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Ecological Restoration Strategy for the Cape Paterson Ecovillage Site

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1.0 INTRODUCTION

1.1 Background

The Cape Paterson Ecovillage project is a joint venture between Brendan Condon and Mike O'Mullane that is proposing to construct an Ecovillage to the west of the township of Cape Paterson. This report has been produced as a background document to provide an outline of how Australian Ecosystems intends to restore, revegetate and manage indigenous vegetation on the proposed Cape Paterson Ecovillage Site (CPES). It also makes recommendations for restoration of the adjacent Bunurong Coastal Reserve (BCR).

It incorporates findings from studies done by Neville Rosengren of the areas geomorphological significance and by Ecology Australia of the areas ecological significance. These studies were conducted to identify any constraints to development on the CPES and to make recommendations as to how ecological and geomorphological impacts could be minimised. Relevant sections of these reports are summarised where appropriate.

1.2 Study Area

1.2.1 Location

Cape Paterson is situated seven kilometres south of Wonthaggi, in Bass Shire. The Subject Land proposed for development covers 40 hectares on the western margins of the Cape Paterson township, with Seaward Drive and Wilsons Road forming the northern and western boundaries respectively (refer to Landscape Development Plan 7, page 5). The Bunurong Coastal Reserve (BCR) which abuts the southern boundary extends east to Harmers Haven and west to Wreck Creek, three km west of Inverloch (Bedggood et al 2005).

LEGEND

1 Heathland revegetation
2 Modified fuel buffer
3 Local parks
4 Pocket parks
5 Ornamental streetscape planting
6 Wetland
7 Drainage line
8 Community garden precinct
9 Village green/amphitheatre
10 Sports precinct
11 Playground

07 LANDSCAPE DEVELOPMENT PLAN

Title
Seaward Drive
Cape Paterson

Address
22.02.2012

Date
Scale 0 20 40 60 80 100 m

Orientation

Cape Paterson ecovillage

1.2.2 Physiography

Rosengren, (2005) states that *much of the landscape has the appearance of dune topography with crenulate and sub-parallel ridges reflecting their aeolian origin, but these have also been reshaped by slope failure, hillside creep and surface wash. The irregular topography includes shallow, enclosed and semi-enclosed depressions of impeded drainage. Perched water tables occur on impermeable horizons that are either clay deposits or fine sands locally cemented by weathering residues of carbonate or iron.*

The Ecovillage site is an undulating low plateau between 27 to 30 metres elevation with internal local relief approximately 10 metres. There are two groups of locally steep slopes - an east-facing set along the south and central part of the site and a south-facing set along the southern margin. These slopes converge to the south east enclosing a broad south-facing depression in the Coastal Reserve crossed by narrow but deeply incised small stream channels. The surface sand is white to grey and across the whole site is predominantly siliceous with very low carbonate fraction. Carbonate fraction may increase at depth but no calcareous concretions or sheets were seen and no to very weak reaction was obtained from application of dilute acid.

Several explanations may be offered to account for the locally steep slopes in the site.

(a) The east-facing slopes appear to be the stabilised front (i.e. the slip face) of a previously active dune system advancing from the north west.

(b) The south-facing slopes possibly also mark an old shore line alignment at a higher sea level and the slopes above are the remnants of a high foredune developed over a weathered outcrop of the Strzelecki Group sediments.

(c) Alternatively, these slopes may be the windward face of a cliff-top dune developed at a lower sea level with a more abundant supply of exposed sand.

Rosengren (2005) assessed the site as being *of moderate to high local geoscience significance. This rating is based on the occurrence of a variety of surface forms that indicate a possibly complex history of landscape development, reflecting different sea levels in the past (higher and lower) and the influence of wind in shaping a previously active dune landscape. There do not appear to be any individual landforms of higher significance at the*

site, but the area is representative of much of the topography of the coastal plateau between the Powlett River and Cape Paterson.

Rosengrens recommendations were that *with sensitive design and construction techniques, the site could be utilised for the proposed Ecovillage while maintaining elements of the geoscience significance*. Site design will therefore conserve all geomorphically significant landscape features.

1.2.3 Soils

Soils were sampled at a number of sites across the study area. The soil type of each vegetation community present is briefly described under Section 3.2

There is a mosaic of surficial materials of sand, sandy clay and clay overlying the weathered surface of the Mesozoic sedimentary rocks. The presence of clay at variable depth accounts for several perched water tables across the site (Rosengren, 2005).

Soils across the majority of the site consist of a thin (<200 mm deep) A_0 horizon of sandy loam overlying varying depths of free-draining acidic grey to red-brown sands. Soils in low-lying areas are similar although contain more loam and course organic matter and have clayey sand or sandy clay sub-soils from a depth of around 200 to 1200 mm.

1.2.4 Hydrology

The Ecovillage site forms part of the catchment of a small creek that rises in the adjacent coastal reserve. There are no defined watercourses on the site and drainage occurs along broad swampy depressions or as sub-surface flow. The impeding clay layer in the soil profile causes low-lying parts of the site to become seasonally waterlogged or inundated.

2.0 METHODOLOGY

The study area was surveyed on foot in June 2005. All native and introduced plant species were recorded. The distribution of existing native vegetation communities (i.e. Ecological Vegetation Classes) was mapped, as was the presumed distribution of vegetation communities prior to clearance. This was determined by examining site topography, hydrology and soil types and comparing this to local environments still supporting native vegetation, including roadsides and the Wonthaggi Heathland Reserve.

2.1 Plant Taxonomy

Plant taxonomy in this plan follows the Flora Information System (Department of Sustainability and Environment, East Melbourne, Victoria), with consideration to the Census of Victoria Vascular Plants (Walsh and Stajic, 2007). The biological nomenclature convention adopted in this document follows Common name (*Scientific name*) for flora species and Common name (*Scientific name)* for fauna species.

3.0 FLORA VALUES

3.1 Pre-European Vegetation

Prior to disturbance caused by European land use the study area would have supported diverse assemblages of indigenous flora. The following reconstruction has been pieced together by examining scant historic evidence, remnant vegetation in the area and comparison with native vegetation in similar environments elsewhere in Victoria.

Higher dunes across the site would have supported dense Sand Heathland. On the lower slopes of these dunes and across the gently undulating northern area this vegetation type would have merged into Damp Heathland/Woodland. The upper sections of the swampy depressions that flow in a southerly direction of the site would have supported Wet Heath, while the lower, more fertile, sections supported Swamp Scrub. Areas of enclosed basins supported Brackish Wetland. Coast Banksia Woodland occurred closer to the coast on the pale yellow sands of recently formed dunes.

3.2 Existing Vegetation

3.2.1 Vascular Plant Species

A total of 155 vascular plant species were recorded on the Subject Land, 121 (78%) of which are indigenous and 34 (22%) exotic species. One plant species of State-significance (Prom Sheoak) was recorded for the adjacent roadside reserves (Bedggood, 2005).

