivores (esp. rabbits, kangaroos, wallabies and deer)	Initial site clearing and establishment	Bush Regeneration Contractor
Koala Feed Tree Plantings		
Plant species for revegetation are to include species recorded on the site that are recognised as feed trees for the koala, namely *Eucalyptus robusta*, *E. microcorys* and *E. signata* and feed trees for other threatened species previously recorded on the site, including the Grey-headed Flying Fox and Squirrel Glider	Within 6 months of works commencing	Bush Regeneration Contractor
Koala feed tree plantings to be advanced stock (ie 300 mm or 75 litre pots, or around 3 m height), protected (from deer browsing) by shade cloth (geotextile fabric) secured with 2 m high star pickets	Within 6 months of works commencing	Bush Regeneration Contractor
Koala feed tree plantings to be replaced to maintain 100% of original planting numbers, with replacement of failed stock within three months of failure	Post-construction; within 3 months of failure; replacements to occur as required for life of project	Landscape contractor & Bush Regeneration Contractor
Asset Protection Zones		
Maintenance of landscaped gardens shall comply with prescriptions of an Inner Protection Area (see Appendix 5 of Planning for Bushfire Protection 2006 and Specifications for Asset Protection Zones)	Post-construction	Landscape contractor

Activity	Timing	Role
Ensure species selection for landscaped areas avoids accumulation of fire fuels and is consistent with the requirements of an Inner Protection Area	Post-construction	Landscape contractor
Pruning and selective thinning of trees and shrubs as required in landscaped areas, to avoid contiguity of vegetation (horizontally and vertically)	Post-construction	Landscape contractor
Pruning and selective thinning of trees and shrubs as required in bushland areas, to avoid contiguity of vegetation (horizontally and vertically)	Post-construction	Bush Regeneration Contractor
Ongoing maintenance to remove flammable fuels	Post-construction	Landscape contractor
Regular mowing of lawns	Post-construction	Landscape contractor
Manual removal of combustible materials, particularly within the landscaped areas	Post-construction	Landscape contractor
Maintenance and Monitoring		
Maintenance (tertiary) weeding, maintenance of plantings and replacement of failed plants	Annually or as required in perpetuity	Bush Regeneration Contractor
Monitoring surveys (Collection of photo point and floristic (quadrat) monitoring data; assess weed growth; assess status of nest boxes; fuel loads in APZ and health of recruitment trees)	Biannually (every 6 months) for first 3 years	Project Ecologist
Monitoring Reports	Biannually (every 6 months) for first 3 years	Project Ecologist
Monitoring and maintenance of nest boxes	20 year period (from date of installation)	Project Ecologist

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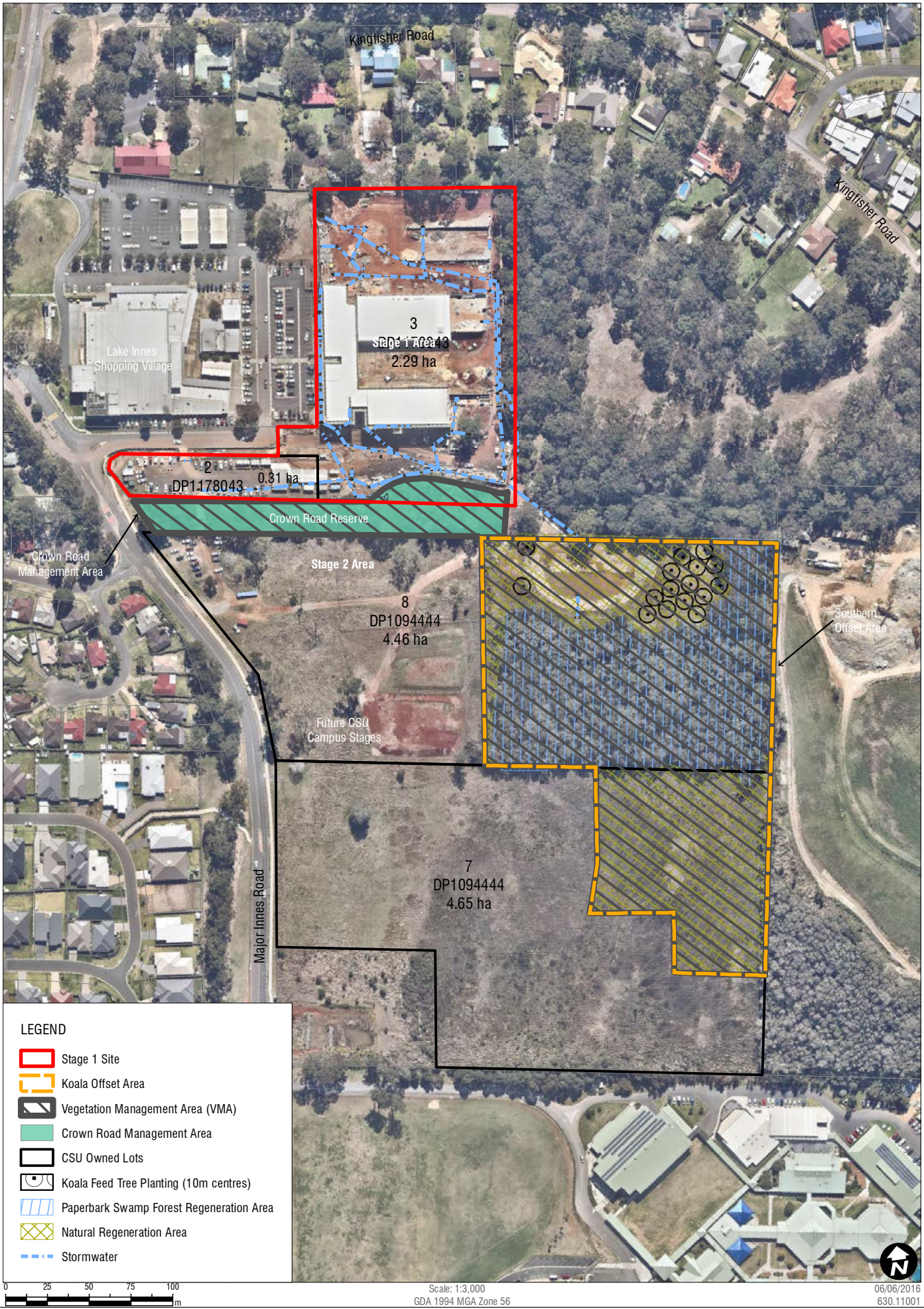
Aerial image of the Subject Site (Stage 1)

