

Vegetation Management Plan

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Photo 1 - Typical River-flat Eucalypt Forest on site

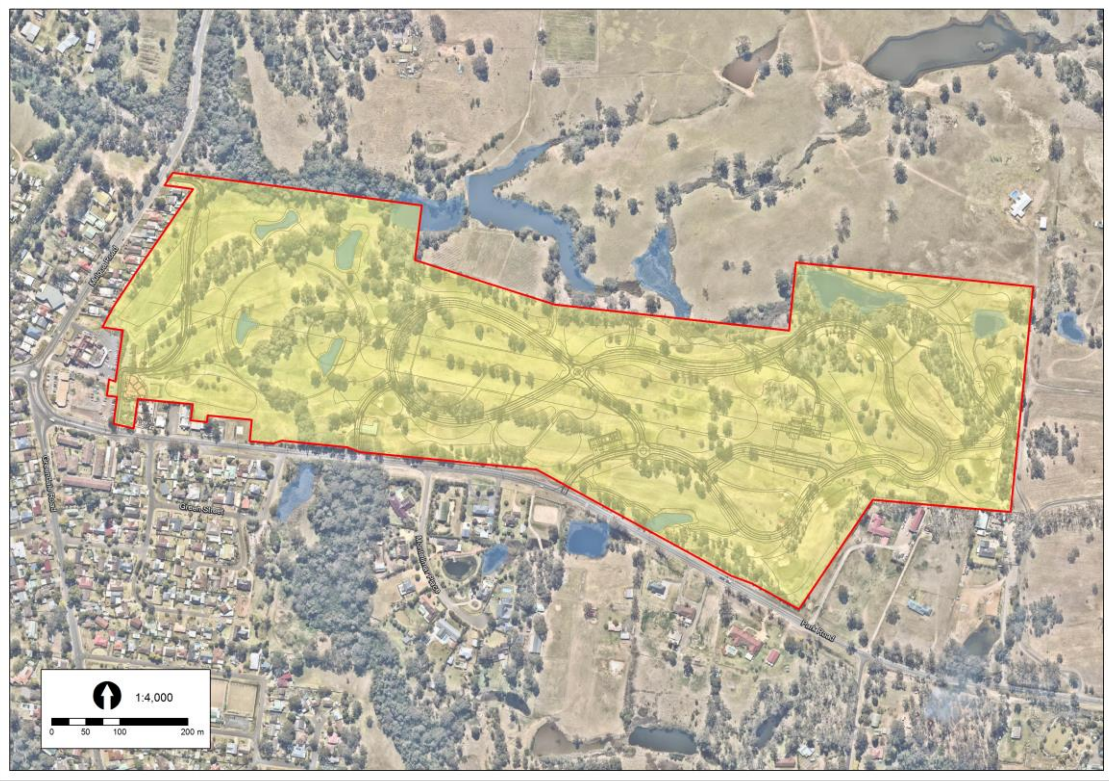


Figure 1 - Study site



Photo 2 - Typical Cumberland Plain Woodland on site

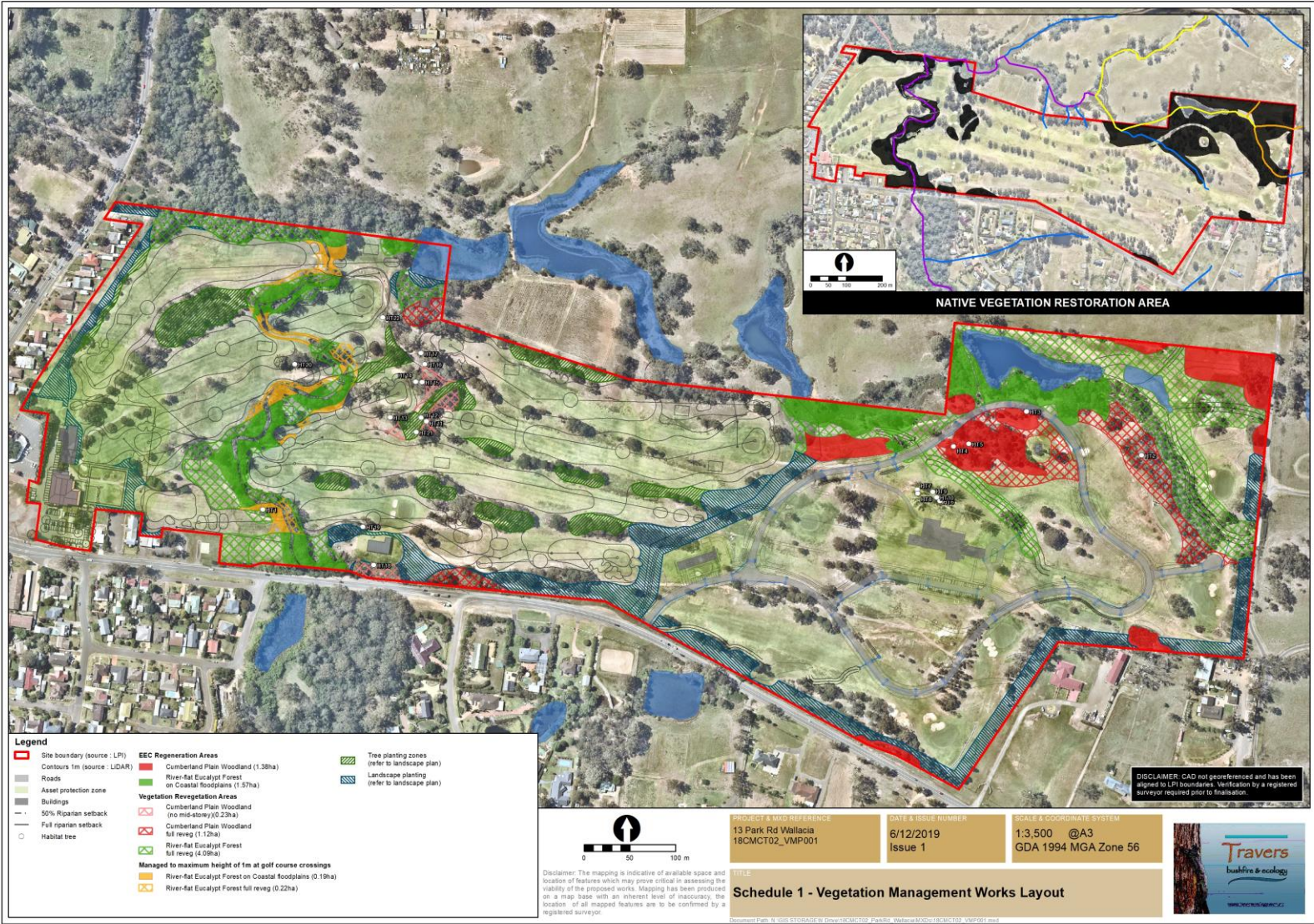


Figure 2 - Proposed site layout plan

Vegetation Management Aims

The purpose of the Vegetation Management Plan (VMP) is to define and document the actions to be implemented to protect and restore remnant vegetation, riparian areas and associated habitats within Lot 2 DP 1108408, 13 Park Road, Wallacia. The proposed development involves: (a) Redesign of the existing golf course and retention of the existing workshop / maintenance shed; (b) Alterations and additions to the existing club; (c) and the development of Nepean Memorial Park within the eastern portion of the site. This will include the construction of a multipurpose chapel and administration office, burial sites as well as the associated road network.