3.2.2 Vegetation Composition and Condition

The vegetation of the study area has been profoundly altered from its pre-European state by a number of processes including vegetation clearing, grazing, soil disturbance, changes to hydrological regimes and weed invasion.

Remnant vegetation on the CPES is of varying quality. Much of the site currently supports pasture dominated or exclusively occupied by exotic plant species, including Kikuyu (**Pennisetum clandestinum*), Sweet Vernal-grass (**Anthoxanthum odoratum*), and Rough Cat's-ear (**Hypochoeris radicata*). Diverse indigenous vegetation is mainly confined to the southern section of the site, adjacent to the coastal reserve and includes Brackish Wetland, Brackish Swamp Scrub and Coast Banksia Woodand. There are isolated, degraded remnants of Swamp Scrub in the central southern section and in the windbreak running

north-south through the site and of Sand Heathland and Wet Heath in the fenced area of the steep dune that runs perpendicular to Wilsons Road. The BCR generally supports more intact native vegetation, with diverse remnants of Brackish Wetland, Swamp Scrub, Wet Heath, Coast Banksia Woodland and Coastal Dune Scrub/Coastal Dune Grassland Mosaic.

The following descriptions of vegetation communities include those that occur as remnants on the CPES and in BCR, and those that would have occurred on the CPES prior to clearing. The following section has been modified from Bedggood et al (2005).

Coastal Dune Scrub/Coastal Dune Grassland Mosaic

These communities are confined to the BCR in the study area and have been mapped as a mosaic as they intergrade and would be difficult to separate at the scale the vegetation map has been produced at. Both communities are fully exposed to salt-ladden on-shore winds.

Coastal Dune Grassland generally occurs as a narrow band just above the high tide mark on the front of the primary or foredune. It consists of the native, sand-binding Hairy Spinifex (*Spinifex hirsuta*) sometimes associated with Dune Thistle (*Actites megacarpa*) and Strand Sedge (*Carex pumila*).

Coastal Dune Scrub occurs just on the landward side of Coastal Dune Grassland, often continuing over the secondary dune where it is then be replaced by Coast Banksia Woodland, and consists of an open to dense shrub-layer of Coast Wattle (*Acacia longifolia* ssp. *sophorae*), Coast Beard-heath (*Leucopogon parviflorus*) and Coast Everlasting (*Ozothamnus turbinatus*). Associated species can include Coast Spear-grass (*Austrostipa stipoides*) and Coast Fireweed (*Senecio spathulatus*). Both communities occur on unconsolidated, free-draining, nutrient poor, yellow beach sands with a high proportion of shell material. These sands have a pH of 8 to 8.5.

Coast Banksia Woodland

In general, this is a distinctive coastal vegetation type of protected secondary or tertiary dunes, with relatively tall trees (Coast Banksia *Banksia integrifolia* and Coast Manna Gum *Eucalyptus viminalis* ssp. *pryoriana*). On the Subject Land and BCR its present structure and floristics are indicative of past disturbances, probably including grazing and at least partial clearing. The shrub stratum is very dense and includes Coast Tea-tree (*Leptospermum laevigatum*), Coast Wattle (*Acacia sophorae*) and Coast Beard-heath (*Leucopogon parviflorus*). Characteristic species of the ground stratum include Coast Sword-sedge

(*Lepidosperma gladiatum*) and Austral Hounds-tongue (*Cynoglossum australe*). Formerly Coast Banksia would have been the common structural dominant, however the density of this species has declined due to clearing and changes in ecological processes. This modified form of Coast Banksia Woodland is the dominant vegetation type of the adjacent BCR and is represented in the southern part on the Subject Land.

The soil type of this community is generally free-draining, yellowish sand with a pH of 6.5.

Sand Heathland

This vegetation class is depleted across the state, and is restricted to deep, free-draining infertile sands. It can be treeless or an open woodland of Coast Manna Gum, with a low, dense heathy shrub layer and a field-layer dominated by various sedge and rush species as well as smaller herbs. The dominant stratum is a shrub layer of 1-2 m including a moderately dense to closed cover of Heath Tea-tree (*Leptospermum myrsinoides*), Prickly Tea-tree (*L. continentale*), Green Sheoak (*Allocasuarina paradoxa*) and or Silver Banksia (*Banksia marginata*) and scattered wattles (*Acacia* spp.). Prominent sub-shrubs include Showy Bossiaea (*Bossiaea cinerea*), Broom Spurge (*Amperea xiphoclada* var. *xiphoclada*) and Common Aotus (*Aotus ericoides*). Herbaceous species such as Tassel Rope-rush (*Hypolaena fastigata*), and Sandhill Sword Sedge (*Lepidosperma concavum)* form an open to dense ground layer. In the Cape Paterson area, Sand Heath is also known from some elevated northern sites in the Village (Carr and McMahon 2001).

The soil type of this community consists of a thin dark grey loamy sand A horizon over a free-draining, nutrient poor, grey to reddish brown acidic sand, with a pH of 5.0.

Damp Heathland / Woodland

Damp Heathland has been all but eliminated from the broader study area, with small remnants occurring along Wilsons Road and Seaward Drive. The vegetation is tolerant of intermittent waterlogging and periodic drying out, and of low nutrient soils. The shrubby overstorey is dominated by Prickly Tea-tree (*Leptospermum continentale)* and the State-significant Prom Sheoak *(Allocasuarina media)* and Silver Banksia. The understorey is typically a dense sward of rushes and sedges, including Sandhill Sword-sedge (*Lepidosperma concavum)* and Bare Twig-rush (*Baumea juncea*) and grasses. Emergent eucalypts include Narrow-leaf Peppermint (*E. radiata*), Swamp Gum (*E. ovata*) and Messmate (*E. obliqua*).

This community grows on soils consisting of a thin dark grey sandy loam A horizon overlaying grey loamy sand to a depth of 900mm. Below this there is a narrow horizon of grey light sandy clay which may cause waterlogging of the above horizons in wet conditions. This horizon grades into grey clayey sand which continues to an unknown depth.

Wet Heathland

The low shrubby vegetation of this EVC occupies lower slopes or interdune depressions that experience more prolonged waterlogging than those supporting Damp Heathland. Wet Heathland is typically dominated by Scented Paperbark (*Melaleuca squarossa*) and Prickly Tea-tree (*Leptospermum continentale)* and has a grassy to sedgey understorey commonly dominated by Pithy Sword-sedge (*Lepidosperma longitudinale*), Zig-zag Bog-rush (*Schoenus brevifolius*), Spreading Rope-rush (*Empodisma minus*) and/or Bare Twig-rush (Baumea juncea). There is a tiny, degraded remnant of Wet Heath on a soak at the base of the steep dune in the south west of the Subject Land. In the broader study area there are remnants within the BCR, and Wet Heath is a major component of the property to the east of the Subject Land, which is presently being cleared for subdivision (Carr and McMahon 2001).