FIGURE 1



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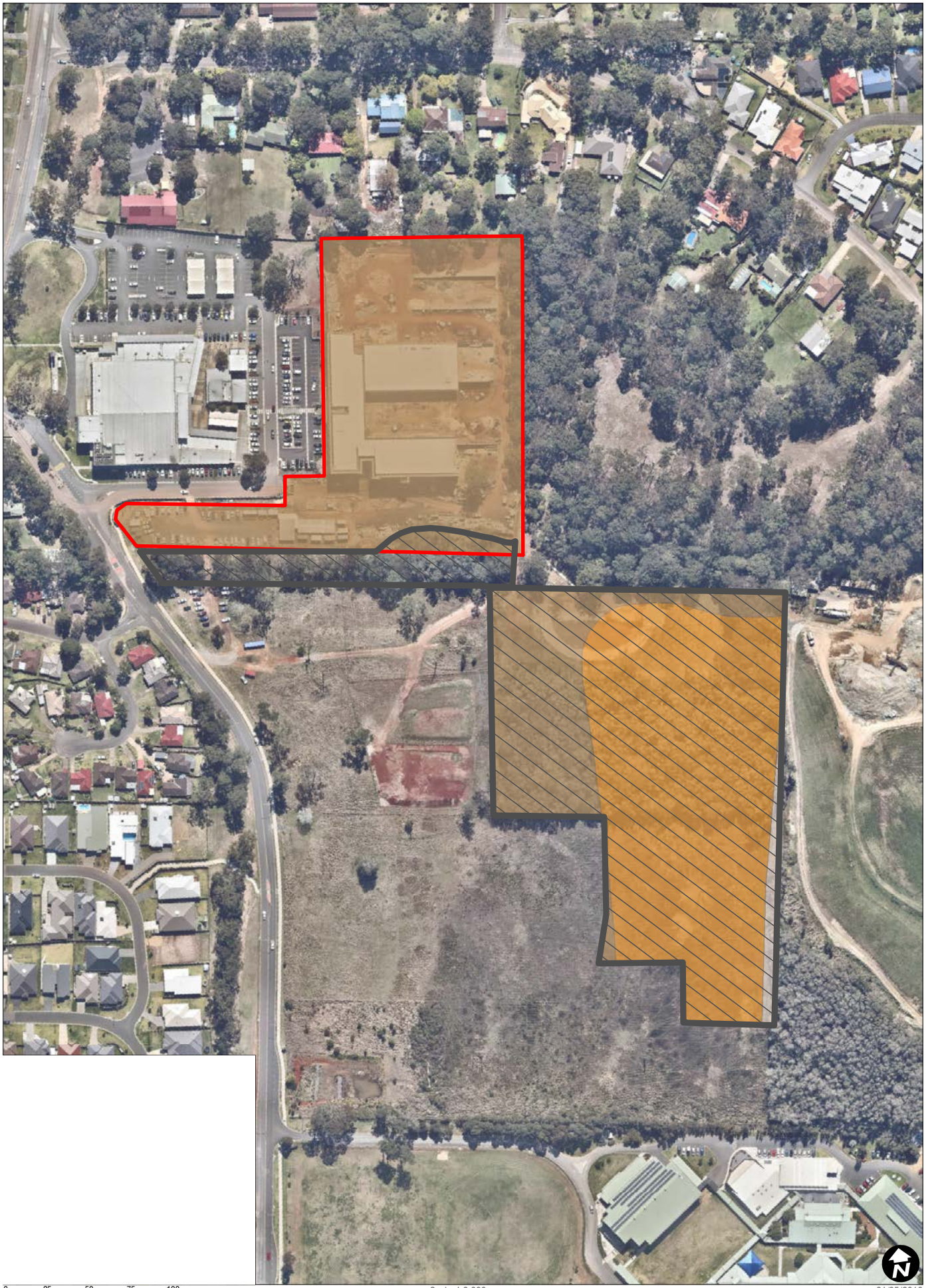
Vegetation Management Area (VMA)

FIGURE 2



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GDA 1994 MGA Zone 56

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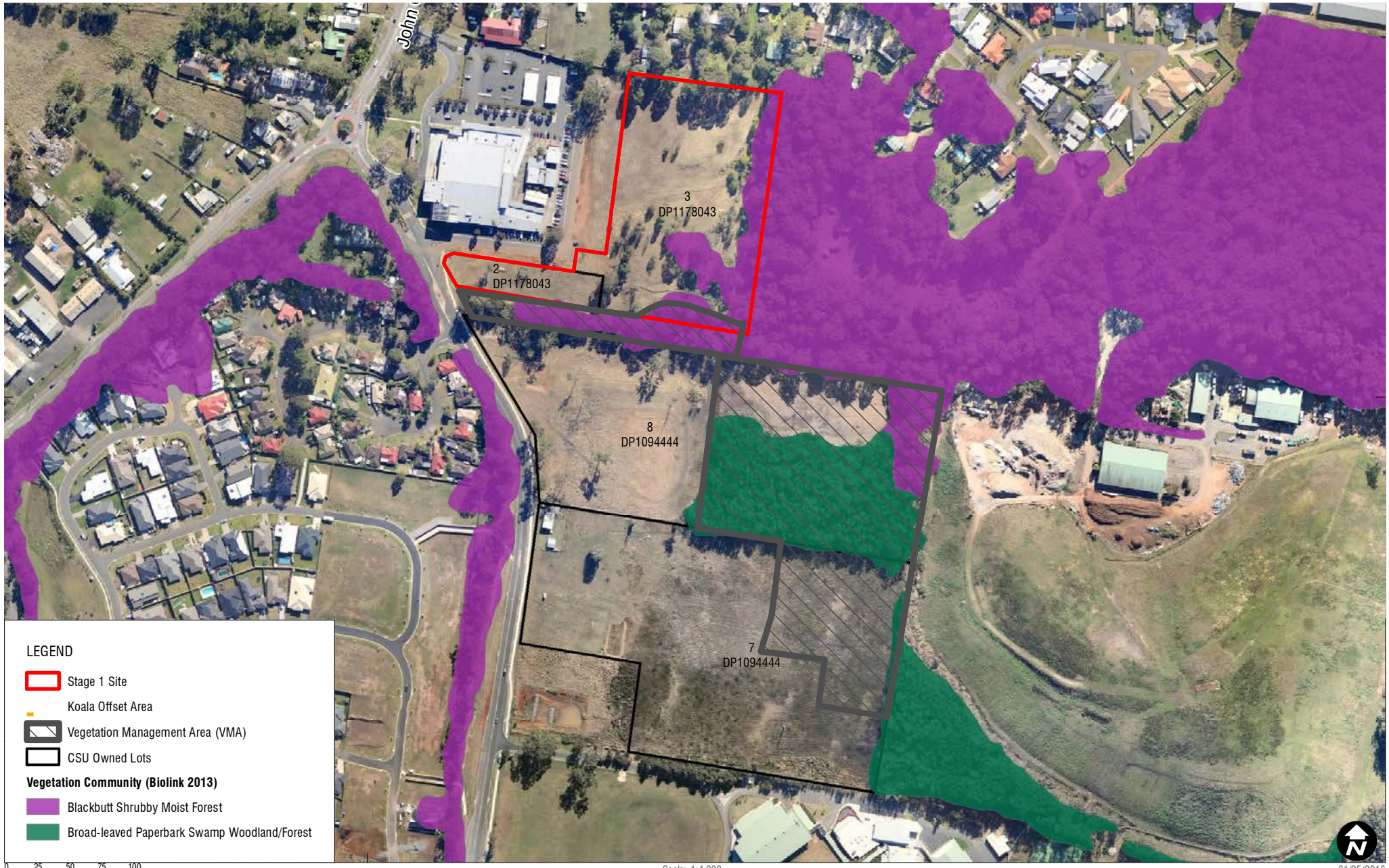
Soil Types

FIGURE 3



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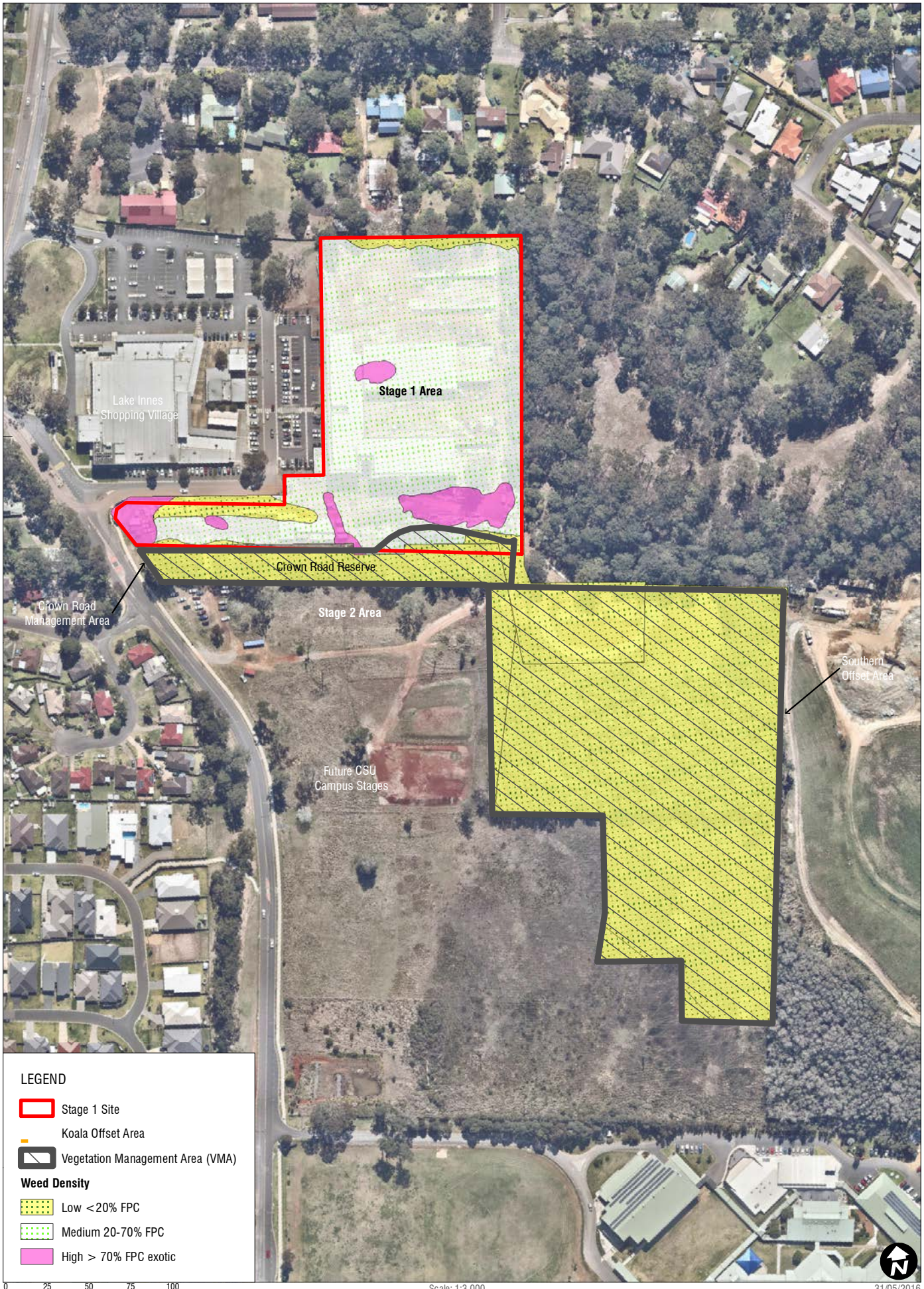
Council Vegetation Mapping within the VMA