The aims of the VMP include:

- Retention and regeneration of existing EEC vegetation
- Revegetation of EECs and associated habitat within identified restoration areas
- Installation of permanent and temporary (for construction) fences
- Weed control within restoration areas.
- Management of hollow-bearing trees
- Enhance arboreal connectivity

Existing Vegetation

River-flat Eucalypt Forest on Coastal Floodplains (RFEF) - EEC:

Occurrence - Lower slopes along and adjacent to drainage lines and waterbodies that may be occasionally flooded.

Trees: *Eucalyptus tereticornis* (Forest Red Gum), *Casuarina glauca* (Swamp Oak), *Casuarina cunninghamiana* (River Oak), *Angophora subvelutina* (Broad-leaved Apple), *Melaleuca styphelioides* (Prickly-leaved Tea Tree), *Acacia parramattensis* (Parramatta Wattle), *Acacia decurrens* (Black Wattle) and *Melia azedarch* (White Cedar).

Shrubs: *Bursaria spinosa* (Native Blackthorn), *Solanum prinophyllum* (Forest Nightshade)

Groundcovers: *Clematis aristata* (Old Man’s Beard), *Dichondra repens* (Kidney Weed), *Juncus usitatus* (Common Rush), *Microlaena stipoides* (Weeping Grass) and *Oplismenus aemulus* (Australian Basket Grass).

Cumberland Plain Woodland (CPW) - CEEC:

Occurrence - Small patches across the site, largely along or near the northern boundary east of Jerrys Creek with smaller remnants along the southern boundary also.

Trees: *Eucalyptus tereticornis* (Forest Red Gum), *Eucalyptus moluccana* (Grey Box), *Acacia parramattensis* (Parramatta Wattle) and *Acacia decurrens* (Black Wattle)

Shrubs: *Acacia implexa* (Hickory), *Bursaria spinosa* (Native Blackthorn), *Dillwynia sieberi* (Prickly Parrot-pea), *Einadia hastata* (Berry Saltbush) and *Einadia trigonos* (Fishweed).

Groundcovers: *Aristida vagans* (Threeawn Speargrass), *Arthropodium milleflorum* (Pale Vanilla-lily), *Centella asiatica* (Swamt Pennywort), *Dichondra repens* (Kidney Weed), *Glycine clandestinum* (Twining Glycine), *Goodenia hederacea* (Ivy-leaved Goodenia), *Microlaena stipoides* (Weeping Grass), *Pseuderanthemum variabile* (Pastel Flower) and *Themeda australis* (Kangaroo Grass).

Open Waterbodies with Occasional Fringing Macrophytes:

Occurrence - There are three (3) main waterbodies on the site, and one (1) tiny one in the western portion of the site.

Vegetation: The edges of the waterbodies contain *Typha orientalis* (Cumbungi), *Persicaria* spp. (Knotweeds), *Ludwigia peploides* (Water Primrose), *Triglochin microtuberosa* (Water Ribbons) and *Eleocharis sphacelata* (Tall Spike-rush).

Ornamental and Managed Landscape (Plantings)

Occurrence - This description covers the remainder of the site to include the fairways and greens, planted vegetation between the fairways, general landscaping and revegetation.

Trees: *Sapium sebiferum* (Chinese Tallow Tree), *Photinia robusta* (Photinia), *Acer negundo* (Box Elder), *Betula pendula* (European White Birch), *Ulmus parvifolia* (Chinese Elm), *Lophostemon confertus* (Brush Box), *Liquidambar stryacaflua* (Sweet Gum), *Pinus* spp. (Pines), *Cupressus* spp. (Cypress), *Populus alba* (Poplar), *Grevillea robusta* (Silky Oak), non-endemic Eucalypts and *Melaleuca* spp. (Paperbarks), *Callistemon viminalis* (Weeping Bottlebrush), *Corymbia citriodora* (Lemon-scented Gum), *Celtis sinensis* (Chinese Hackberry), and *Araucaria cunninghamiana* (Hoop Pine).

Shrubs: absent

Groundcovers: Managed lawn

Bush Regeneration & Enrichment Planting

Areas of existing RFEF and CPW vegetation will be regenerated. This will primarily involve bush regeneration, weed control and protection from potential disturbance. Bush regeneration is likely to proceed naturally through recruitment within the existing vegetation and is likely to include enrichment native planting as advised by the project ecologist, using CPW and RFEF species.

Total area is 31400 m², comprised of 17600 m² RFEF and 13800 m² CPW. Enrichment plantings shall achieve the following densities and planting numbers:

- Canopy tree species – 1 per 250 m² (Total area of 31,400 m² = 118 units)
- Sub-canopy tree species – 1 per 250 m² (Total area of 31,400 m² = 118 units)
- Shrubs & vine species – 1 per 10 m² (Total area of 31,400 m² = 3,140 units)
- Grass & groundcover species – 1 per 1 m² (Total area of 31,400 m² = 34,400 units)

All bush regeneration works are to be undertaken by a fully qualified bush regeneration team. A minimum native species richness of 40 species must be achieved after 5 years and regenerated indefinitely within the regeneration areas. Restoration areas are to be monitored and audited by an appointed project ecologist to achieve the restoration performance targets.

Weed Control

Weed control works within the restoration areas are to be undertaken by a qualified bushland regeneration team using standard industry practice.

Regarding weeds, the *Biosecurity Act* (2015) stipulates “duties” which will fall under a general biosecurity duty and additional duties that may also fall under mandatory measure, regional recommended measure, prohibited matter or biosecurity zone. Each of these measures may have specific actions required for each weed species that can be mandatory, recommended or prohibited. The follow schedule is recommended:

- Primary (initial) weed control is to be undertaken prior to any revegetation plantings. Removal of woody weeds should be undertaken first followed by herbaceous weed control.
- Secondary weeding should be conducted in the following 3-6 months after primary weeding to remove weed regrowth or overlooked weeds.
- Maintenance weeding should be undertaken 6-12 times a year until such time as the resistance of the bushland to weeds increases, then only requiring hand weeding on a needs basis. Maintenance weeding is to be conducted for a minimum period of five (5) years after construction works have been completed.

Weed control works are to be undertaken over a minimum maintenance period of five (5) years. Weed control works are to be monitored and audited by an appointed project ecologist to achieve the restoration performance targets.

Herbicide Use

Only operators with Chemcert or equivalent training must undertake the spraying of weeds. The use of Glyphosate based herbicides is recommended in accordance with the manufacturer’s labels. Glyphosate may be utilised for cut/paint of stems and trunks, for scrape/paint of vine stems, and for use in spraying equipment at 1:100 or as per label instructions. The operator must evaluate the success of each treatment after a set period of time according to the labelled effective treatment of each species for each herbicide. Care must be taken when applying herbicides near water bodies due to the sensitivity of waterways and resident flora and fauna.

All herbicides must be applied according to the herbicide usage label and provisions of the Protection of the Environmental Operations Act (NSW).