This community grows on soils consisting of a dark grey organic sandy loam A horizon overlaying an acidic (pH 4.75) dark grey to brownish loamy sand to a depth of 850mm. Below this to a depth of 1200mm is a horizon of brownish sand. As with Damp Heathland there is then a narrow horizon of light grey sandy clay which causes waterlogging of the above horizons in wet conditions. Below this abrupt change of texture the soil again changes to sand, grey to light grey in colour that at the time of sampling was wet to saturated.

Swamp Scrub

Swamp Scrub formerly occupied vast areas of the hinterland between Cape Paterson and Wonthaggi. Extant remnants are now few, and in the study area the community is patchily distributed along Wilsons Road and Seaward Drive, with two remnant stands on the Subject Land – both in the southern section. One of these remnants is heavily grazed; the other is part of the Coastal Lagoon Complex in the south east. This atypically occurs on a broader-source dune of the Coastal Lagoon and is in association with a suite of dune species including Bower Spinach (*Tetragona implexicoma*), Seaberry Saltbush (*Rhagodia candolleana*) and Small-leaved Clematis (*Clematis microphylla*) and probably once supported emergent Coast Banksia.

Swamp Scrub is characteristically dominated by a dense canopy of Swamp Paperbark (*Melaleuca ericifolia*), sometimes associated with Woolly Tea-tree (*Leptospermum lanigerum*). The understorey is variable and can range from dense herbs, sedges and grasses to dominated by bryophytes or can be bare except for dense leaf-litter.

This community grows on waterlogging soils consisting of a grey sandy loam A horizon overlying grey clayey sand to a depth of 1000mm. Below this is a horizon of grey light sandy clay to a depth of 1400mm. This grades into a stiff medium sandy clay to a depth of 2000mm. Below this is a meter thick horizon of heavy grey clay with no visible sand which probably represents decomposed Lower Cretaceous bedrock.

Brackish Swamp Scrub

This vegetation is a coastal variant of Swamp Scrub, with a similar Swamp Paperbark overstorey, but with an understorey characterised by species tolerant of saline conditions, e.g. Shiny Swamp-mat *(Selliera radicans)* Creeping Cotula (*Leptinella reptans*), Coast Saw-sedge (*Gahnia trifida*), Nodding Club-sedge (*Isolepis cernua*) and Salt Lobelia *(Lobelia irrigua*). It occupies defined narrow drainage lines between dunes or broad, semi-enclosed depressions close to the coast and has similar soil characteristics to typical Swamp Scrub. However, floristic differences can be attributed to higher levels of salt in the soil, generally above 2000 *m*S/cm^3.

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Brackish Wetland

This is the treeless component of the coastal lagoon complex, occupying saline-influenced broad depressions in the dune system. It is dominated by Knobby Club-sedge *(Ficinia nodosa)*, Sea Rush (*Juncus kraussii*) and Common Reed (*Phragmites australis*). Parts of this community on the Ecovillage site have high cover of Kikuyu (* *Pennisetum clandestinum*). Intact remnants occur in the BCR., A number of species characteristic of seasonal inundation are present, including Water Ribbons (*Triglochin procerum* spp. agg.), Common Spike-rush (*Eleocharis acuta*), Small River Buttercup (*Ranunculus amphitrichus*), Shiny Pennywort (*Hydrocotyle sibthorpioides*), and Grassy Daisy (*Brachyscome graminea*). Soil type is again similar to Swamp Scrub, although has varying depths of sand over the impermeable clayey sub-soils.

4.0 VEGETATION MANAGEMENT

4.1.1 Vegetation Management Goals

The goals of the management of the native vegetation and revegetated areas on the Cape Paterson Ecovillage Site will be to:

1. Protect and enhance the diversity and structure of indigenous plant communities
2. Maintain and increase the populations of indigenous plant species
3. Maintain and improve the habitat of native fauna
4. Prevent weed invasion and reduce the cover and diversity of weed species
5. Eradicate or reduce the impact of feral animals
6. Minimise the impact of visitor pressure on the areas values
7. Minimise off-site impacts (eg. Noise or nutrient pollution) on the reserves ecological values
8. Reduce the risk of fire spreading from natural and re-vegetated areas into residential areas

4.3.2 Key Weed Species

One of the greatest challenges in restoring and managing the native vegetation of the Cape Paterson Ecovillage Site will be the effective control of weeds. Much of both the CPES and the BCR is currently dominated by exotic pasture and remnant vegetation that has been invaded by environmental weeds including Boneseed, Bridal Creeper, Sweet Pittosporum and Blackberry. Control of weeds on the CPES must be done in conjunction with removal of highly dispersive weeds in the adjacent roadsides and BCR, otherwise these weeds will simply re-invade via vectors such as birds, wind or human foot traffic.

The first priority in the control of weeds is to restrict their introduction, establishment and spread. Motor vehicles and construction machinery are potential vectors for the dispersal of weeds and these should be cleaned before being allowed to enter the site. Table 1 (page 16) details methods for controlling the key environmental weed species that threaten the ecological integrity of remnant vegetation at the CPES, BCR and of revegetated areas.

Weeds listed as high priority could be eradicated from the area in one treatment, obviously with the need for ongoing monitoring to detect the need for follow-up treatment of seedling recruitment. Species listed as ongoing priority will be very difficult to completely eradicate but should be kept in check by minimising soil disturbance and spot treatment of any severe infestations.

Table 1 Recommended weed control methods

Herbicides in the following table are mainly listed by their trade names. They should only be applied by people with experience in weed control that can confidently identify native species from exotics.

WEED SPECIES OR SPECIES GROUP	PRIORITY FOR CONTROL	TIMING	CONTROL METHODS	LOCATION
African Boxthorn (**Lycium ferocissimum*)	High	Any Time	Chainsaw or pole-saw lower braches for access into stem and in order to leave (dead) plant standing for bird habitat. Drill stems and fill with RoundUp Biactive™ diluted with 1 part water to 2 parts herbicide	
Water Couch (**Paspalum distichum*)	High	Summer	Spray with Round Up Biactive™ at a rate of 130ml per 10 litres water or Fusilade™ if indigenous broadleaf species are present.	Wet areas
Blackberry (**Rubus anglocandicans)*	On-going	Spring Summer	Spot spray with Brush-off at a rate of 1gram per 10 liters and a non-ionic surfactant such as BS100 ™	Widespread
Exotic grasses Kikuyu (**Pennisetum clandestinum*) Toowoomba Canary Grass (**Phalaris aquatica)*	On-going	Summer	Spray with Round Up Biactive™ at a rate of 9L/ Hectare (or 1.2L per 100L water) or Fusilade™ if indigenous broadleaf species occur amongst grasses	Widespread
Exotic annual grasses including; Annual Rye-grass (**Lolium rigidum*), Squirrel-tail Fescue (**Vulpia bromoides*), Soft Brome (**Bromus hordeaceus*)	On-going	Autumn and pre-seeding	Spray with RoundUp Biactive ™ at a rate of 100 ml per 10 Litres	Widespread