FIGURE 4



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Weed Density

Figure 5

APPENDIX A

CONDITIONS OF CONSENT RELEVANT TO VMP

1 FINAL CONDITIONS OF CONSENT – PRE-CONSTRUCTION AND CONSTRUCTION

SLR Ecology has reviewed the *Conditions of Consent* for DA No 2014/19, and has identified the following conditions as relevant (in part at least) to SLR.

A - GENERAL MATTERS

Condition	SLR Scope of Work

(8) (A195) Ongoing maintenance works detailed in the approved Vegetation Management Plan are to be carried out in perpetuity	• Bushland management, maintenance of plantings and weed control (not part of SLR scope)
	• SLR to design and implement VMP monitoring programme. Monitoring programme to be set out in VMP. Includes:
	  • Establish baseline monitoring sites and prepare baseline monitoring report;
	  • 6-monthly inspections of VMP works during first two years, with provision of progress reports and recommendations for corrective actions for two years after planting
	  • (Note: additional fees would be required to implement monitoring programme)

(9) (A196) Trees numbered 922, 933, 934, 949, 954, 963 and 983 on the Tree Protection Zone For Retain Trees Map (Figure 3a-c) of the Flora and Fauna Assessment Report by SLR are to be retained.	• Noted. Fee included in day rate for Project Arborist (see below) • Inspections of retained trees by Project Arborist • Draft and submit certification letter that trees have been retained as per Condition A(9)
(10) (A197) The first 300mm of soil and any vegetative matter within the Madeira Vine infestation located in the central area of the lot is to be removed prior to bulk earthworks commencing and disposed of as solid waste to a licensed landfill.	• Site inspection to map Madeira infestation; • Provision of response to Council on weed management strategy (in progress) • Recommend re-wording of Condition A(10) • Add specific measures to VMP
(11) (A198) All offset tree plantings detailed in the vegetation managements [sic] plan are to [sic] advanced stock of no smaller than 3m high. All plantings are to be protected from deer browsing via the provision of 1.8m high guards using shade cloth and 3 star pickets.	• Noted. To be incorporated into VMP. • Monitoring inspections of offset plantings as part of VMP monitoring programme (see Condition A(8) above)

B – PRIOR TO ANY WORKS COMMENCING ON SITE

Condition	SLR Scope of Work

(7) (B195) Prior to construction, Council is to approve to its satisfaction a vegetation management plan. Vegetation management plan is to [sic] cover all offset areas as defined in the Draft Master Plan dated February 2013, nest box provision, asset protection zone measures, street tree and landscape plantings	• Prepare detailed Vegetation Management Plan (VMP)
	• VMP scope to include:
	  • Site inspection to map weed density and infestations (inc. Madeira Vine)
	  • GIS mapping
	  • Compensatory plantings (density and number)
	  • Weed control strategies
	  • Responsibilities and timing of actions
	  • Consultation with Council bushland officer
	  • Review and QA check

(14) (C015) Tree protection fencing, compliant with *AS 4970/2009 Protection of trees on development sites* must be provided. The fencing shall be in place prior to the commencement of any works or soil disturbance and maintained for the entirely of the works.	• Project Arborist to inspect tree protection measures as part of tree removal inspections at Condition D(4).
(15) (C195) Prior to any works, including vegetation removal, commencing, establishment works relevant to stage 1 of the development, as per the approved vegetation management plan, are to have commenced.	Noted. No scope required.
(16) (C196) Prior to any works commencing Tree Protection Zone For Retain Trees Map (Figure 3a-c) of the Flora and Fauna Assessment Report by SLR is to be updated to reflect the additional trees for retention as per Condition A-196.	To be completed by others. No scope required.

D – DURING WORK

Condition	SLR Scope of Work
(3) (D043) Any damage to a tree nominated for retention/protection during the construction phase shall be treated by an Arborist with a minimum qualification AQF level 5 (diploma level) or an international qualification considered equivalent by Council, or a person deemed suitable by Council at the developers expense.	• Site inspection by SLR Project Arborist as part of Condition D(4) • Onsite and written advice to construction contractor on remedial actions (as required)
(4) (D044) An Arborist, with a minimum qualification AQF level 5 (diploma level) or an international qualification considered equivalent by Council, or a person deemed suitable by Council shall be engaged to supervise all on site clearing and shall certify in writing that [sic] clearing has occurred in accordance with the approved plans and conditions of this consent.	• SLR Project Arborist to supervise all onsite tree removal (number days to be confirmed; three working days' notice required to mobilise) • Draft and submit certification letter.
(5) (D045) A suitably qualified ecological consultant shall inspect all native trees that have been approved for removal before they are felled. If there are any koala or other fauna species in the tree, work in the vicinity is to cease until the animal has moved from the area. If it is likely that hollows are providing habitat for native species, traps shall be set for several nights and any native species found shall be relocated to an appropriate nearby location.	• Pre-clearing surveys by SLR Ecologist • Flagging of active habitat trees with coloured flagging tape • Measures to be included in VMP • Trapping budget to be on day rate for single ecologist; trapping budget not included
(6) (D050) The capacity and effectiveness of tree protection fencing, compliant with *AS 4970/2009 Protection of trees on development sites* shall be maintained at all times in accordance with the approved management plan until such time as the site is no longer subject to any construction or earth works.	• Inspection of tree protection fencing by SLR Project Arborist as part of Condition D(4) • Draft and submit certification letter.

APPENDIX B

VEGETATION MANAGEMENT PLAN REQUIREMENTS (PORT MACQUARIE HASTINGS COUNCIL)

Port Macquarie – Hastings Council

Vegetation Management Plan Requirements

The following requirements are to be addressed for the development of VMPs.

EXISTING SITE CONDITIONS

- Vegetation map of existing and retained vegetation. Vegetation needs to be mapped at vegetation community level. Structure condition (age and forms) needs to be included.
- Weed map detailing current weed condition (species, extent, density).
- Soils map.
- Topography.

PROPOSED ENVIRONMENTAL WORKS

- Management units mapped, staging and costing table defined for each unit.
- Planting works table (were required) for each unit. Planting table to identify species, area and planting densities (plants/m2).
- Bush regeneration works map and table for each work unit. Detail on type and timing of control works and target weed species.
- Type, number and location of Nesting Boxes (if applicable).
- Mapped APZ and treatment requirements (if applicable).
- Fire History mapped and Ecological Burning requirements identified (for bushland areas >1ha).
- Inclusion of management recommendations from any ecological assessments.
- List of proposed native plants to be planted (if applicable).
- KPoM works (if applicable)

MONITORING AND REPORTING

- Detailed monitoring and audit proforma for each management unit.
- Schedule of proposed reporting periods (minimum yearly reporting).
- KPoM monitoring requirements (if applicable)

MAINTENANCE AND CONTINGENCY

- Detail on scheduled maintenance of plantings, nesting boxes, APZ, and bush regeneration areas.
- Contingency plans for failed works.