Table 1 - Weed control methods and priorities

Scientific Name	Common Name	Control Method	Priority
<i>Cinnamomum camphora</i>	Camphor Laurel	Cut / drill and paint	High
<i>Eragrostis curvula</i>	African Lovegrass	Hand Removal / spot spray	High
<i>Lantana camara</i>	Lantana	Cut and paint	High
<i>Ligustrum sinense</i>	Small-leaved Privet	Cut and paint	High
<i>Ligustrum lucidum</i>	Large-leaved Privet	Cut / drill and paint	High
<i>Olea europaea subsp. africana</i>	African Olive	Cut and paint	High
<i>Phytolacca octandra</i>	Inkweed	Hand Removal	High
<i>Rubus fruticosus</i> sp. agg.	Blackberry Complex	Hand Removal / Slash & spray	High
<i>Cirsium vulgare</i>	Spear Thistle	Hand Removal	Medium
<i>Conyza</i> spp.	Fleabane	Hand Removal	Medium
<i>Ehrharta erecta</i>	Panic Veldtgrass	Hand Removal / spot spray	Medium
<i>Paspalum dilatatum</i>	Paspalum	Hand Removal	Medium
<i>Senecio madagascariensis</i>	Fireweed	Hand Removal	Medium
<i>Solanum mauritianum</i>	Wild Tobacco	Hand Removal	Medium
<i>Bidens pilosa</i>	Cobbler's Pegs	Do not disturb	Low
<i>Briza subaristata</i>	-	Hand Removal	Low
<i>Cyperus eragrostis</i>	Umbrella Sedge	Hand Removal	Low
<i>Hypochaeris radicata</i>	Flatweed	Hand Removal	Low
<i>Lactuca serriola</i>	Prickly Lettuce	Hand Removal	Low
<i>Solanum nigrum</i>	Blackberry Nightshade	Hand Removal	Low
<i>Trifolium repens</i>	White Clover	Hand Removal	Low

Site Preparation & Protection of Native vegetation

Prior to the commencement of construction works, the following site preparation must be undertaken:

- Install temporary construction proof fencing for all works.
- Sediment fencing should be attached to or adjacent to the construction proof fencing.
- Eliminate all potential access and deter pedestrian access from the restoration areas.
- Commence weed control of all restoration areas prior to planting works.
- Mark all trees to be removed in accordance with the approved tree retention and removal plans.
- Retained habitat trees are to be marked and protected from clearance during vegetation clearance works. Habitat trees being removed are to be dismantled by a climbing arborist and removed under supervision of the project ecologist.
- A minimum of 12 nest boxes as specified below are to be installed within the restoration areas prior to vegetation removal works under the direction of the project ecologist and according to the Nest Box Design and Installation Specifications (Pages 5 & 6).

Relocation of Tree Hollows

Habitat trees should be retained wherever possible. Habitat trees being removed are to be dismantled by a climbing arborist and removed under supervision of the project ecologist. Sections containing good quality hollows are to be retained, modified with supports and re-attached to suitable trees within the restoration areas.

Nest Box Supply

Nest boxes are to be supplied and installed within the restoration areas under the direction of the project ecologist. A total minimum of 12 nest boxes are to be installed in accordance with the Nest Box Design and Installation Specifications (Pages 5 & 6). A minimum of 10 nest boxes suitable for hollow-roosting microbats are to be installed. The remaining nest boxes should be a mix of large, medium and small boxes suitable for forest owls, possums and general birds. The approximate location for nest box installation is shown in Schedule 1 (Page 4) and design is to be in accordance with the Nest Box Design and Installation Specifications (Pages 5 & 6).

Lot 2 DP 1108408
13 Park Road, Wallacia
18CMCT02

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Vegetation Management Specifications

Fully Structured Revegetation Specifications

Table 1 provides a revegetation species list. Only locally occurring native species are to be used in revegetation works commensurate with Cumberland Plain Woodland (CPW), on non-floodplain areas, and River-flat Eucalypt Forest (RFEF), in floodplain areas adjacent to watercourses. Native macrophyte species are to be used in enrichment planting surrounding the proposed detention basins. If other species are utilised, these are to be approved by the project ecologist. All plants utilised for restoration are to be sourced from the local area with a local provenance certificate. A minimum of 30 native species shall be used as part of the revegetation works.

Revegetation within the CPW and RFEF restoration areas is to achieve fully structured revegetation in the entire area and shall achieve the following densities and planting numbers over a total area of 56,600 m² (43,100 m² RFEF + 13,500 m² CPW):

- Canopy tree species – 1 per 50 m² (Total area of 56,600 m² = 1,088 units)
- Sub-canopy tree species – 1 per 30 m² (Total area of 56,600 m² = 1736 units)
- Shrubs & vine species – 1 per 10 m² (Total area of 56,600 m² = 5430 units)
- Grasses, groundcovers, sedges and rushes – 4 per 1 m² (Total area of 54,400 m² = 258,500 units)
- Grasses, groundcovers, sedges and rushes – 6 per 1 m² (Total area of 2,200 m² = 13,200 units) Note: The higher density of ground layer plantings is to occur in the riparian zone (RFEF planting) where shrubs plantings are to be kept to 1m tall (0.22ha area)

All installed plantings are to be protected with a 2 L cardboard box or plastic guards to protect from grazing animals such as kangaroos and rabbits. Pindone rabbit baiting is to be undertaken throughout the entire maintenance period as directed by the project ecologist with approximately 3 baiting sessions per year.

It is expected that at least 85% of plantings will survive. If the success rate is less than this, supplementary planting will be required. All plant maintenance is to be undertaken over a 5 year minimum period. Contingency planting of up to 20% is to be included within the contracted works to be utilised for any loss of plant stock.

Enrichment planting within bush regeneration zones is specified on page 2 of 7 (Bush Regeneration & Enrichment Planting)

Temporary and Permanent Fencing

Temporary construction proof fencing (1.8 m high) is to be installed around all work areas. A temporary 1.2 m rural fence is to demarcate the native vegetation restoration area (Schedule 1 - Vegetation Management Works). This fencing shall remain in place until all construction works are completed and plantings have established and is only to be moved under the direction of the project ecologist.

Permanent fencing is to be installed in selected areas to be identified at a later stage. The posts are to be galvanised metal or non-combustible, include at a minimum a 5 strands of plain wire. Barb wire is not to be installed at any time. The permanent fence is to be retained and maintained in good condition at all times in perpetuity.

Project Management, Reporting and Auditing

The flowing project management tasks are to be undertaken.

1. Engagement of qualified and experienced bushland regeneration contractors.
2. All plant stock is to be certified as local provenance from the supplier, with preference for seeds collected from similar community types.
3. All weed control works and planting are to be undertaken by a qualified bushland regenerator / contractor.
4. Engagement of a project ecologist to undertake auditing, reporting and compliance certification.
5. Photo points and monitoring quadrats are to be set up at the beginning of contract work monitored at least annually for 5 years.
6. A compliance statement is to be submitted to Council upon completion of the revegetation works (1 year) and at the end of the 5 year maintenance period assessing compliance with the stipulated restoration performance targets.

Restoration Performance Targets

The following restoration performance targets are to be audited and compliance certificate issued by the project ecologist demonstrating satisfactory completion of the works in the Vegetation Management Plan.