WEED SPECIES OR SPECIES GROUP	PRIORITY FOR CONTROL	TIMING	CONTROL METHODS	LOCATION
Exotic broad-leaf daisies including; Cape Weed (**Arctotheca calendula*), Cat's-ears (**Hypochoeris* species), Hairy Hawkbit (**Leontodon taraxacoides*), Ox-tongue (**Helminthotheca echioides*)	On-going	Autumn and preceding	Spot spray with Kamba M™ at a rate of 70 ml per 10 Litres and a non-ionic surfactant such as BS100	Widespread
Exotic legumes including; Clovers (**Trifolium* species) Medics (**Medicago* species)	Ongoing	Autumn and preceding	Spot spray with Brush-Off ™ at a rate of 1gram per 10 litres and a non-ionic surfactant such as BS100 ™ in serious infestations only	Widespread

4.2 Revegetation Plan

Extensive re-vegetation is proposed for the Cape Paterson Ecovillage Site (refer to Plan 08: Ecological Restoration Plan, page 18). The aims of this re-vegetation will be to:

- Help to re-instate the areas local character
- Restore local native plant communities
- Provide additional habitat and movement corridors for native fauna
- Assist in control and suppression of environmental weeds
- Provide visual amenity to residents and visitors

To improve the long term viability of native plant and animal communities at the Cape Paterson Ecovillage Site the area must be linked to other remnants of native vegetation. This will allow the ongoing function of ecological processes and prevent genetic isolation and subsequent problems with inbreeding. This will be achieved by the creation of corridors of indigenous vegetation between this and other areas of remnant vegetation. The Coastal Reserve and roadside vegetation greatly enhances the viability of remnant habitat areas at Cape Paterson Ecovillage Site, as they function as important biological corridors linking it with other areas of native vegetation, providing a pathway for movement of a variety of animals.

The main factors that contribute to the functioning of a corridor are continuity and presence of suitable habitat. It is therefore important to protect and enhance the habitat values of the Coastal Reserve and local roadsides.

4.3 Bushfire Management Strategy

A key consideration in designing re-vegetation works at the CPES is the protection of residential areas from bushfire (refer to Plan 06: Bushfire Management Plan, page 19). Terramatrix was commissioned by Cape Paterson Partnership to undertake a bushfire assessment and prepare a Bushfire Management Statement (BMS) for Cape Paterson Ecovillage (Stephenson *et al*., 2012). In the report produced following this assessment, areas where modified fuel buffers were required to protect residential areas were identified, and recommendations were made as to the types of plants and planting densities that would be suitable for establishing in within these buffers. For example in areas marked modified fuel buffer 1only a limited selection of low-growing, non –flammable species will be planted at 5 plants per square meter.

LEGEND

-Refer to ecological restoration strategy for detail

REMNANT ENHANCEMENT

- Coast Banksia Woodland
- Swamp Scrub
- Brackish Swamp Scrub
- Brackish Wetland

RESTORATION

- Sand Heathland
- Damp Heathland
- Wet Heathland
- Swamp Scrub
- Brackish Swamp Scrub

MODIFIED FUEL BUFFER

- Modified fuel buffer- below residential development to south-west (limited plant selection)
- Modified fuel buffer- slashed grass with scattered trees
- Sand Heathland
- Damp Heathland
- Wet Heathland
- Swamp Scrub
- Brackish Swamp Scrub
- Brackish Wetland
- Ornamental streetscape planting (Damp Heathland)
- Ornamental streetscape planting (Sand Heathland)
- 1 Parkland- slashed grass
- 2 Wetland
- 3 Drainage line

08 ECOLOGICAL RESTORATION PLAN

Title

Seaward Drive
Cape Paterson

Address

22.02.2012

Date

Scale 0 20 40 60 80 100 m

Orientation N

Cape Paterson ecovillage

LEGEND

1 Heathland restoration

2 Modified Fuel Buffer (minimum 27 metres wide from lots and 50 metres from ecologdes). Buffer also provides firebreak to existing subdivision to the east

3 Modified Fuel Buffer with wetland and drainage line

4 Parkland

5 Community garden precinct

6 Roads

7 Shared trafficable walking, bicycle and emergency vehicle access

Passing bay along emergency vehicle access

Vehicle egress points from Ecovillage site

8 Lots and ecolodges with BAL-12.5

9 Lots with BAL-19

10 Fire hydrants will be provided in accordance with CFA requirements

10,000L static water supply

Large static water supply at Sustainability & Environmental Education Centre & Ecolodges

06 BUSHFIRE MANAGEMENT PLAN

Title

Seaward Drive
Cape Paterson

Address

10.02.2012

Date

Scale 0 20 40 60 80 100 m

Orientation

Cape Paterson ecovillage

All recommendations made in the Terramax report were followed in the design of this re-vegetation plan. In the modified fuel buffer the following prescriptions will be followed:

- Within 10 metres of a building flammable objects such as plants, mulches and fences will not be located close to the vulnerable parts of the building such as windows, decks and eaves;
- Plants greater than 10 centimetres in height at maturity will not be placed directly in front of a window or other glass feature;
- Grass around properties will be kept short. Five centimetre or less is considered short;
- Shrubs will not be planted under trees;
- Trees will not overhang the roofline of buildings, touch walls or other elements of a building; and
- Trees to be planted to ensure canopy separation of two metres and overall canopy cover of no more than 15% at maturity
- Shrubs will be in clumps no greater than 10 square metres which are separated from each other by at least 10 metres;
- Shrubs and trees will not form a continuous canopy.

High quality habitat restoration

An area of the high quality habitat restoration abuts the Bunurong Coastal Reserve, and revegetation of this area will enhance the habitat values of the BCR. Revegetation works within the high quality habitat area will aim to replicate a number ecological vegetation classes including Coast Banksia Woodland, Swamp Scrub, Sand Heathland and Brackish Wetlands.

Preparation of the site will begin with a year of weed control; this will exhaust a degree of the exotic seed stored. During this time areas of remnant vegetation will be identified and exotic species eradicated to allow the indigenous vegetation to regenerate. After the year of weed control, the site will be prepared for planting to begin.

Planting density will be at 5 plants per m2 throughout this area. This high density planting allows quick establishment of indigenous species which helps in the suppression of weeds. An example of the composition of the 5 plants per m2 for Swamp Scrub would be a shrub, two sedges, a grass and a forb. This area would be planted out within a six month time

frame, with ongoing weed control for the subsequent five years. This ongoing weed control should seek to maintain any regenerating indigenous species such that in time, the ecosystem will become self-sustaining.