COSTINGS

- Annual costings of each management unit and the overall budget for life of the VMP including KPoM budget, where applicable.

MAPPING OF ENVIRONMENTAL LANDS

- Applicant to submit geo-referenced file (AutoCAD dwg or GIS shapefile) of environmental lands. All spatial data is to be spatially referenced to MGA Zone 56 coordinates.

DEDICATION AND VOLUNTARY PLANNING AGREEMENTS

- Where the environmental land is to be dedicated to Council. The timing of dedication in relation to rehabilitation stages and development construction is to be stated.

PORT MACQUARIE
HASTINGS

VMP Audit and Monitoring Proforma

Area No.	
Date of Inspection	
Personnel Recording	
Revegetation Performance Approximate date the area was first rehabilitated	
Sample Size – Area (m2) of sample site	

Map of Management Unit

Previous Activity since last audit / report:

Regeneration/ Revegetation hours allocated | Regeneration / Revegetation hours spent

Previous audit / report actions undertaken:

General Vegetation Area Performance / Observations

	Major	Minimal	None	N/A
Evidence of any pollution, rubbish, litter, excessive sediment or erosion.				
Evidence of weeds adjacent to the rehabilitation area likely to impact it.				
Evidence of plant pests and diseases or feral animal populations.				
	Good	**Fair**	**Poor**	**N/A**
Evidence of macro fauna colonisation / use (scats, tracks and sitings)				
Evidence of micro fauna colonisation / use (insects, lizards etc)				
Assessment of overall Habitat Value (eg. Animal hiding places, vegetation cover, food etc.)				

Regeneration / Weed Control Performance

Approximate date the area first underwent weed control

Natural Recruitment: Natural recruitment observed	Yes	No

Weeds species identified	Estimate % coverage (by area projected to ground)		Estimate % age composition	
	Canopy	Ground	Mature	Seedlings

Weed Control Comments and Observation Notes:

PORT MACQUARIE HASTINGS

Revegetation Performance	Approximate date the area was first rehabilitated	
	Sample Size – Area (m2) of sample site	

Vegetation/ Plant Growth:

Approximate native plant count within sample area:	Trees		Shrubs		Grasses / Herbs	
Species Diversity : (approx no. of different species in each stratum)	Trees		Shrubs		Grasses / Herbs	
Species Growth (m): (height of average specimen in each stratum class in metres)	Trees		Shrubs		Grasses / Herbs	

	>50%	50-20%	20-5%	<5%	Nil
Canopy Cover: Estimate % coverage by area (projected to ground)					
Plant Mortality Rates : Estimate percentage death of new plants					
Bare Soil : Percentage coverage of area					

Humus / Leaf Litter Depth : (mm) average in sample area	

	Yes	No
Fauna: Evidence of plant damage / death caused by feral animals?		

Detail:

			Yes	No
Number of nest boxes in monitoring area?		Nest boxes inspected?		

Detail any nest box issues: nest box damage, takeover by feral animals, damage to tree caused by nest box.

GENERAL COMMENTS AND OBSERVATION NOTES:

CORRECTIVE ACTIONS REQUIRED / RECOMMENDED:	Yes	No
Follow up: were previous corrective actions successful and issues addressed?		

Detail follow up and new corrective actions proposed.

PORT MACQUARIE HASTINGS

APPENDIX C

FLORA SPECIES LIST

Appendix C Flora species list collected from the subject site (updated 28 July 2014)

NOTES	
KEY	
Symbol	**Description**
S1	Species detected within the Stage 1 Area on the subject site at Port Macquarie
S2	Species detected within the Stage 2 Area on the subject site at Port Macquarie
*	Exotic species
N	Noxious weed species (listed for Port Macquarie Hastings LGA)

STATUS	SCIENTIFIC NAME	COMMON NAME	S1	S2
	Anthericaceae			
	Tricoryne elatior	Yellow Autumn Lily	X	
	Apiaceae			
*	*Foeniculum vulgare*	Fennel	X	
*	*Hydrocotyle bonariensis*	Pennywort	X	
	Apocynaceae			
*	*Gomphocarpus fruticosus*	Narrow-leaved Cottonbush	X	
	Parsonsia straminea	Common Silkpod	X	X
	Araliaceae			
	Polyscias sambucifolia subsp. *sambucifolia*	Elderberry Panax	X	X
	Arecaceae			
	Livistona australis	Cabbage Palm		X
	Asparagaceae			
*N(4)	*Asparagus aethiopicus* (syn. *Protasparagus aethiopicus*)	Asparagus Fern; Ground Asparagus	X	
*N(2, 4)	*Asparagus plumosus* (syn. *Protasparagus plumosus*)	Climbing Asparagus Fern	X	
	Asteraceae			
*	*Ageratum conyzoides* subsp. *conyzoides*	Goatweed	X	
	Bidens pilosa	Cobblers Peg	X	
*	*Bidens subalternans*	Greater Beggar's Ticks	X	
*	*Cirsium vulgare*	Spear Thistle	X	
*	*Conyza bonariensis*	Flaxeaf Fleabane	X	
*N(4)	*Chrysanthemoides monilifera* subsp. *rotundata*	Bitou Bush	X	
*	*Erigeron karvinskianus*	Bony-tip Fleabane	X	
*	*Gamochaeta purpurea*	Purple Cudweed	X	
*N(4)	*Senecio madagascariensis*	Fireweed	X	
	Basellaceae			
*N(4)	*Anredera cordifolia*	Madeira Vine	X	
	Bignoniaceae			
*	*Jacaranda mimosifolia*	Jacaranda	X	
	Pandorea pandorana subsp. *pandorana*	Wonga Wonga Vine		X
*N(3)	*Tecoma stans*	Yellow Bignonia	X	
	Blechnaceae			
	Blechnum indicum	Swamp Water Fern	X	X
	Doodia aspera	Prickly Rasp Fern		X
	Casuarinaceae			
	Allocasuarina littoralis	Black She-oak	X	
	Casuarina glauca	Swamp Oak	X	

Appendix C Flora species list collected from the subject site (updated 28 July 2014)

STATUS	SCIENTIFIC NAME	COMMON NAME	S1	S2
	Clusiceae			
	Hypericum gramineum	Small St. John's Wort		X
	Commelinaceae			
	Commelina cyanea	Native Wandering Jew	X	X
*	*Tradescantia fluminensis*	Wandering Jew	X	
	Convolvulaceae			
	Convolvulus erubescens	Blushing Bindweed		X
	Dichondra repens	Kidney Weed		X
*	*Ipomoea cairica*	Coastal Morning Glory		X
	Cyatheaceae			
	Cyathea australis	Rough Tree-fern	X	X
	Cyperaceae			
	Baumea juncea	-		X
	Carex appressa	Tall Sedge		X
	Carex brownii	-		X
	Chorizandra cymbaria	-		X
	Chorizandra sphaerocephala	Roundhead Bristle-sedge		X
	Cladium procerum	-		X
*	*Cyperus brevifolius*	Mullumbimby Couch	X	
	Gahnia clarkei	Tall Saw-sedge		X
	Lepidosperma laterale	-	X	
	Schoenus melanostachys	Black Bog-rush		X
	Dennstaedtiaceae			
	Histiopteris incisa	Bat's Wing Fern		X
	Hypolepis glandulifera	Downy Ground Fern		X
	Pteridium esculentum	Common Bracken	X	
	Dilleniaceae			
	Hibbertia aspera	Rough Guinea Flower		X
	Hibbertia scandens	Climbing Guinea Flower		X
	Ericaceae - Styphelioideae			
	Leucopogon juniperinus	Prickly Beard-heath		X
	Fabaceae - Caesalpinioideae			
*	*Senna pendula* var. *glabrata*	-		
	Fabaceae - Faboideae			
*	*Erythrina x sykesii*	Coral Tree		X
	Glycine clandestina	-	X	
	Hardenbergia violacea	False Sarsparilla		X
	Kennedia rubicunda	Dusky Coral Pea	X	
*	*Trifolium repens*	White Clover	X	
*	*Vicia sativa* subsp. *nigra*	Narrow-leaved Vetch	X	
	Fabaceae - Mimosoideae			
	Acacia binervata	Two-veined Hickory	X	
	Acacia floribunda	White Sally Wattle	X	
	Acacia irrorata subsp. *irrorata*	Green Wattle	X	
	Acacia longifolia subsp. *longifolia*	Sydney Golden Wattle	X	X
	Acacia melanoxylon	Blackwood	X	
*	*Acacia podalyriifolia*	Queensland Silver Wattle	X	
	Acacia ulicifolia	Prickly Moses	X	
	Gentianaceae			
*	*Centaurium erythraea*	Common Centaury	X	