1. Installation and maintenance of temporary and permanent protection fencing, as well as sediment and erosion control items as specified by the project ecologist.
2. The coverage of the weeds is to not be any greater than 10% after 3 years and 5% after 5 years as determined by the project ecologist.
3. Planting in within the restoration areas includes planting of approximately 1,206 canopy trees, 1,854 sub-canopy trees, 8,570 shrubs/vines and 303,100 groundcovers/sedges/rushes, covering 32.5 ha.
4. Minimum of 30 native, locally occurring species are to be utilised in the revegetation works. The provenance of the tube stock or plantings shall be provided to the project ecologist for certification purposes. Species should be chosen from Table 1 or alternatives as approved by the project ecologist.
5. Any failed plantings are to be replaced during the 5 year maintenance period (20% contingency plantings).
6. A minimum of 12 nest boxes of various sizes and types are to be installed in accordance with the Nest Box Specifications and Installation Plan.
7. Improved diversity and density of native vegetation in all restoration areas.

Monitoring Locations

Monitoring of the progress of weed removal, plant growth and natural regeneration is to be undertaken within the restoration areas. A minimum of ten monitoring quadrats are to be to be established at the commencement of restoration works and then monitored every year for 5 years, with annual progress reports to be submitted to Wollondilly Council. The suggested location of these quadrats is identified in Schedule 1.

Monitoring activities will include:

1. A photographic record for comparative purposes taken on an annual basis.
2. A minimum of thirteen (13) nested flora quadrats are to be undertaken within the restoration areas to assess the achievement of the performance targets. The quadrats are to be placed in representative locations and are to be a minimum outer dimension of 5x5 m with a 1 m² internal nested quadrat. These quadrats should capture all of the different Revegetation and Restoration types.
3. An overall vegetation condition map based on standard bush regeneration vegetation condition assessment methodology.

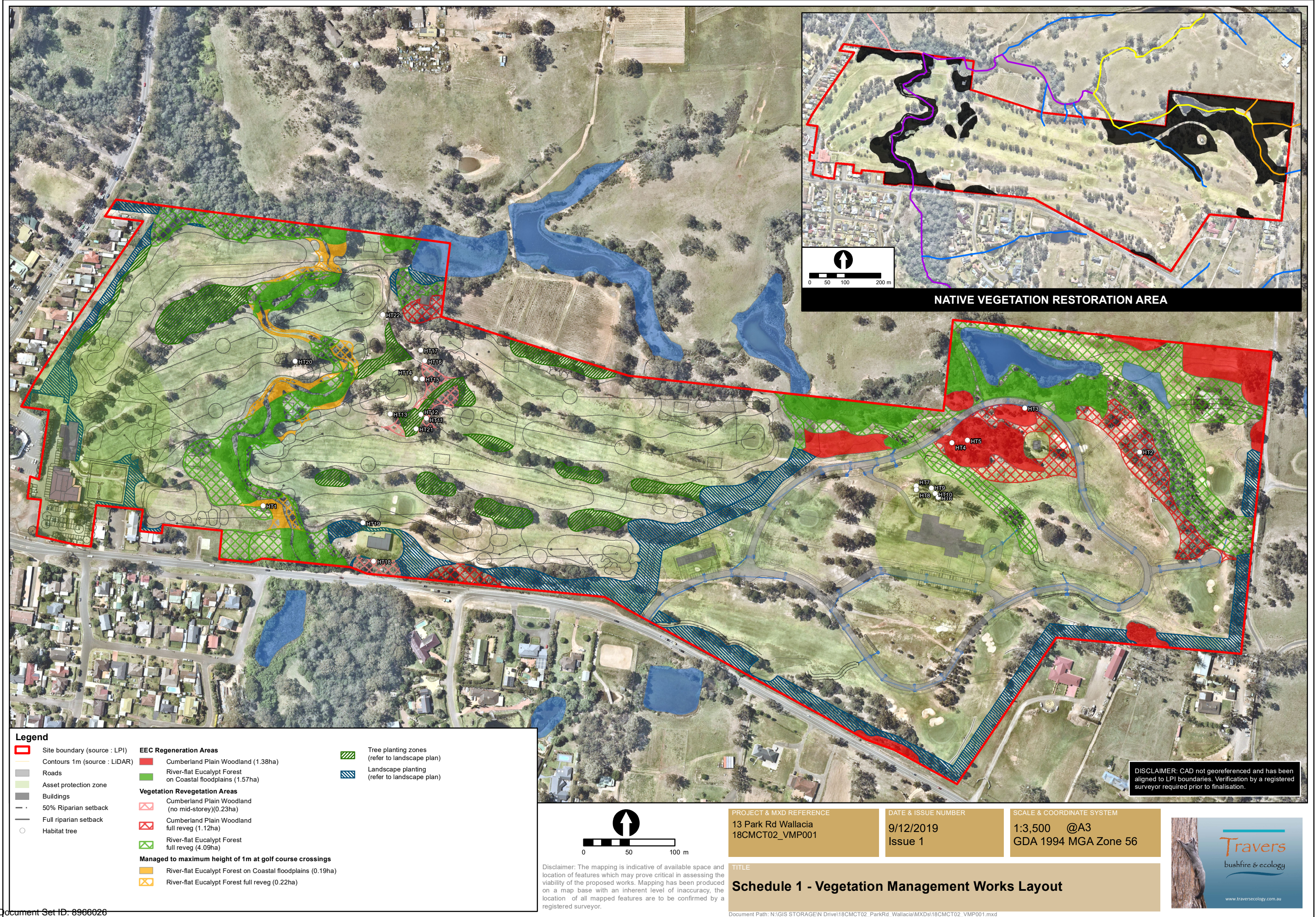


Photo 3 - Open water body on site surrounded by River-flat Eucalypt Forest (left) and fringing macrophytes

Revegetation Species List

Note: Any variation to the revegetation list below is to be approved by the project ecologist.