Landscaping/Revegetation (modified fuel buffers)

These areas occur along road sides, between houses and in general areas of open space. In these areas species selection will be based on replicating EVCs appropriate to particular environments and soil types, however planting density (which will ultimately determine vegetation structure) will be based on prescriptions to reduce wildfire risk.

These landscaping works will occur in stages that relate to the sale of each stage of the CPE. It will only be after infrastructure such as roads, and services such as electricity and sewerage are connected, that these landscaping works will begin.

The landscaping works will be protected by temporary fences which will be erected to prevent damage by tradespersons during the time of house construction. These fences will only be erected in areas where there is potential for damage to plants, i.e. around house sites. Once the house developments are completed the fences will be removed.

Bunurong Coastal Reserve

The CPE intends to work in conjunction with relevant authorities, to carry out a range of environmental works within the BCR. CPE would carry out these works only in the area of BCR that is directly joining of the two lands to the foreshore. CPE is proposing to control the most environmentally invasive weeds that occur within the BCR, which would include species such as Sweet Pittosporum, Blackberry, Boneseed and Mirror Bush (see Table 1 for weed control methods). The works would involve the initial eradication of the target species, followed by yearly survey of the site and eradication of any further regeneration or missed individuals. This would be part of a five year weed action plan.

Bedggood (2005), provides the following description of the Coast Banksia Woodland that occurs within the Bunurong Coastal Reserve that a joins the CPE.

"On the Subject Land and BCR its present structure and floristics are indicative of past disturbances probably including at least partial clearing and grazing. The shrub stratum is very dense and includes Coast Tea-tree, Coast Wattle and Coast Beard-heath. Formerly

Coast Banksia would have been the common structural dominant, however the density of this species has declined due to clearing and changes in ecological processes."

In accordance with these findings CPE would undertake species enrichment plantings throughout areas of the BCR that would have formerly comprised Coast Banksia Woodland. These plantings would focus primarily on structurally dominant species such as Coast Banksia (*Banksia integrifolia*) and would also be part of the five year plan.

5.0 FAUNA

5.1 Protection of fauna habitat values

The Cape Paterson Ecovillage Site is an altered landscape, much of which is dominated by introduced plants. However, the area still provides valuable habitat to a range of native fauna species. Shrubs such as Giant Honeymyrtle provide cover to small birds, constructed dams provide habitat for frogs and water birds, while the open spaces offer hunting grounds for raptors such as the Nankeen Kestrel and Black-shouldered Kite. Current habitat values on the site will be maintained while improvement of the quality of indigenous vegetation will allow a greater diversity of indigenous species to colonise the area.

5.2 Creating specific habitat for rare fauna

The following species were identified by Bedggood et al (2005) as having the potential to colonise the proposed constructed wetlands and revegetated areas of the CPES (Table 2, below). Each species has been assigned a probability of colonisation: high, moderate, low or uncertain.

Table 2 Fauna species likely to colonise proposed constructed wetlands

Species	High	Moderate	Low	Uncertain
Wetlands				
Birds				
Baillon's Crake		✓		
Spotless Crake		✓		
Dusky Moorhen	✓			
Purple Swamp Hen	✓			
Eurasian Coot	✓			
Australasian Grebe	✓			
Masked Lapwing	✓			

Species	High	Moderate	Low	Uncertain
Latham's Snipe	✓			
Australian White Ibis	✓			
Straw-necked Ibis	✓			
Royal Spoonbill		✓		
Great Egret		✓		
Cattle Egret	✓			
White-faced Heron	✓			
White-necked Heron	✓			
Australasian Bittern		✓		
Australian Wood Duck	✓			
Pacific Black Duck	✓			
Frogs				
Eastern Banjo Frog	✓			
Striped Marsh Frog	✓			
Spotted Marsh Frog	✓			
Common Eastern Froglet	✓			
Southern Brown Tree Frog	✓			
Whistling Tree Frog		✓		
Revegetated Areas				
Birds				
Black-shouldered Kite		✓		
Peregrine Falcon		✓		
Welcome Swallow	✓			
Grey fantail	✓			
Willie Wagtail	✓			
Beautiful Firetail		✓		
Grey Shirke-thrush		✓		
Magpie-lark	✓			
Brown Thornbill	✓			
White-browed Scrubwren	✓			
Chestnut-rumped Heathwren				✓
Superb Fairy-wren	✓			
Silvereye	✓			
Little Wattlebird	✓			
Australian Magpie	✓			

Species	High	Moderate	Low	Uncertain
Mammals				
Short-beaked Echidna	✓			
Common Wombat	✓			
Common Ringtail Possum	✓			
Swamp Antechinus			✓	
Southern Brown Bandicoot				✓
White-footed Dunnart				✓
Broad-toothed Rat				✓
Reptiles				
Swamp Skink				✓
Pale-flecked Garden Sunskink	✓			
Metallic Cool-skink		✓		
Blotched Blue-tongue Lizard	✓			
Glossy-grass Skink		✓		

All species of indigenous fauna will benefit from control of weeds and restoration of indigenous vegetation. In restoring ecological communities at the CPES Australian Ecosystems intends to create specific habitat for rare and threatened species. Actions that taken for these species include the following:

Growling Grass Frog (*Litoria raniformis*)

- Habitat for this species can be created in constructed wetlands by planting dense swards of deep marsh vegetation, dominated by species such as Water ribbons (*Triglochin procerum*).
- Having wetlands that occasionally dry out will reduce the risk of invasion and persistence of Mosquito Fish, which are known to exert high predation pressure on frog eggs and tadpoles.
- Logs beside wetlands provide important over-wintering habitat
- This species could potentially be re-introduced to the site if it does not naturally colonise. Allow 3 to 5 years of vegetation establishment before release to ensure adequate habitat and food resources have built up enough to support a sustained population.