Appendix C Flora species list collected from the subject site (updated 28 July 2014)

STATUS	SCIENTIFIC NAME	COMMON NAME	S1	S2
	Gleicheniaceae			
	Gleichenia dicarpa	Pouched Coral Fern		X
	Goodeniaceae			
	Goodenia bellidifolia subsp. *argentea*	-		X
	Goodenia stelligera	Spiked Goodenia		X
	Haloragaceae			
	Gonocarpus teucrioides	Raspwort		X
	Lauraceae			
	Cassytha glabella	-	X	
*N(4)	*Cinnamomum camphora*	Camphor Laurel	X	X
	Cryptocarya sp.			X
	Lobeliaceae			
	Lobelia anceps	-		X
	Pratia purpurascens	Whiteroot		X
	Lomandraceae			
	Lomandra filiformis subsp. *filiformis*	Wattle Mat-rush	X	
	Lomandra longifolia	Spiny-headed Mat-rush	X	X
	Lomandra multiflora subsp. *multiflora*	Many-flowered Mat-rush		X
	Lomariospidaceae			
*	*Nephrolepis cordifolia*	Fishbone Fern		X
	Luzuriagaceae			
	Geitonoplesium cymosum	Scrambling Lily		X
	Malaceae			
*	*Cotoneaster pannosus*	-	X	
	Malvaceae			
*	*Sida rhombifolia*	Paddy's Lucerne	X	
	Melastomataceae			
*	*Tibouchina urvilleana*	Purple Glory Bush		X
	Meliaceae			
	Synoum glandulosum subsp. *glandulosum*	Scentless Rosewood	X	
	Menispermaceae			
	Stephania japonica	Snake Vine	X	
	Moraceae			
	Ficus rubiginosa	Port Jackson Fig		X
	Myrsinaceae			
*	*Anagallis arvensis*	Scarlet Pimpernel	X	
	Myrtaceae			
	Callistemon rigidus	Stiff Bottlebrush		X
	Callistemon salignus	Willow Bottlebrush	X	
	Corymbia intermedia	Pink Bloodwood	X	X
	Eucalyptus microcorys	Tallowood	X	X
	Eucalyptus resinifera subsp. *resinifera*	Red Mahogany	X	X
	Eucalyptus robusta	Swamp Mahogany	X	X
	Eucalyptus siderophloia	Grey Ironbark	X	X
	Eucalyptus racemosa subsp. *racemosa (*syn. *Eucalyptus signata*	Scribbly Gum	X	X
	Eucalyptus tereticornis	Forest Red Gum	X	X
	Leptospermum juniperinum	Prickly Tea-tree		X
	Leptospermum polygalifolium subsp. *cismontanum*	Tantoon		X
	Melaleuca linariifolia	Flax-leaved Paperbark	X	X

Appendix C Flora species list collected from the subject site (updated 28 July 2014)

STATUS	SCIENTIFIC NAME	COMMON NAME	S1	S2
	Melaleuca nodosa	Prickly-leaved Paperbark	X	X
	Melaleuca quinquenervia	Broad-leaved Paperbark	X	X
	Melaleuca sieberi	-		X
	Melaleuca styphelioides	Prickly-leaved Tea Tree	X	X
	Melaleuca thymifolia	Thyme Honey-myrtle		X
	Ochnaceae			
*	*Ochna serrulata*	Mickey Mouse Plant	X	X
	Oleaceae			
*	*Ligustrum lucidum*	Large-leaved Privet	X	
	Notelaea longifolia f. *longifolia*	Mock Olive		X
	Orchidaceae			
	Spiranthes australis	Ladies' Tresses	X	
	Passifloraceae			
*	*Passiflora edulis*	Common Passionfruit		X
	Philydraceae			
	Philydrum lanuginosum	Frogmouth		X
	Phormiaceae			
	Dianella caerulea var. *caerulea*	Blueberry Lily		X
	Dianella longifolia var. *longifolia*	-		X
	Phyllanthaceae			
	Breynia oblongifolia	Coffee Bush	X	
	Glochidion ferdinandi var. *ferdinandi*	Cheese Tree	X	X
	Pittosporaceae			
	Pittosporum revolutum	Rough Fruit Pittosporum	X	
	Plantaginaeae			
*	*Plantago lanceolata*	Lamb's Tongue	X	
	Veronica plebeia	Trailing Speedwell		X
	Poaceae			
*	*Andropogon virginicus*	Whisky Grass	X	
	Aristida vagans	Threeawn Speargrass	X	
*N(4)	*Arundo donax*	Giant Reed, Elephant Grass	X	
*	*Arundo donax* 'Variegata'	Striped Giant Reed	X	
	Austrostipa rudis subsp. *nervosa*	-		X
	Bothriochloa macra	Red Grass	X	
*	*Briza maxima*	Quaking Grass	X	
*	*Briza minor*	Shivery Grass	X	
	Cymbopogon refractus	Barbed Wire Grass	X	
	Cynodon dactylon	Common Couch	X	
	Deyeuxia decipiens	Devious Bent-grass		X
	Dichelachne micrantha	Shorthair Plumegrass	X	X
	Digitaria didactyla	Queensland Blue Couch		
	Echinopogon caespitosus var. *caespitosus*	Bushy Hedgehog-grass		X
	Echinopogon ovatus	Forest Hedgehog Grass	X	
	Entolasia marginata	Bordered Panic	X	
	Entolasia stricta	Wiry Panic		X
	Eragrostis elongata	Clustered Lovegrass	X	
	Imperata cylindrica var. *major*	Blady Grass	X	
	Lachnagrostis filiformis	-		X
*	*Lolium perenne*	Perennial Ryegrass		
	Microlaena stipoides var. *stipoides*	Weeping Grass		X
	Oplismenus imbecillis	Creeping Beard Grass		X
*	*Paspalum dilatatum*	Paspalum	X	

Appendix C Flora species list collected from the subject site (updated 28 July 2014)

STATUS	SCIENTIFIC NAME	COMMON NAME	S1	S2
*	*Paspalum mandiocanum*	Broadleaf Paspalum	X	X
	Paspalum orbiculare	Ditch Millet		X
*	*Paspalum urvillei*	Vasey Grass	X	
	Poa labillardierei var. *labillardierei*	-		X
	Phragmites australis	Common Reed		X
	Sacciolepis indica	Indian Cupscale Grass		X
*	*Setaria parviflora*	-	X	
*	*Setaria sphacelata*	South African Pigeon Grass	X	
*	*Sporobolus africanus*	Parramatta Grass	X	
	Themeda australis	Kangaroo Grass	X	
	Zoysia macrantha	Prickly Couch		X
	Polygonaceae			
	Persicaria decipiens	Slender Knotweed		X
	Proteaceae			
	Banksia integrifolia subsp. *integrifolia*	Coast Banksia	X	
	Banksia spinulosa	Hairpin Banksia		X
*	*Grevillea robusta*	Silky Oak	X	
	Lomatia silaifolia	Crinkle Bush		X
	Persoonia levis	Broad-leaved Geebung	X	
	Ranunculaceae			
	Ranunculus inundatus	River Buttercup		X
	Ranunculus lappaceus	Common Buttercup		X
	Rhamnaceae			
	Alphitonia excelsa	Red Ash		X
	Pomaderris lanigera	Woolly Pomaderris	X	
	Rosaceae			
*N(4)	*Rubus anglocandicans*	Blackberry		X
	Rubus moluccanus var. *trilobus*	Molucca Bramble		X
	Rubiaceae			
*	*Richardia humistrata*			
	Santalaceae			
	Exocarpos cupressiformis	Cherry Ballart	X	
	Selingellaceae			
	Selaginella uliginosa	Swamp Selaginella		X
	Scrophulariaceae			
	Myoporum acuminatum	Boobialla	X	
	Smilaceae			
	Smilax glyciphylla	Sweet Sarsaparilla		X
	Solanaceae			
*	*Solanum mauritianum*	Wild Tobacco	X	
*	*Solanum nigrum*	Blackberry Nightshade	X	
	Thymelaceae			
	Pimelea linifolia subsp. *linifolia*	Slender Rice-flower	X	
	Verbenaceae			
*N(4)	*Lantana camara*	Lantana	X	
	Violaceae			
	Viola caleyana	Swamp Violet		X
	Viola hederacea	Ivy-leaved Violet	X	
	Vitaceae			
	Cayratia clematidea	Native Grape		X