Table 1 – Recommended Revegetation Species List			
Scientific name	Common name	CPW	RFER
Canopy Trees 1 per 50 m ² or 1 per 250 m ²			
<i>Acacia parramattensis</i>	Sydney Green Wattle	✓	✓
<i>Angophora subvelutina</i>	Broad-leaved Apple		✓
<i>Casuarina cunninghamiana</i>	River Oak		✓
<i>Casuarina glauca</i>	Swamp Oak		✓
<i>Eucalyptus amplifolia</i>	Cabbage Gum	✓	✓
<i>Eucalyptus crebra</i>	Narrow-leaved Ironbark		✓
<i>Eucalyptus fibrosa</i>	Broad Leaved Ironbark		✓
<i>Eucalyptus moluccana</i>	Grey Box	✓	✓
<i>Eucalyptus paniculata</i>	Grey Ironbark		✓
<i>Eucalyptus tereticornis</i>	Forest Red Gum	✓	✓
<i>Eucalyptus viminalis</i>	Manna Gum		✓
<i>Melaleuca decora</i>	White Feather Honey Myrtle		✓
Sub-canopy Trees 1 per 30 m ² or 1 per 250 m ²			
<i>Acacia implexa</i>	Hickory wattle	✓	
<i>Acacia parramattensis</i>	Sydney Green Wattle	✓	✓
<i>Angophora floribunda</i>	Rough-barked Apple	✓	✓
<i>Backhousia myrtifolia</i>	Grey Myrtle	✓	✓
<i>Melaleuca linearifolia</i>	Snow-in-summer		✓
<i>Melaleuca nodosa</i>	Ball Honey Myrtle	✓	
<i>Melaleuca stypheloides</i>	Prickly-leaved Tea Tree	✓	
Shrubs 1 per 10 m ²			
<i>Acacia floribunda</i>	White Sally	✓	
<i>Acacia implexa</i>	Hickory Wattle		✓
<i>Breynia oblongifolia</i>	Coffee Bush	✓	✓
<i>Bursaria spinosa</i> subsp. <i>spinosa</i>	Native Blackthorn	✓	✓
<i>Callistemon salignus</i>	Willow Bottlebrush		✓
<i>Daviesia ulicifolia</i>	Gorse Bitter Pea		✓
<i>Dillwynia sieberi</i>	Prickly Parrot-pea		✓
<i>Dodonaea viscosa</i> subsp. <i>cuneata</i>	Wedge-leaf Hop-bush	✓	
<i>Pultenaea microphylla</i>	Egg and bacon pea	✓	
Grasses / Groundcovers (various densities)			
<i>Aristida vagans</i>	Three-awn Speargrass		✓
<i>Centella asiatica</i>	Swamp Pennywort	✓	✓
<i>Commelina cyanea</i>	Scurvy Weed	✓	✓
<i>Cymbopogon refractus</i>	Barbwire Grass	✓	✓
<i>Dianella caerulea</i>	Blue Flax-lily		✓
<i>Dichondra repens</i>	Kidney Weed	✓	✓
<i>Doodia aspera</i>	Prickly Rasp Fern	✓	
<i>Echinopogon caespitosus</i>	Bushy Hedgehog-grass	✓	✓
<i>Einadia hastata</i>	Berry Saltbush	✓	✓
<i>Entolasia marginata</i>	Bordered Panic	✓	✓
<i>Geranium homeanum</i>	Northern Cranesbill		✓
<i>Geranium solanderi</i>	Cutleaf Cranesbill	✓	✓
<i>Imperata cylindrica</i>	Blady Grass	✓	✓
<i>Lomandra longifolia</i>	Spiky-headed Mat-rush	✓	✓
<i>Microlaena stipoides</i>	Weeping Grass	✓	✓
<i>Oplismenus aemulus</i>	Basket Grass	✓	✓
<i>Oxalis perennans</i>	Yellow-flowered Wood Sorrel	✓	✓
<i>Persicaria decipiens</i>	Slender Knotweed	✓	
<i>Philydrum lanuginosum</i>	Woolly Frogmouth		✓
<i>Pratia purpurascens</i>	Whiteroot	✓	✓
<i>Pseuderanthemum variabile</i>	Pastel Flower		✓
<i>Pteridium esculentum</i>	Bracken	✓	
<i>Rytidosperma tenuius</i>	Wallaby Grass		✓
<i>Solanum prinophyllum</i>	Forest Nightshade		✓
<i>Veronica plebeia</i>	Creeping Speedwell	✓	✓
<i>Viola hederacea</i>	Ivy-leaved Violet	✓	
Sedges / Rushes 6 per m ²			
<i>Baumea articulata</i>	Jointed Twig-Rush		✓
<i>Baumea juncea</i>	-		✓
<i>Carex appressa</i>	Tall Sedge		✓
<i>Cyperus gracilis</i>	Slender Flat Sedge		✓
<i>Eleocharis sphacelata</i>	Tall Spike-rush		✓
<i>Ficinia nodosa</i>	Knobby Club-rush		✓
<i>Gahnia clarkei</i>	Tall Saw-sedge		✓
<i>Isolepis inundata</i>	Swamp Club-rush		✓
<i>Juncus usitatus</i>	Common Rush		✓
<i>Schoenoplectus mucronatus</i>	River Club-rush		✓
Vines 1 per 10m ²			
<i>Einadia nutans</i> subsp. <i>linifolia</i>	Climbing Saltbush		✓
<i>Glycine clandestina</i>	Twining Glycine	✓	✓
<i>Glycine tabacina</i>	Twining Glycine	✓	✓
<i>Hardenbergia violacea</i>	False Sarsparilla	✓	✓



Site boundary (source : LPI)

Contours 1m (source : LIDAR)

Roads

Asset protection zone

Buildings

50% Riparian setback

Full riparian setback

Habitat tree

EEC Regeneration Areas

Cumberland Plain Woodland (1.38ha)

River-flat Eucalypt Forest on Coastal floodplains (1.57ha)

Vegetation Revegetation Areas

Cumberland Plain Woodland (no mid-storey)(0.23ha)

Cumberland Plain Woodland full reveg (1.12ha)

River-flat Eucalypt Forest full reveg (4.09ha)

Managed to maximum height of 1m at golf course crossings

River-flat Eucalypt Forest on Coastal floodplains (0.19ha)

River-flat Eucalypt Forest full reveg (0.22ha)

Tree planting zones (refer to landscape plan)

Landscape planting (refer to landscape plan)

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

PROJECT & MXD REFERENCE

13 Park Rd Wallacia
18CMCT02_VMP001

DATE & ISSUE NUMBER

9/12/2019
Issue 1

SCALE & COORDINATE SYSTEM

1:3,500 @A3
GDA 1994 MGA Zone 56

TITLE

Schedule 1 - Vegetation Management Works Layout

Document Path: N:\GIS STORAGE\N Drive\18CMCT02_ParkRd_Wallacia\MXD\18CMCT02_VMP001.mxd

DISCLAIMER: CAD not georeferenced and has been aligned to LPI boundaries. Verification by a registered surveyor required prior to finalisation.

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Version: 1, Version Date: 17/12/2019

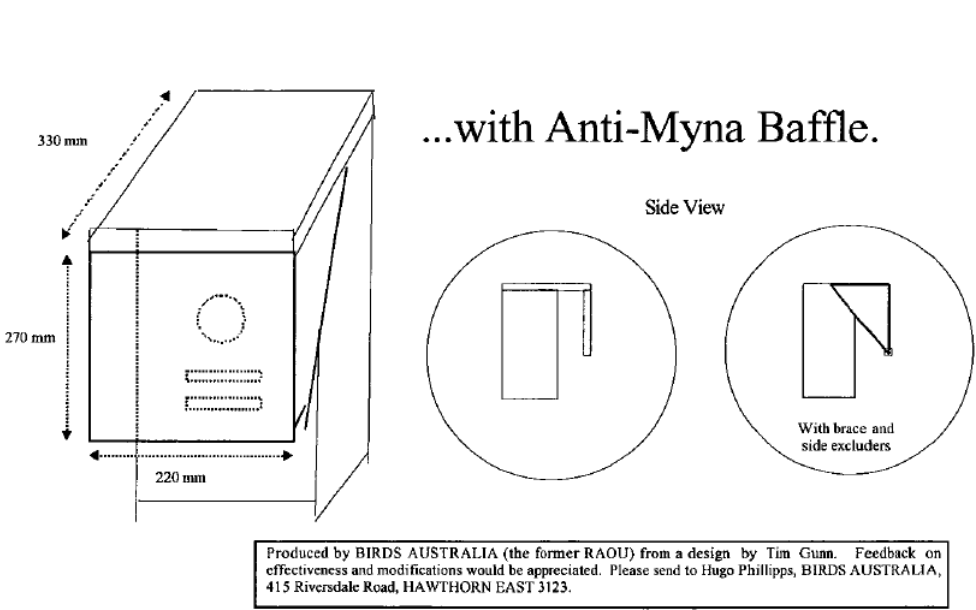
Nest Box Design Specifications

The following nest box designs are provided by *Travers bushfire & ecology* as a guide for construction purposes.