Southern Brown Bandicoot, Swamp Antechinus and White-footed Dunnart (*Isoodon obesulus,* Antechinus *minimus* and *Sminthopsis leucopus*)

- These species have potential to benefit from the re-creation of large areas of dense, species-rich coastal heathland habitat, especially as this will be contiguous with the existing coastal reserve
- These species will benefit from having contiguous indigenous vegetation between larger islands of habitat. Therefore the connectivity of roadside vegetation and between the BCR and CPES should be improved.
- Exclusion of cats and dogs and the control of foxes will aid the survival of these species
- Road signs with "Wildlife Habitat Zone, Drive Carefully" and the creation of culverts for wildlife movement under roads could assist the survival of these species.
- Ground shelters for these species could be provided

Swamp Skink and Glossy Grass Skink (*Ergenia coventryi* and *Pseudomoia rawlinsoni*)

- These species will benefit from a combination of dense area of sedges for sheltering from predators and open areas for sun-basking beside wetlands.
- Logs beside wetlands could provide important over-wintering habitat

Beautiful Firetail, Chestnut-rumped Heathwren, Southern Emu-wren, Bassian Trush

- These species have potential to benefit from the re-creation of large areas of dense, species-rich coastal heathland habitat, especially as this will be contiguous with the existing coastal reserve
- These species will benefit from having contiguous indigenous vegetation between larger islands of habitat. Therefore the connectivity of roadside vegetation and between the BCR and CPES should be improved.
- Exclusion of cats and the control of foxes will aid the survival of these species

Ballion's Crake, Spotless Crake, Buff-banded Rail, Australasian Bittern, Great Egret and Latham's Snipe

- Habitat for these species can be created in constructed wetlands by planting a diversity of habitat types including dense swards of Water ribbons (*Triglochin procerum*), Water Milfoils (*Myriophyllum* species), sedges such as Fine Twig-rush (*Baumea arthropyhlla*) and Jointed Twig-rush (*B. articulata*) and species-rich, seasonally inundated meadows.
- Exclusion of cats and the control of foxes will aid the survival of these species

Darter, Cormorants

- Log perches could be provided in some wetlands for these species. However, not all wetlands should provide such vantage points as they could become habitually used by predators, such as raptors, thus having a negative impact on secretive wetland birds and reptiles.

Southern Pygmy Perch, Common Jollytail

- Permanent wetlands with relatively clean water and dense aquatic vegetation could be stocked with these fish. Allow 3 to 5 years of vegetation establishment before release to ensure adequate habitat and food resources have built up enough to support a sustained population.

6.0 PEST ANIMAL MANAGEMENT

Key pest animal species present at Cape Paterson Ecovillage Site are the Red Fox *(Vulpes vulpes)* and the European rabbit *(Oryctolegus cuniculus)*. The Red Fox is an opportunistic predator on many species including rabbits, native mammals, birds, reptiles and invertebrates. Ground nesting birds such as Stubble Quail are especially at risk from fox predation. Table 2 and Table 3 (page 27) summarise methods for controlling pest animals within the Cape Paterson Ecovillage site.

Rabbits cause damage to native vegetation by selectively grazing palatable species and by preventing the regeneration of trees and shrubs. There are a variety of techniques available for rabbit control (such as warren destruction, baiting or biological control using Rabbit Calcivirus Disease), but best results are often achieved by a combination of these. It is therefore important to monitor the population numbers to determine the effectiveness of control programs. Rabbit burrows should be fumigated rather than ripped to prevent soil disturbance. This should be done in autumn, when soil settles with onset of autumn rains. Upgrading and maintaining a rabbit-proof fence will be necessary to stop new individuals entering the site.

Pest animals are known for their association with exotic vegetation, for example Blackberry often provides shelter for rabbits and foxes. Weed control undertaken in conjunction with pest control should aid in deterring pest fauna at the site. The management of pest animals on the site should be undertaken in co-operation with adjacent landholders so that a coordinated approach to the problem can be formulated and implemented.

Box 1 Pest Animal Control Recommendations

1. Instigate a pest animal control program. Baiting programs should be done in accordance with the recommendations of the Keith-Turbull Research Institute.
2. Upgrade the perimeter fence so that it is fox and rabbit proof. This will require an apron of small gauge wire to be attached from 0.5 meters up the fence then folded along the ground and securely pinned a distance of 1 meter from its base.

Table 3 Recommended pest animal control methods

Pest Animal	Control Methods	Timing
Red Fox	1. Initial monitoring of numbers 2. Den location and fumigation 3. Live trapping followed by destruction by a veterinarian	Prior to trapping Autumn Autumn
European Rabbit	1. Initial monitoring of numbers 2. Baiting using carrots baited with 'Pindone' 3. Burrow location and fumigation (eg. Phostoxin tablets placed down burrows)	Prior to control (easiest early spring) Late summer-early Autumn (before Autumn rains) Autumn

Table 4 Recommended timeline for pest animal control strategies

Time of year	Management actions
September	Initial rabbit monitoring Initial fox monitoring
February	Rabbit baiting using carrots containing 'Pindone'
May	Fox trapping
June	Rabbit burrow location and fumigation Fox den location and fumigation

7.0 VISITOR ACCESS MANAGEMENT

7.1 Community Use and Participation

It is important that the community come to understand and appreciate the value of native vegetation. The coastal reserve and revegetated areas of the site will be an invaluable educational resource for schools in the area, providing a living outdoor classroom for the study of many aspects of ecology and restoration. The imperative to allow public access and appreciation must be balanced with the need to prevent unacceptable levels of disturbance to sensitive wildlife, soil disturbance and weed invasion.

Box 2 Visitor Access Management Recommendations

1. Develop educational materials for the reserve and CPES such as a booklet
2. Monitor the use of the reserve and revegetated areas and restrict access if necessary

8.0 OTHER MANAGEMENT ISSUES

8.1 Soil Disturbance

Soil disturbance within the reserve and revegetated areas must be kept to a minimum, as there is a direct correlation between soil disturbance and weed invasion. Soil disturbance can be caused by machinery, vehicles, stock and human foot traffic and occurs most readily in wet conditions.

Box 3 Soil Disturbance Management Recommendations

Vehicles and machinery should not be allowed within the coastal reserve if soil wetness is such that the passage of wheels leave a rut or imprint in the soil surface. As a general rule vehicles or machinery should be excluded from the reserve and revegetated areas unless there is a compelling need for management purposes or fire control.

8.2 Hydrology and Run-off

Appropriate management of hydrology and run-off is critical to the survival of the native vegetation. Only relatively clean storm-water should be allowed to enter the Cape Paterson Ecovillage Site wetlands. Run-off from the site will be treated in constructed wetlands then the water will discharged into Swamp Scrub on the site where it will filter into the sandy substrate. There will be no point discharge into the coastal reserve from the Ecovillage site.

8.3 Site Infrastructure

To maintain the integrity of the reserve and CPES the body corporate must be diligent in maintaining site infrastructure. This will involve maintaining clear signage that states allowable and prohibited activities. The reserve will also require sturdy fencing and lockable gates to prevent unauthorised access of vehicles or pedestrians.

9.0 MONITORING

This ecological restoration plan sets out recommendations for the management of the native vegetation in the Cape Paterson Ecovillage Site Reserve. Monitoring is essential to ensure that management aims such as the prevention of weed invasion, the maintenance of the populations of rare species, colonization by native fauna and the protection and enhancement of the diversity and structure of indigenous plant communities are being achieved. If they are not being achieved the results of monitoring will help to determine how management may need to be modified.