Appendix C Flora species list collected from the subject site (updated 28 July 2014)

STATUS	SCIENTIFIC NAME	COMMON NAME	S1	S2
	Cissus hypoglauca	Water Vine	X	
	Total species indigenous to Port Macquarie LGA	123		
	Total exotic species	50		

APPENDIX D

WEED CONTROL TECHNIQUES

Appendix D Weed Control Techniques

Control of Woody Weeds *(eg Lantana, Cotoneaster, Privet, Camphor Laurel Cassia/Senna)*	
Cut and Paint	• Useful for small to medium sized woody weeds up to 100mm in diameter. • Make horizontal cut as close to the ground as possible with secateurs, loppers or a bush saw. • Apply herbicide immediately to the exposed flat stump.
Stem Injection	• For use on larger shrubs or trees with a diameter of more than 100mm. • At the base of the shrub or tree drill at a 45 degree angle into the sapwood at 5cm intervals and inject the herbicide immediately.
Frilling or Chipping	• Make a hole in the sapwood with a chisel or axe. • Fill each hole/cut with herbicide immediately. • Repeat the process at 5m intervals around the tree.
Control of Weeds with Underground Reproductive Systems *(eg Dandelion, Paddys Lucerne, Catsear, Asparagus Fern, Ginger Plant, Oxalis, Onion Weed, Madiera Vine)*	
Hand Removal of Plants with Taproots (*eg* Paddys Lucerne, Dandelion)	• Gently remove and bag seeds or fruit. • Push a narrow trowel or knife into the ground next to the taproot. Carefully loosen soil and repeat this step around the taproot. • Grasp stem at ground level, rock plant backwards and forwards pulling gently.
Crowning (*eg* Asparagus Fern)	• Gently remove and bag stems with seed and/or fruit. • Grasp the stems or leaves together so that the base of the plant is visible. • Insert, at an angle, a knife or lever close to the crown. • Cut through all the roots around the crown. • Remove and bag the crown.
Removal of Plants with Bulbs, Corms or Tubers (*eg* Onion Weed)	• Move leaf litter away from base of plant. • Dig down next to the stem until the bulb or tuber is reached. • Remove plant and carefully remove and bag bulb or tuber.
Herbicide Treatment: Stem Swiping	• Gently remove any seed or fruit and carefully place into a bag. • Using a herbicide applicator, swipe the stems/leaves.
Control of Small Hand Pullable Plants *(eg Fleabane, Crofton Weed, small grasses, seedlings)*	
Hand Removal (minimal disturbance)	• Gently 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 gently. • Carefully tap the roots to dislodge any soil. • Replace disturbed soil and pat down.
Control of Vines and Scramblers *(eg Balloon Vine, Morning Glory, Madeira Vine, Blackberry)*	
Hand Removal	• Take hold of one runner and gently pull it along the ground towards you. • 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 system needs to be removed manually or scrape/cut and paint with herbicide immediately. • Bag any reproductive parts.
Stem Scraping	• With a knife, scrape 15-30cm of the stem to reach the layer below the bark/outer layer. • Immediately apply herbicide along the length of the scrape.

BUSH REGENERATION INFORMATION SHEET

Control of Woody Weeds

Examples of woody weeds include:
- lantana, bitou bush, cotoneaster, privet (cut and paint)
- camphor laurel, Mickey Mouse bush (ochna) and cassia/senna (stem scrape)

METHODS OF REMOVAL

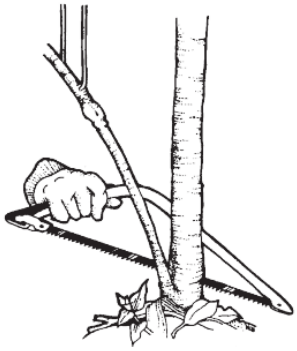
❶ *CUT AND PAINT* —Useful for small to medium sized woody weeds up to 10cm basal diameter

STEP 1 Make a horizontal cut as close to the ground as possible with secateurs, loppers or a bush saw.

STEP 2 Immediately apply herbicide to the exposed flat stump surface.

SAFETY CONSIDERATIONS

The following general precautions should be made when using herbicides:
- Read the label before opening the container and follow the instructions.
- Wear protective clothing as directed on the label.
- Wash hands after use and before eating or smoking.



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 and translocation of herbicide ceases.
- If plants resprout, cut and paint the shoots after sufficient regrowth has occurred.
- Stem scraping can be more effective on some woody weeds.

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AABR Australian Association of Bush Regenerators

Illustrations: V.Bear

BUSH REGENERATION INFORMATION SHEET

Control of Weeds with Underground Reproductive Structures

Examples: Weeds with
- Tap roots - catsear, dandelion
- Rhizomes - asparagus fern, ginger plant
- Bulbs and corms - oxalis, onion weed, watsonia, freesias, montbretia
- Tubers - madiera vine, arrow head vine

METHODS OF REMOVAL

❶ *HAND REMOVAL OF PLANTS WITH A TAPROOT*

Examples: Paddy's lucerne, dandelion

STEP 1 Gently remove and bag seeds or fruit.

STEP 2 Push a narrow trowel or knife into the ground next to the taproot. Carefully loosen soil. Repeat this step around the taproot.

STEP 3 Grasp stem at ground level, rock plant back wards and forwards and pull gently.

STEP 4 Gently tap the roots to dislodge soil. Replace disturbed soil and lightly pat down.

❷ *CROWNING (Many grasses can be crowned)*

Example: asparagus fern

STEP 1 Gently remove and bag stems with seed or fruit.

STEP 2 Grasp the leaves or stems together so that the base of the plant is visible.

STEP 3 Insert, at an angle, a knife or lever, close to the "crown".

STEP 4 Cut through all the roots around the crown.

STEP 5 Remove and bag the crown.

HAND REMOVAL

CROWNING

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BUSH REGENERATION INFORMATION SHEET

Control of Small Hand-pullable Plants

To Control:
- **Small soft weeds eg. fleabane, crofton weed, small grasses**
- **Seedlings of any weeds including privet, lantana, moth vine**

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Illustrations: V.Bear

METHODS OF REMOVAL

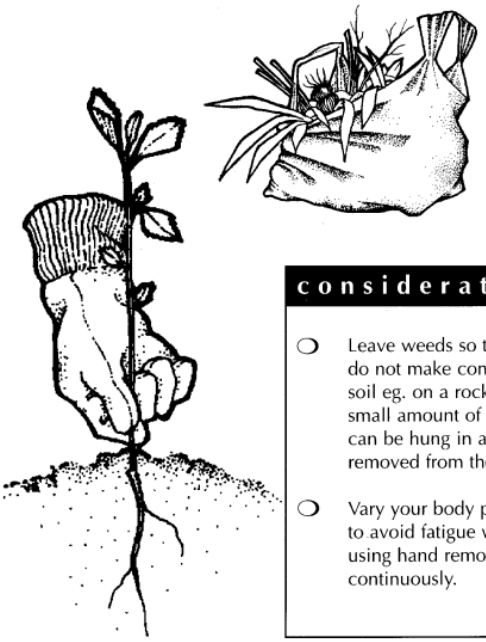
1 *HAND REMOVAL (Minimal Disturbance)*

STEP 1 Gently remove any seeds or fruits and carefully place into a bag.

STEP 2 Grasp stem at ground level.

STEP 3 Rock plant backwards and forwards to loosen roots, and pull out gently.

STEP 4 Carefully tap the roots to dislodge any soil. Replace disturbed soil and pat down.



considerations

- Leave weeds so that roots do not make contact with soil eg. on a rock - a small amount of debris can be hung in a tree or removed from the site.
- Vary your body position to avoid fatigue when using hand removal continuously.