- Timber is to be of high grade structural ply approximately 15 mm thick.
- The lid is to be hinged at the rear side of the box that is affixed to the tree to allow internal inspections from the front side. Lids are to be well sloped to the front to allow runoff by rain. Hinges are to be robust and made of brass, stainless steel or galvanised. Lids are to be larger than the overall cross sectional size of the box and placed so that a small eave exists on all sides to prevent entry of rain.
- Two vertical timber supports (approximately 30x30mm timber strips 150 mm apart) are to be attached down the rear face of the box so that there are two points of attachment to the trunk on a curved surface and the box does not rock in the wind. This will also provide easy attachment points to the trees without having to screw through the inside of the box. These are to be made of treated pine and any screws into this (for hinges etc.) should be treated pine or stainless. Holes at both ends of both supports are to be predrilled for easy attachment to trees. Timber supports should not be placed directly onto the box but with small timber spacers so that an eave is permissible along this side of the roof.
- Boxes to be constructed for a target species. Recommended dimensions of nest boxes for select fauna species are supplied in Table 1 below. Entry holes are best placed in the front for birds or the sides for arboreal mammals.
- For bird boxes, an anti-myna baffle (illustrated below) or steeply sloped roof with side excluders should be placed to prevent direct front access to the entry hole. Bird boxes should allow the wall to be climbed from the entry hole down to the base. This may be achieved by depth controlled saw cuts, robust matting or a ladder. Boxes with anti-myna baffle may require the same placed below the hole on the external front.
- Joints are to be glued and screwed for strength. Glue should be labelled as non-toxic wood glue.
- All fasteners used are to be weather resistant stainless steel, galvanised or other. Screws into the treated pine supports are to be stainless steel or treated pine screws.
- All fasteners for tree attachment are to be supplied (stainless steel or treated pine coach screws). These are to be a suitable gauge depending the size of bow and suitable length to pass through the vertical timber supports, through the bark and cambium, and into a sufficient extent of heartwood. Heartwood penetration will depend on the size of the box. Screws for small boxes should extend a minimum of 20mm into the heartwood of hardwood eucalypts and medium boxes ~40mm. All boxes are to be screwed so that a small distance for growth exists between the timber supports and the trunk. This can be achieved with a small stainless sleeve over the screw.
- 5 mm drainage holes are to be drilled in each corner at the base.
- Exterior of the boxes (including treated pine supports) are to be painted with a primer and then a minimum of two coats of external non-alcohol based acrylic paint. The colour selected should be consistent with the colour of the recipient trunk and therefore recipient trees should ideally be prior selected.

Attachment Method

Travers bushfire & ecology generally recommends that the boxes should be fixed with robust stainless steel or treated pine coach screws that penetrate through the cambium and into the heartwood of the tree to ensure a very secure attachment. Any other method of attachment selected should also ensure the box is secured to prevent movement or fall and allows for the future growth of the tree without any cambium constriction over the complete life of the box.



Anti-Myna Baffle
(Sourced from Birds Australia Information Sheet No.5 – 30 July 2001).

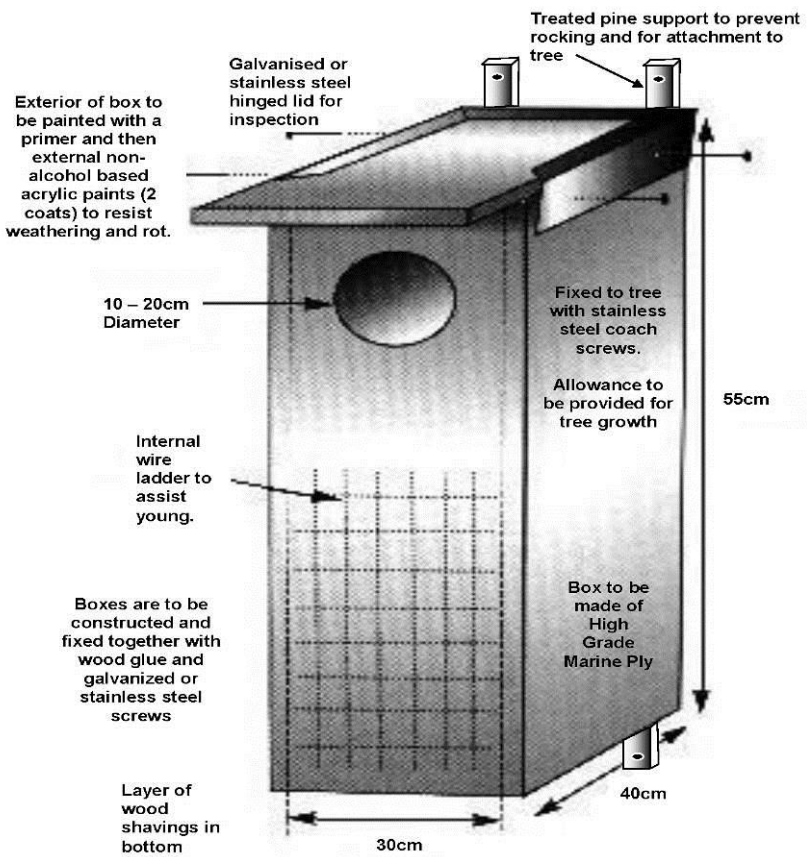
Placement of Nest Boxes

Refer to the nest box installation plan (Figure 2) for installation locations. The following guidelines are to be followed for installation on the nominated trees.

- Choose larger and more mature the recipient trees placed on the trunk greater than 6m in height. Generally place nest boxes as high as possible bird boxes (including owls). Gliders and microbat boxes may be placed lower but a high as possible out of standard ladder reach.
- Place away from continual direct mid-day summer sun on the edge of clearings and preferably on the southern side of the trunk.
- Place with large entry holes away from any prevailing winds when close to open water-bodies. Protect entries from strong southerly winds close to the ocean and contrastingly cool-hot westerly winds in different seasons.
- Attached box securely so that they do not shift or shake in response to strong winds or being knocked by the movements of heavier animals, e.g. possums and goannas.
- To make boxes inaccessible to cats and rats or to also assist target species by exclusion of possums, the base of trunk or branches may also require the placement of tree guards or exclusion collars.
- Boxes should ideally be placed accessible for management but concealed from interference.