Aims:

1. To assess the success of revegetation program and wetland establishment over the first few years and determine the need for enrichment plantings
2. To assess changes in wetland species composition, diversity and structure over time and make recommendations for the manipulation of species composition if necessary
3. To assess the colonization of revegetated habitats by native fauna
4. To assess the effectiveness of weed control, aiming for reduction to less than 5% weed cover

Methods:

1. Establish a set of permanent quadrats (10 by 10 m), throughout the planted areas, one in each revegetation zone. Data on species composition, species cover/abundance, vegetation health and % weed cover should be collected in spring following the planting.

If the density, structure or composition does not reach the desired characteristics, enrichment plantings should be carried out.

2. Establish a set of permanent quadrats (10 by 10 m), one in each vegetation type throughout Cape Paterson Ecovillage Site. Data on species composition, species cover/abundance, vegetation health and % weed cover should be collected in spring.. Any declining or deteriorating vegetation types will require management actions. The body corporate ranger should co-ordinate a herbarium collection of vascular plants and fungi of the CPES, BCR and the broader area.

3. Carry out a bi-annual weed survey in previously treated areas. If the weed cover in a quadrat is found to be more than 10 %, weed control and management methods need to be reviewed.

4. Conduct annual/seasonal quantitative and qualitative fauna surveys to determine fauna use of revegetated habitats. This could include bird transects, seasonal frog call censuses, active searching for reptiles, spotlighting, Elliot trapping, pitfall trapping and hair-tubing. One role of the ranger employed by the body corporate would be to co-ordinate these surveys as well as record incidental fauna observations and to co-ordinate a database of fauna sightings that residents and local naturalists and school groups could contribute to.

Recommendations:

1. Carry out a flora and fauna monitoring program at Cape Paterson Ecovillage Site. This should be an initial responsibility of company carrying out the revegetation and weed control programs in the area, which should then be followed on by the body corporate after the hand-over.

2. Monitoring at the Cape Paterson Ecovillage Site should include the establishment of permanent photo points in the north-west corner of each vegetation quadrat and other appropriate areas.

10.0 FURTHER STUDIES

An additional brief flora survey of remnant vegetation in spring should be undertaken to detect any seasonal species, which might not have been present during the vegetation survey. Further information is required to determine the status of fauna in the reserve and CPES. A summer survey of reptiles and amphibians is recommended and has the potential to identify additional significant species within the study area.

11.0 CONCLUSION

The major recommendations made in this report are to:

1. Instigate ongoing weed and feral animal control programs
2. Revegetate the site using indigenous species
3. Design revegetation to comply with recommendations on reducing wildfire risk

The revegetation of the Cape Paterson Ecovillage site provides an outstanding opportunity to conduct research into methods of revegetation and habitat restoration in a context which could involve residents and the local community.

12.0 REFERENCES

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Appendix 1 Vascular plant species for Cape Paterson study area

Data From: Flora Information System: Biodiversity and Natural Resources: DSE - 2004

Species recorded during the current study are in **bold**.

Those annotated '**?**' are unconfirmed species identifications.

N denotes species recorded during the current study but not in the flora DRA.

Letters preceding the scientific name indicate the conservation status of the species.

An asterisk (*) denotes exotic species.

# denotes native species occurring outside their natural range.

Plant names follow Walsh and Entwisle (1994, 1996, 1999) or Ross and Walsh (2003).

DC = recorded by Damien Cook

CR= occurs in Coastal Reserve

Ferns and Fern-like Plants		
Azollaceae		
Azolla filiculoides	Pacific Azolla	DC
Dennstaedtiaceae		
Pteridium esculentum	Austral Bracken	
Selaginellaceae		
Selaginella uliginosa	Swamp Selaginella	
Monocotyledons		
Centrolepidaceae		
Centrolepis fascicularis	Clustered Centrolepis	DC
Cyperaceae		
Baumea acuta	Pale Twig-sedge	DC
Baumea juncea	Bare Twig-sedge	DC / CR
Carex breviculmis	Short-stemmed Sedge	DC
Carex pumila	Strand Sedge	
Eleocharis acuta	Common Spike-sedge	
Ficinia nodosa	Knobby Club-sedge	
Isolepis inundata	Swamp Club-sedge	
Isolepis platycarpa	Broad-fruit Club-sedge	
Lepidosperma concavum	Sandhill Sword-sedge	
Lepidosperma longitudinale	Pithy Sword-sedge	
Schoenus brevifolius	Zig-zag Bog-sedge	DC / CR
Schoenus nitens	Shining Bog-sedge	DC
Schoenus mascilinus	Creeping Bog-sedge	DC
Iridaceae		
* *Crocosmia X crocosmiiflora*	Montbretia	
Patersonia fragilis	Short Purple-flag	DC / CR
Juncaceae		
* *Juncus articulatus*	Jointed Rush	DC / CR
Juncus caespiticus	Grassy Rush	
Juncus filicaulis	Tread Rush	DC
Juncus kraussii subsp. australiensis	Sea Rush	
Juncus pallidus	Pale Rush	DC
Juncus planifolius	Broad-leaf Rush	DC
Juncus procerus	Tall Rush	

Juncaginaceae		
Triglochin procerum (Broad-erect leaves)	Water Ribbons	DC
*Triglochin striatum (*Broad-leaf)	Streaked Arrow-grass	DC
Liliaceae		
Burchardia umbellata	Milkmaids	DC
Dianella brevicaulis	Small-flower Flax-lily	
Dianella sp. aff. revoluta (Coastal)	Coast Flax-lily	
Poaceae		
* *Agrostis capillaris s.l.*	Brown-top Bent	
* *Ammophila arenaria*	Marram Grass	
Austrodanthonia setacea	Bristly Wallaby-grass	DC
Austrodanthonia spp.	Wallaby Grass	
Austrostipa stipoides	Coast Spear-grass	DC
Distichlis distichophylla	Australian Salt-grass	DC
Hemarthria uncinata var. uncinata	Mat Grass	DC
* *Ehrharta erecta var. erecta*	Panic Veldt-grass	
* *Holcus lanatus*	Yorkshire Fog	
* *Hordeum marinum*	Sea Barley-grass	
Imperata cylindrica	Blady Grass	
Lachnagrostis filiformis	Common Blown-grass	
* *Lolium perenne*	Perennial Rye-grass	
Microlaena stipoides var. stipoides	Weeping Grass	DC
* *Pennisetum clandestinum*	Kikuyu	
Phragmites australis	Common Reed	
Poa labillardierei	Common Tussock-grass	DC
Poa poiformis	Coast Tussock-grass	
Poa sieberiana	Grey Tussock-grass	
Poa tenera	Slender Tussock-grass	DC
Spinifex hirsuta	Hairy Spinifex	DC
Sporobolis virginicus	Salt Couch	DC
Zoysia macrantha	Prickly Salt-grass	DC
Restionaceae		
Empodisma minus	Spreading Rope-rush	
Typhaceae		
Typha domingensis	Narrow-leaf Cumbungi	DC
Xanthorrhoeaceae		
Lomandra longifolia subsp. longifolia	Spiny-headed Mat-rush	
Lomandra nana	Dwarf Mat-rush	DC
Dicotyledons		
Aizoaceae		
Carpobrotus rossii	Karkalla	DC / CR
Tetragonia implexicoma	Bower Spinach	
Tetragona tetragonoides	Bower Spinach	DC
Apiaceae		
Apium prostratum	Sea Celery	DC / CR
Centella cordifolia	Centella	
Daucus glochidiatus	Australian Carrot	
Hydrocotyle hirta	Hairy Pennywort	DC / CR
Hydrocotyle mucosa	Mossy Pennywort	DC / CR
Hydrocotyle sibthorpioides	Shiny Pennywort	DC / CR
Lilaeopsis polyantha	Australian Lilaeopsis	DC / CR