BUSH REGENERATION INFORMATION SHEET

Control of Vines and Scramblers

Examples of vines include:
- **balloon vine, morning glory, honeysuckle, cape ivy, jasmine, madeira vine, blackberry**

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AABR Australian Association of Bush Regenerators

Illustrations: V.Bear

METHODS OF REMOVAL

1 *HAND REMOVAL*

STEP 1 Take hold of one runner and gently pull it along the ground towards you.

STEP 2 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.

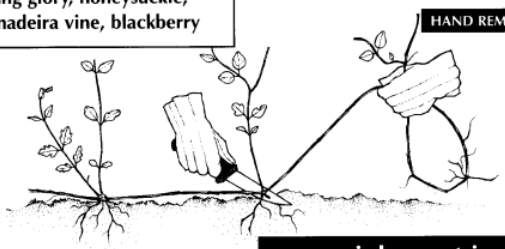
STEP 3 The major root systems need to be removed manually or scrape/cut and painted with herbicide.

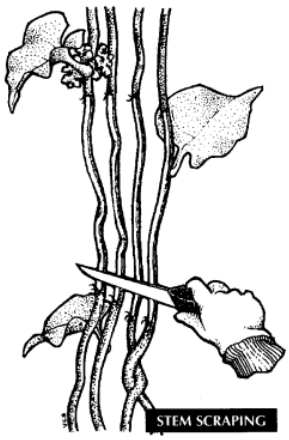
STEP 4 Bag any reproductive parts.

2 *STEM SCRAPING*

STEP 1 With a knife, scrape 15 to 30 cm of the stem to reach the layer below the bark/outer layer.

STEP 2 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 (>1cm) should have two scrapes opposite each other.
- Aerial tubers on madeira vine should die with the plant when stem scraping is used. Those that fall from the plant in the scraping process need to be bagged.
- Vines can be left hanging in trees after treatment.

APPENDIX E

NEST BOX DIMENSIONS

Source:
Port Macquarie Hastings Council (August 2014)

HABITAT/NEST BOX SPECIFICATINS

WHAT SIZE BOX IS REQUIRED?

Considerable research has been done on natural hollows, which have been regularly used by wildlife. The size, shape, wall thickness, depth, height above ground, and aspect of the hollows has been taken into consideration. This information has been standardised and put into this table, and is sourced from Ipswich City Council
Data based on Ipswich Council (undated); unless otherwise stated in notes column.

COMMON NAME	LATIN NAME	DIMENSIONS			MINIMUM HEIGHT	ORIENTATION AND NOTES	RECORDS/NOTES
		A (width and breadth)	B (depth)	C (entrance diameter)			
BIRDS							
Cockatiel	*Nymphicus hollandicus*	200	450	100	7	Vertical	
Dollarbird	*Eurystomus orientalis*	235	450	100	7	Vertical	
Grey Shrike Thrush	*Cullurincincia harmonica*	175	250	90 square	5	Vertical hidden	
Nankeen Kestrel	*Falco cenchroides*	275	750+	125	5	Horizontal, end entry	
Sacred Kingfisher	*Todiramphus sanctus*	130	500	75	5	Horizontal	
Kookaburra	*Dacelo gigas*	275	0	125	7	Horizontal, end entry	
Lorikeet	*Trichoglossus spp.*	135	400	65	5	Vertical or horizontal front entry	
Owlet Nightjar	*Aegotheles cristatus*	150	300	70	4	Vertical	
Barn Owl	*Tyto alba*	250	400	Platform	5	n/a	
Boobook Owl	*Ninox novae-zealandiae*	235	450	100	7+	Vertical	
Pardalotes	*Pardalotus spp.*	120	500	40	5	Horizontal, end entry	
Crimson Rosella	*Platycercus elegans*	200	400	90	3	Vertical or horizontal front entry	
Eastern Rosella	*Platycercus*	200	400	75	4	Vertical or horizontal front entry	
Swallow	*Hirundo neoxena*	130	130	Platform	3	Under cover	
Teal	*Anus spp.*	300	600	100	1.5	Vertical over water	
Pacific Black Duck	*Anus superciliosa*	350	450	120	1.5	Vertical over water	
MAMMALS							
Brown Antechinus	*Antechinus stuartii*	130	200	20-25	1.5	Vertical or horizontal. The smaller aperture will exclude Sugar Gliders, but both species are known to time-share the one hollow or box.	Abundant records in urban and coastal Port Macquarie
Pygmy Possum	*Acrobates pygmaeus*	130	200	20-25 high by 60mm long	1.5	Vertical or horizontal. The aperture should be a slit (Jason Berrigan pers. comm.).	Records scarce, nearest are at Diamond Head
Brush-tailed Phascogale	*Phascogale tapoatafa*	250	300	60	3 to 4	Vertical or horizontal. Shade required during hottest part of the day so orient the box on SE side of tree. Choose a tree with dense crown and minimal exposure to winter cold. These species climb best on rough bark so avoid gum-barked species. Rich food sources are needed nearby (banksias, paperbarks, bloodwoods, tallowwoods etc.).	
Brush-tailed Possum	*Trichosurus vulpecula*	350	500	120	3 to 4	Vertical or horizontal. The nest box needs to be hang and nailed to the tree using 2 strips of galvanised steel. The strips need only go halfway round the tree to allow for growth and to prevent ringbarking. Orient box away from cold winter winds and ensure shade during hot part of the day.	
Mountain Brushtail Possum	*Trichosurus caninus*	400	600	150	3 to 4	Vertical or horizontal	
Ringtail Possum	*Pseudocheirus peregrinus*	200	450	100	3 to 4	Vertical or horizontal	
Feather-tailed Glider	*Acrobates pygmaeus*	260	200	50	6	Vertical. Feathertails mostly use bat boxes (Bernard Whitehead pers. comm.).	Recorded from Sea Acres and North Shore
Greater Glider	*Petauroides volans*	350	300	80	8	Vertical. Gliders are often eaten by owls, so choose a site which is obscured from view, and install a rear-facing entry design as well (see Hollow Log Homes in Useful Contacts).This also reduces the use of these boxes by birds.	
Sugar Glider	*Petaurus breviceps*	260	300	50	3 to 6	Vertical. Gliders are often eaten by owls, so choose a site which is obscured from view, and install a rear-facing entry design as well (see Hollow Log Homes in Useful Contacts). This also reduces the use of these boxes by birds. Shade required during hottest part of the day so orient the box on SE side of tree. Choose a tree with dense crown and minimal exposure to winter cold. These species climb best on rough bark so avoid gum-barked species. Rich food sources are needed nearby (banksias, paperbarks, bloodwoods, tallowwoods etc.). (Jason Berrigan pers. comm.).	
Squirrel Glider	*Petaurus norfolkensis*	200	450	50	3 to 4	Vertical. Gliders are often eaten by owls, so choose a site which is obscured from view, and install a rear-facing entry design as well (see Hollow Log Homes in Useful Contacts). This also reduces the use of these boxes by birds. Shade required during hottest part of the day so orient the box on SE side of tree. Choose a tree with dense crown and minimal exposure to winter cold. These species climb best on rough bark so avoid gum-barked species. Rich food sources are needed nearby (banksias, paperbarks, bloodwoods, tallowwoods etc.) (Jason Berrigan pers. comm.).	
Insectivorous bats		Base entrance dimensions			4		
Chocolate Wattled Bat	*Chalinolobus sp.*	320x230	0	10-15x150		**NOTES (principally from Bernard Whitehead of Saltair unless otherwise stated):** **1.** Approach clear of foliage below the entrance (2mx2m). **2.** Between NW and E (preferably N) **3.** Quiet location on tree or house will do. **4.** The temperature of the artificial roost box is critical for microbats as they have very	
Sheathtail bats							
Yellow-bellied Sheathtail Bat	*Saccolaimus flaviventris*	25–35 mm					
Free-tail Bats							
Eastern Freetail Bat	*Mormopterus sp*	12-15mm					
East-coast Free-tailed Bat	*Mormopterus norfolkensis*						
White-striped Freetail Bat	*Tadarida australis*	15-25mm					

Source:
Port Macquarie Hastings Council (August 2014)