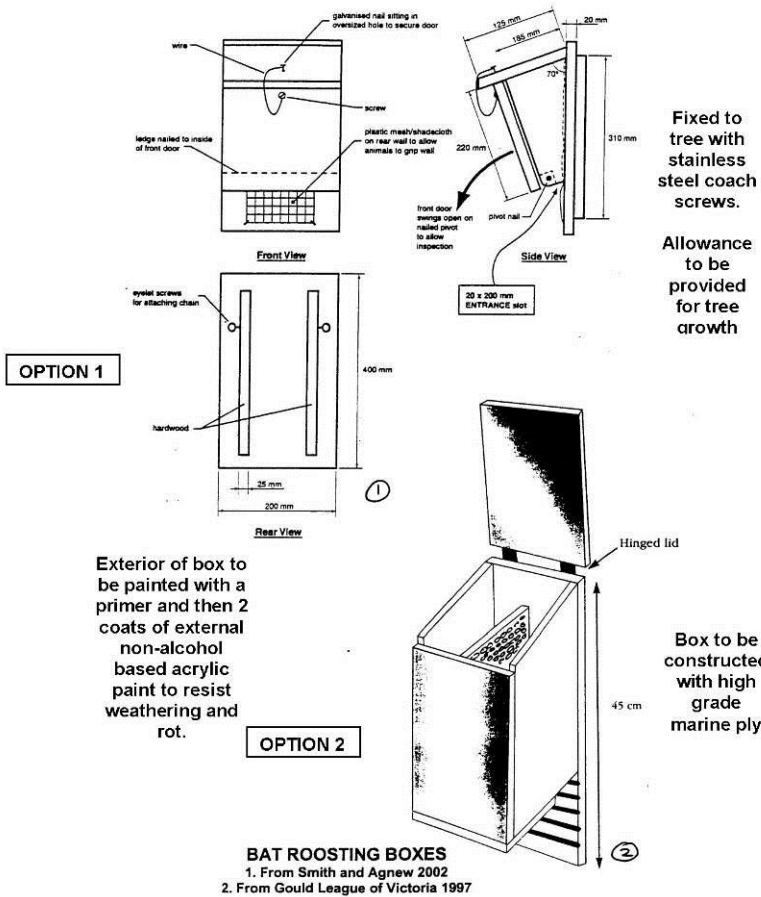


Typical non-painted microbat boxes screwed into Trees



Example 1 - DIMENTIONS APPLIED FOR A LARGE PARROT
ROOSTING / NESTING BOX

Note: Small parrot nest boxes will require a reduced entry hole size of 5 – 10cm in diameter



DESIGN 3 - MICROBAT NEST BOX DETAIL (Option 1 & 2)
Note: Alternative designs available for alternative mounts

Nest box dimensions for typical fauna

The following internal and external dimensions are recommended for the list of species. In choosing the ideal size boxes and openings the advice of an experienced Restoration Ecologist is to be sought

Table 2 - Recommended Nest Box Dimensions for typical fauna
(Source: Birds Australia Supplement No. 5 – Nest Boxes for Natives)

SPECIES	INT DIAM	DEPTH/LENGTH	ENT DIAM	VERT/HOR	HEIGHT	SEASON	REF
Antechinus, Yellow-footed	-	-	20-25 mm	-	-	-	Trainor (1995)
Bat sp.	70-100 x 150-240 mm	200-250 mm	15-20 mm slit	v	-	-	BFNC (n.d.)
Bat, Chocolate Wattled	-	-	10 mm slit	-	-	-	Trainor (1995)
Bat, Gould's Wattled	-	-	10 mm slit	-	-	-	Trainor (1995)
Bat, Lesser Long-eared	-	-	10 mm slit	-	-	-	Trainor (1995)
Black-Cockatoo, Glossy	300 mm	870-1000 mm	160 x 200 mm	v	-	-	Pedler (1996)
Boobook, Southern	-	-	150 mm	h	-	-	Trainor (1995)
Brushtail-Possum sp.	320 mm	400 mm	120-150 mm	v	4-8 m	Autumn	MZES (n.d.)
Brushtail-Possum sp.	210 x 240 mm	380 mm	c.120 mm	v	-	-	RSPCA (n.d.)
Brushtail-Possum sp.	-	-	90 mm	-	-	-	Trainor (1995)
Cockatoo, Sulphur-crested	-	-	150 mm	v	-	-	Trainor (1995)
Corella, Little	-	-	150 mm	-	-	-	Trainor (1995)
Corella, Long-billed	-	-	150 mm	-	-	-	Trainor (1995)
Duck, Australian Wood	200 mm	500 mm	120 mm	v	-	-	Trainor (1995)
Duck, Pacific Black	450 x 300 mm	-	120 mm	-	-	-	Elliot (1994)
Duck, Pacific Black	-	-	120 mm	h	-	-	Trainor (1995)
Duck, Pink-eared	-	-	-	-	-	-	Elliot (1994)
Galah	200 mm	650 mm	120 mm	v	6 m	Aug-Nov	Adams (1980)
Galah	200 mm	650 mm	120 mm	v	6 m	Sep-Jan	MZES (n.d.)
Galah	-	-	150 mm	-	-	-	Trainor (1995)
Glider, Feather-tailed	-	-	20-25 mm	-	-	-	Trainor (1995)
Glider, Squirrel	-	-	60 mm	-	-	-	Trainor (1995)
Glider, Sugar	250 mm	300 mm	50 mm	v	4-8 m	Jun-Dec	MZES (n.d.)
Glider, Sugar	200 mm	450 mm	35-40 mm	v	-	-	BFNC (n.d.)
Glider, Sugar	-	-	25-30 mm	-	-	-	Trainor (1995)
Kestrel, Nankeen	400 mm	750 mm	100 mm	v	5 m	Aug-Nov	Adams (1980)
Kingfisher, Sacred	130 mm	600-900 mm	75 mm	h	5-10 m	Sep-Mar	Adams (1980)
Kookaburra sp.	300 mm	500 mm	>130 mm	h	5-10 m	Sep-Jan	Adams (1980)
Kookaburra sp.	400 mm	-	130 mm	h	5-10 m	Sep-Jan	MZES (n.d.)
Kookaburra sp.	300 x 150-200 mm	600 mm	open	h	-	-	BFNC (n.d.)
Kookaburra, Laughing	150-300 mm	>400 mm	80-120 mm	h	-	-	Elliot (1994)
Kookaburra, Laughing	-	-	120 mm	h	-	-	Trainor (1995)
Lorikeet sp.	120 mm	600 mm	60 mm	h	5 m	Aug-Jan	Adams (1980)
Lorikeet, Little	-	-	25-30 mm	-	-	-	Trainor (1995)
Lorikeet, Musk	-	-	25-30 mm	-	-	-	Trainor (1995)
Lorikeet, Purple-crowned	-	-	25-30 mm	-	-	-	Trainor (1995)
Owl, Barn	400 mm	750 mm	open	h	5 m	Aut-Spr	Adams (1980)
Owl, Barn	-	-	150 mm	h	-	-	Trainor (1995)
Owlet-nightjar, Australian	100-150 mm	300-350 mm	60-80 mm	v	5 m	Sep-Dec	Adams (1980)
Owlet-nightjar, Australian	150 mm	>150 mm	70-120 mm	v	-	-	Elliot (1994)
Owlet-nightjar, Australian	150 mm	400 mm	50 mm	v	-	Sep-Dec	BFNC (n.d.)
Owlet-nightjar, Australian	-	-	40 mm	-	>5 m	-	Trainor (1995)
Owlet-nightjar, Australian	-	-	25-30 mm	-	-	-	Trainor (1995)
Pardalote sp.	120 mm	400-500 mm	30-45 mm	h	5 m	Jul-Jan	Adams (1980)
Pardalote sp.	120 mm	450 mm	30-45 mm	h	5 m	Jul-Jan	MZES (n.d.)
Pardalote, Striated	200 x 120-150 mm	-	25-35 mm	v/h	-	-	Elliot (1994)
Pardalote, Striated	90 x 120-140 mm	200 mm	30 mm	h	-	Aug-Feb	BFNC (n.d.)
Parrot, Red-rumped	100 mm	600 mm	75 mm	v/h	5 m	Aug-Jan	Adams (1980)
Parrot, Red-rumped	100-150 mm	400 mm	70-120 mm	h	-	-	Elliot (1994)
Parrot, Red-rumped	200-240 mm	400 mm	60-70 mm	v	-	-	BFNC (n.d.)
Parrot, Red-rumped	-	-	25-30 mm	-	-	-	Trainor (1995)
Phascogale, Brush-tailed	-	-	25-30 mm	-	-	-	Trainor (1995)
Ringtail-Possum sp.	250 mm	350 mm	80 mm	v	4-8 m	Apr-Nov	MZES (n.d.)
Ringtail-Possum sp.	250 mm	400 mm	60-80 mm	v	-	Mar-Nov	BFNC (n.d.)
Ringtail-Possum sp.	-	-	90 mm	-	-	-	Trainor (1995)
Rosella sp.	120-150 mm	>400 mm	70-120 mm	-	-	-	Elliot (1994)
Rosella sp.	150-200 mm	350-800 mm	75-100 mm	v/h	5 m	Aug-Jan	MZES (n.d.)
Rosella sp.	c.130 x 180 mm	c.400 mm	80 mm	v	-	-	Morrison (1996)
Rosella, Crimson	150-200 mm	350-800 mm	75-100 mm	v/h	5-6 m	Sep-Jan	Adams (1980)
Rosella, Eastern	135-150 mm	350-800 mm	75-100 mm	v/h	5-6 m	Aug-Jan	Adams (1980)
Rosella, Eastern	240 mm	400 mm	70 mm	v	-	-	BFNC (n.d.)
Rosella, Eastern	-	>500 mm	60 mm	-	>5 m	-	Trainor (1995)
Shrike-thrush, Grey	150-200 mm	200-300 mm	150 mm	-	-	-	Elliot (1994)
Shrike-thrush, Grey	150-200 x 200-300 mm	150-200 mm	open	h	-	-	BFNC (n.d.)
Swallow, Welcome	130 mm	-	open	h	3 m	Aug-Dec	Adams (1980)
Teal, Chestnut	200-400 mm	450-750 mm	100-120 mm	v	1.5 m	Sep-Dec	Adams (1980)
Teal, Chestnut	450 x 300 mm	-	80-100 mm	-	-	-	Elliot (1994)
Teal, Grey	200-400 mm	450-750 mm	100-120 mm	v	1.5 m	All year	Adams (1980)
Teal, Grey	450 x 300 mm	-	80-100 mm	-	-	-	Elliot (1994)
Teal, Grey	-	-	90 mm	-	-	-	Trainor (1995)
Treecreeper sp.	90-150 mm	100-150 mm	50-80 mm	v	-	-	Elliot (1994)
Treecreeper sp.	150 mm	400 mm	50 mm	v	-	-	BFNC (n.d.)
Treecreeper, White-throated	75-100 mm	300-400 mm	50-70 mm	v	5 m	Aug-Jan	Adams (1980)