Asteraceae			
	Actites megalocarpa	Dune Thistle	DC / CR
	Brachyscome graminea	Grass Daisy	DC / CR
*	*Aster subulatus*	Aster-weed	
*	*Chrysanthemoides monilifera*	Boneseed	
*	*Cirsium vulgare*	Spear Thistle	
*	*Conyza bonariensis*	Flaxleaf Fleabane	
*	*Cotula coronopifolia*	Water Buttons	
	Euchiton involucratus	Star Cudweed	
*	*Hypochoeris radicata*	Cat's Ear	
	Leptinella reptans	Creeping Cotula	DC
	Olearia axillaris	Coast Daisy-Bush	
	Ozothamnus turbinatus	Coast Everlasting	DC / CR
	Senecio glomeratus	Annual Fireweed	DC / CR
	Senecio ? linearifolius	Fireweed Groundsel	DC / CR
	Senecio odoratus var. odoratus	Scented Fireweed	CR
*	*Sonchus oleraceus*	Common Sow-thistle	
Boraginaceae			
	Cynoglossum australe	Australian Hound's-tongue	
Brassicaceae			
*	*Cakile maritima ssp. maritima*	Sea Rocket	
Campanulaceae			
	Lobelia anceps	Angled Lobelia	
	Lobelia irrigua	Salt Pratia	
Caryophyllaceae			
*	*Cerastium glomeratum s.l.*	Common Mouse-ear Chickweed	
Casuarinaceae			
	Allocasuarina media	Prom Sheoak	
	Allocasuarina paludosa	Scrub Sheoak	
Chenopodiaceae			
	Chenopodium glaucum	Glaucous Goosefoot	
	Rhagodia candolleana subsp. candolleana	Seaberry Saltbush	
Clusiaceae			
	Hypericum gramineum	Small St John's Wort	DC
	Hypericum japonicum	Creeping St John's Wort	DC
Convolvulaceae			
	Dichondra repens	Kidney-weed	
Crassulaceae			
	Crassula helmsii	Swamp Stonecrop	DC
Dilleniaceae			
	Hibbertia sericea s.l.	Silky Guinea-flower	
Droseraceae			
	Drosera pygmea	Tiny Sundew	DC
Epacridaceae			
	Epacris impressa	Common Heath	DC
	Leucopogon ericoides	Pink Beard-heath	DC
	Leucopogon parviflorus	Coast Beard-heath	
Fabaceae			
	Bossiaea cinerea	Showy Bossiaea	
	Dipogon lignosus	Common Dipogon	DC
	Lotus corniculuatus.	Bird's-foot Trefoil	

*	*Melilotus indicus*	Sweet Melilot	
	Geraniaceae		
	Geranium solanderi s.l.	Austral Cranesbill	DC / CR
	Pelargonium australe	Austral Stork's-bill	DC
	Goodeniaceae		
	Goodenia humilis	Swamp Goodenia	DC
	Goodenia ovata	Hop Goodenia	
	Selliera radicans	Shiny Swamp-mat	
	Haloragaceae		
	Gonocarpus humilis	Shade Raspwort	DC
	Gonocarpus micranthus ssp. micranthus	Creeping Raspwort	DC
	Gonocarpus tetragynus	Common Raspwort	DC
	Lauraceae		
	Cassytha glabella	Slender Dodder-laurel	
	Cassytha pubescens s.s.	Downy Dodder-laurel	
	Lythraceae		
	Lythrum hyssopifolia	Small Loosestrife	
	Mimosaceae		
#	*Acacia longifolia subsp. sophorae*	Coast Wattle	
	Acacia verticillata ssp. ovoidea	Ovoid Prickly Moses	DC
	Acacia verticillata subsp. verticillata	Prickly Moses	
	Myoporaceae		
#	*Myoporum insulare*	Common Boobialla	
	Myrtaceae		
	Eucalyptus obliqua	Messmate (where on site ?)	
	Eucalyptus ovata	Swamp Gum (where on site ?)	
	Eucalyptus viminalis subsp. pryoriana	Coast Manna-gum	
	Leptospermum continentale	Prickly Tea-tree	
#	*Leptospermum laevigatum*	Coast Tea-tree	
	Melaleuca ericifolia	Swamp Paperbark	
	Melaleuca squarrosa	Scented Paperbark	
	Oxalidaceae		
	Oxalis exilis	Shady Wood Sorrel	
	Oxalis perennans	Grassland Wood Sorrel	DC
	Phytolaccaceae		
*	*Phytolacca octandra*	Red-ink Weed	
	Pittosporaceae		
*	*Pittosporum undulatum*	Sweet Pittosporum	
	Polygonaceae		
*	*Acetosella vulgaris*	Sheep Sorrel	
	Muehlenbeckia adpressa	Climbing Lignum	DC
*	*Rumex conglomeratus*	Clustered Dock	
*	*Rumex crispus*	Curled Dock	
	Primulaceae		
*	*Anagallis arvensis*	Pimpernel	
	Proteaceae		
	Banksia integrifolia subsp. integrifolia	Coast Banksia	
	Banksia marginata	Silver Banksia	DC
	Ranunculaceae		
	Clematis microphylla	Small-leaved Clematis	

Ranunculus amphitrichus	Small River Buttercup	DC
Rhamnaceae		
Pomaderris paniculosa ssp. paralia	Coast Pomaderris	DC
Rosaceae		
Acaena novae-zelandiae	Bidgee-widgee	
* *Rubus anglocandicans*	Blackberry	
Rubiaceae		
Asperula conferta	Common Woodruff	
Coprosma quadrifida	Prickly Currant-bush	
* *Coprosma repens*	Mirror Bush	
Rutaceae		
Correa alba	White Correa	DC
Solanaceae		
Solanum ?laciniatum	Large Kangaroo Apple	
* *Solanum nigrum sensu Willis (1972)*	Black Nightshade	
Thymelaeaceae		
Pimelea humilis	Common Rice-flower	DC
Violaceae		
Viola hederacea		