COMMON NAME	LATIN NAME	DIMENSIONS			MINIMUM HEIGHT	ORIENTATION AND NOTES	RECORDS/NOTES
		A (width and breadth)	B (depth)	C (entrance diameter)			
Gould's Wattled Bat	*Chalinolobus gouldii*	12-15mm				**4.** The temperature of the artificial roost boxes critical for microbats as they have very specific thermoregulation needs. **5.** Specificity of design and species use is still an evolving process for Australina insectivorous bats, with species using boxes intended for other bat species. Of all of the nest box installations, bat-boxes are currently the least successful. Installation of a range designs is more likely to meet individual species' lifecycle over the year (e.g. single cavity boxes vs colony boxes) and this process is currently an evolving (Jason Berrigan pers. comm.). **6.** Use of cement or woodcrete materials using the "Oregon Wedge" design may attract Little Bent-wing Bats (traditionally cave-dwellers) are about to be trialled (Jason Berrigan pers. comm.). **7.** Placement of more than one bat box on an individual tree can have multiple occupancy (do not care much about the neighbours), but with different aspects is recommended (Jason Berrigan pers. comm.)	
Chocolate Wattled Bat	*Chalinolobus morio*	12-15mm					
Eastern False Pipestrelle	*Falsistrellus tasmaniensis*	16-20mm					
Common Bent-wing Bat	*Miniopterus schreibersii*	Cave dwelling					
Southern Myotis	*Myotis macropus*	16-20mm & Cave dwelling					
Long-eared bats	*Nyctophilus sp.*	320x231	1	10-15x151	5		
Eastern Long-eared Bat	*Nyctophilus bifax*						
Lesser Long-eared Bat	*Nyctophilus geoffroyi*	12-15mm					
Gould's Long-eared Bat	*Nyctophilus gouldi*	12-15mm					
Greater Long-eared Bat	*Nyctophilus timoriensis*	16-20mm					
Eastern Broad-nosed Bat	*Scotorepens orion*	16-20mm					
Central-eastern Broad-nosed Bat	*Scotorepens sp.*						
Greater Broad-nosed Bat	*Scoteanax rueppellii*						
Eastern Forest Bat	*Vespadelus pumilis*						
Southern Forest Bat	*`Vespadelus regulus*						
Little Forest Bat	*Vespadelus vulturnus*	12-15mm					
Data sourced from LaTrobe Filed Naturalists Club (2009); unless otherwise stated in the notes column.							
REPTILES							
Carpet Python	*Morelia spilota*	250	250	100	4	Vertical	
Goanna	*Varanus sp.*	220	200	80	3	Vertical	
INSECTS							
Stingless Native Bee	*Trigona carbonaria*	280x210	105 top 1/2	12		Boxes are constructed by building a solid wooden structure which is then sawn into halves. (Fig 1). The given dimensions have proved to be ideal, larger boxes are less conducive to colony establishment and growth. Oregon pine (Douglas fir) timber is recommended as it is light, durable and provides good insulation. Timber of 25 or 30 mm thickness should be used. A good quality glue should be used to fasten the hives parts to each other. Galvanized nails should be used to nail the hive parts together. An entrance hole of 1.2 cm diameter should be drilled into the bottom box. The bottom board may be extended to provide a landing platform. Only the outside of the box should be painted; the bees quickly coat the inside with resin. The joints of the box may be sealed with beeswax. It is important to manufacture as durable a box as possible as the colony cannot be easily relocated to another box if the old one deteriorates. Source: The archives of the rare fruit council (1998): http://rfcarchives.org.au/Next/CaringForTrees/NativeBees9-88.htm	
		280x210	106 top 1/2				

Data from Birds Australia (2001); unless otherwise stated in the notes column.

Common name	Latin name	Internal diameter	Depth/Length	Entrance diameter	Height	ORIENTATION AND NOTES	
BIRDS							
Crimson Rosella	*Platycercus elegans*	135-240	350-800				
Eastern Rosella	*Platycercus eximus*						
Glossy Black Cockatoo	*Calyptorhynchus lathami*	300	870-1000	160x200	10	Vertical. Height based on Oxley Highway installation (Jason Berrigan pers. comm.) Can consider the use of PVC nest boxes as per those used on Kangaroo Island for Red-tailed Cockatoos (Jason Berrigan pers. comm.).	
Southern Boobook	*Ninox connivens*			150	?	Horizontal	
Long-billed Corella	*Cacatua tenuirostris*			150			
Australian Wood Duck	*Chenonetta jubata*	200	500	120		Vertical	
Pacific Black Duck	*Anas superciliosa*	450x300	120			Horizontal	
Nankeen Kestrel	*Falco cenchroides*	400	750	100	5	Vertical	
Sacred Kingfisher	*Todiramphus sanctus*	130	600-900	75	5 to 10	Horizontal: September to March	
Kookaburra	*Dacelo novaeguineae*	130-400x150-200	400-600	80-120	5 to 10	Horizontal: September to January	
Lorikeet sp.		120	600	60	5	Horizontal: August to January	
Little Lorikeet	*Glossopsitta pusilla*	25-30					
Musk Lorikeet	*Glossopsitta concinna*	25-30					
Barn Owl	*Tyto javanica*	400	700	open	5	Horizontal: autumn-spring	
Owlet Nightjar	*Aegotheles cristatus*	100-150	150-400	25-120	5	Vertical: September-December	
Striated Pardalote	*Pardalotus striatus*	90-120	120-150	25-45	5	Vertical or horizontal: July-February	
Grey Shrike-thrush	*Colluricincla harmonica*	150-200x200-300	150-300	150 (open)		Horizontal	
Welcome Swallow	*Hirundo neoxena*	130		Open	3	Horizontal	
Grey Teal	*Anus gracilis*	450x300		80-100	1.5	Vertical: all year	
Tree-creeper spp.		75-150	100-400	50-80		Vertical	
White-throated Treecreeper	*Carmobates leucophaeus*	75-100	300-400	50-70	5	Vertical: August-January	
MAMMALS							
Yellow-footed Antechinus	Antechinus flavipes			20-25			
Chocolate-wattled Bat	*Chalinolobus morio*			10			
Lesser Long-eared Bat	*Nyctophilus geoffroyi*			10			
Brushtail Possums	*Trichosurus vulpecula*	210-320	380-400	90-150	4 to 8	Vertical, seasonal use: autumn	
Squirrel Glider	*Petaurus breviceps*			60			

Source:
Port Macquarie Hastings Council (August 2014)

COMMON NAME	LATIN NAME	DIMENSIONS			MINIMUM HEIGHT	ORIENTATION AND NOTES	RECORDS/NOTES
		A (width and breadth)	B (depth)	C (entrance diameter)			
Sugar Glider	*Petaurus norfolkensis*			25-50			
Feathertail Glider	*Acrobates pygmaeus*			20-25			
Brush-tailed Phascogale	*Phascogale tapoatafa*			25-30			
Ringtail Possum	*Pseudocherius peregrinus*			60-80			
From Goldingay and Stevens 2009		Wildlife Research, 2009, 36, 81–97					
Common name	**Latin name**	**Internal diameter**	**Depth/Length**	**Entrance diameter**	**Height**	**ORIENTATION AND NOTES**	
BIRDS							
Owlet Nightjar				30-120	2 to 6	Top entry, aspect: north and south	
White-throated Treecreeper				50-80	4 to >6	Top entry, aspect: north and south	
Grey Shrike-thrush				>120	<2 to >6	Top entry, aspect: north and south	
Striated Pardalote				30-49	2 to 4	Top entry	
Crimson Rosella				50-120	<2 to >6	Top entry or spout, aspect: north and south	
Eastern Rosella				50-120	<2 to 6	Top entry, aspect: north and east	
Rainbow Lorikeet				8-120	04-Jun	Top entry, aspect: north	
Glossy Black Cockatoo				>120	>6	Top entry	
Galah				80-120	4 to 6	Top entry, aspect: south	
Chestnut Teal				>120	<2-4	Top entry	
Turquoise Parrot				50-80	<2-4	Spout	
Gould's Wattled Bat				<30-80	2 to >6	Top entry or slit below, aspect: north, south and west	
Gould's Long-eared Bat				<30	2 to 6	Slit below, aspect: north, south, east and west	
Eastern False Pipistrelle				<30	4 to >6	Top entry	
Lesser Long-eared Bat				<30-80	4 to >6	Top entry or slit below,	
Large Forest Bat				<30	4 to >6	Top entry or slit below,	
Southern Forest Bat				<30	4 to >6	Top entry or slit below,	
Chocolate Wattled Bat				<30	4 to 6	Top entry or slit below,	
White-striped Bat				<30	4 to 6	Top entry	