Nest type, quantity & location

Relocated hollows and nest boxes are to be placed through the study area adjacent to the riparian habitats and in larger remaining woodland / forest remnants under the guidance of a fauna ecologist

A total of 12 nest boxes of the following specified types are to be reinstalled onto existing trees within restoration area shown on Figure 3 – Nest Box Installation Plan. The 12 nest boxes are to include a minimum of:

- 2 small nest boxes
- 2 large nest boxes
- 8 microbat boxes

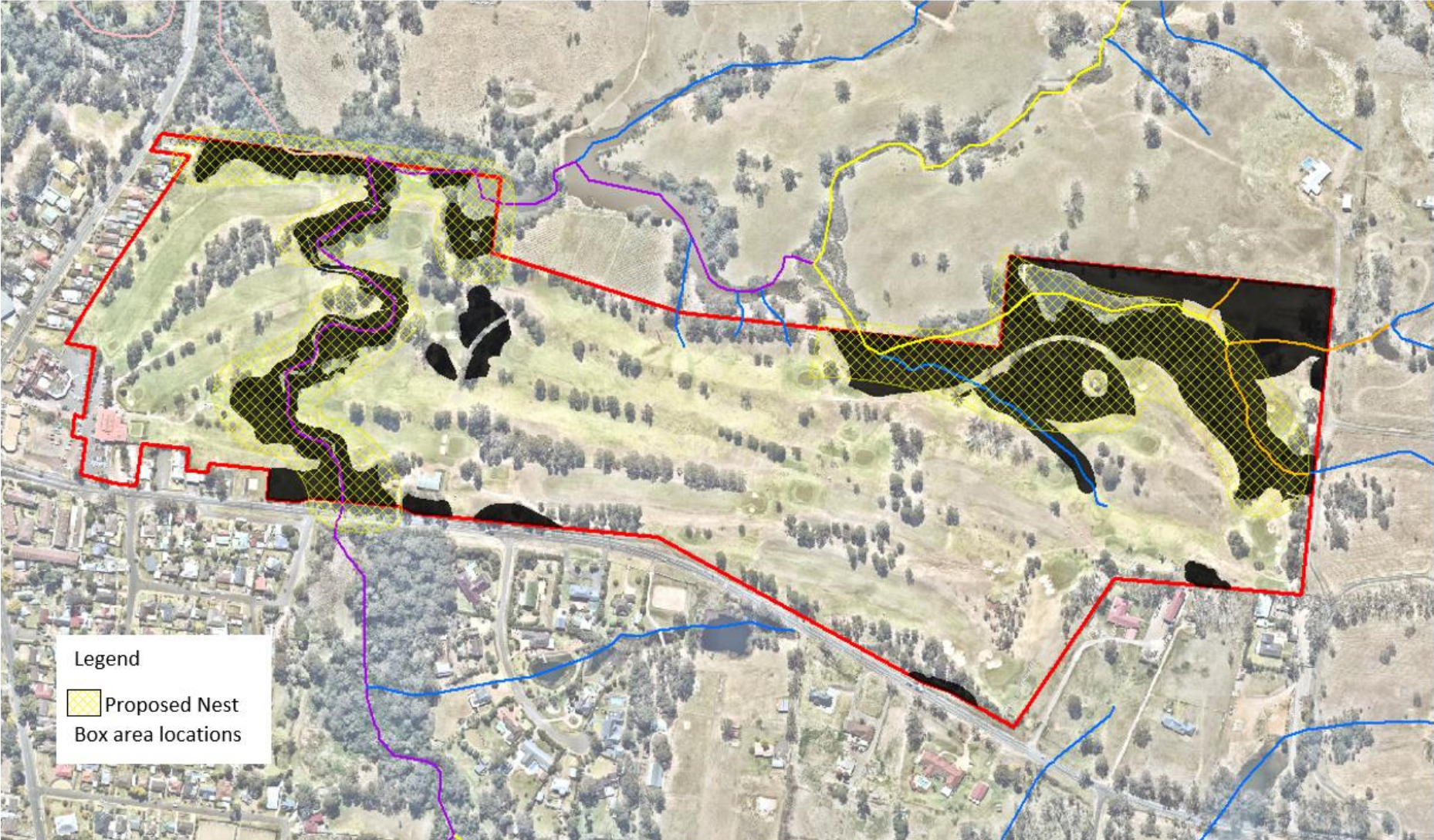


Figure 3 - Nest Box Installation Plan



Lot 2 DP 1108408 & Lot 512 DP 1079728
13 Park Road, Wallacia
18CMCT02

06/12/2019
Issue 1

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Nest Box Installation Plan

